Near-Fatal Self-Harm Among Canadian Adolescents

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Abstract

Objective: To evaluate the clinical features of Canadian adolescents admitted to the intensive care unit (ICU) for medically serious self-harm.

Methods: 2700 Canadian paediatricians were surveyed monthly over two years (January 2017 to December 2018) through the Canadian Paediatric Surveillance Program to ascertain data from eligible cases.

Results: Ninety-three cases (73 female; age 15.2 ± 1.5) met the case definition. Four provinces reported the majority of cases: Quebec (n = 27), Ontario (n = 26), Alberta (n = 21), and British Columbia (n = 8). There were 10 deaths, 9 by hanging. Overdose and hanging were the most frequently reported methods of self-harm (74.2% and 19.4%, respectively). Overdose was more common in females (80.8% females vs. 50% males; χ² = 7.8 (1), p = .005), whereas hanging was more common in males (35% males vs. 15.1% females; χ² = 3.9 (1), p = .04). More females than males had a past psychiatric diagnosis (79% vs. 58%; χ² = 4.1 (1), p = .06), a previous suicide attempt (55.9% vs. 29.4%, χ² = 3.8 (1), p = .05), and prior use of mental health service (69.7% vs. 27.8%, χ² = 10.4 (1), p = .001). Family conflict was the most commonly identified precipitating factor (43%) of self-harm.

Conclusions: Among Canadian adolescents admitted to the ICU with medically serious self-harm, females demonstrate a higher rate of suicide attempts and prior mental health care engagement, whereas males are more likely to die by suicide. These findings are consistent with data from other adolescent samples, as well as data from working-age and older adults. Therefore, a sex-specific approach to suicide prevention is warranted as part of a national suicide prevention strategy; family conflict may be a specific target for suicide prevention interventions among adolescents.

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Objectif: Évaluer les caractéristiques cliniques des adolescents hospitalisés dans une unité de soins intensifs pour une autodestruction médicalement sérieuse.

Méthodes: 2700 pédiatres canadiens ont répondu à un sondage mensuel pendant deux ans (janvier 2017 à décembre 2018) dans le cadre du Programme canadien de surveillance pédiatrique pour vérifier les données des cas admissibles.

Résultats: Quatre-vingt-treize cas (73 de sexe féminin; âge 15,2 ± 1,5) allaient à la définition de cas. Quatre provinces déclaraient la majorité des cas : Québec (n = 27), Ontario (n = 26), Alberta (n = 21), et Colombie-Britannique (n = 8). Il y avait 10 décès, 9 par pendaison. La surdose et la pendaison étaient les méthodes plus fréquemment rapportées d’autodestruction (74,2 % et 19,4 %, respectivement). La surdose était plus commune chez les femmes (80,8 % femmes c. 50 % hommes; X² = 7,8 (1), p = .005), alors que la pendaison était plus commune chez les hommes (35 % hommes c. 15,1 % femmes, X² = 3,9(1), p = .04). Plus de femmes que d’hommes avaient un diagnostic psychiatrique passé (79 % c. 58 %; X² = 4,1(1), p = .06), une tentative de suicide précédente (55,9 % c. 29,4 %, X² = 3,8(1), p = .05), et une utilisation antérieure des services de santé mentale (69,7 % c. 27,8 %, X² = 10,4(1), p = .001). Le conflit familial était le facteur de précipitation le plus communément identifié (43 %) de l’autodestruction.

Conclusions: Chez les adolescents hospitalisés dans une unité de soins intensifs avec une autodestruction médicalement sérieuse, les femmes démontrent un taux plus élevé de tentatives de suicide et d’utilisation antérieure des soins de santé mentale, alors que les hommes sont plus susceptibles de mourir par suicide. Ces résultats sont conformes aux données d’autres échantillons d’adolescents, ainsi qu’aux données d’adultes en âge de travailler et plus âgés. Par conséquent, une approche sexospécifique de la prévention du suicide est justifiée dans le cadre d’une stratégie nationale de prévention du suicide; le conflit familial peut être une cible spécifique des interventions de prévention du suicide chez les adolescents.

Keywords

self-harm, suicide attempt, children, youth, adolescent

Introduction

Suicide is the second leading cause of death among Canadian adolescents ages 15 to 19 years.1 Although suicide-related behaviours are preventable, the suicide rate for Canadian youth ages 15 to 24 from 2007 to 2017 increased by 15% to its highest point since 2000 (12.2 per 100,000).2 Similarly, among adolescents ages 15 to 19 in the United States, the suicide rate increased by 31% from 2007 to 20153 and has continued to rise.4,5 Canada, however, is one of the few industrialized countries without a national suicide prevention strategy.

Suicide is a complex problem that requires a comprehensive approach for prevention.6 An effective primary suicide prevention plan for youth is necessary to have a sustained reduction in the prevalence of suicide. However, given that the number of hospitalizations for intentional self-harm in youth continue to increase across Canada (e.g., 86% increase from 2009 to 2014 among adolescents ages 10 to 17),7 and adolescents aged 15 to 19 have the highest age-specific hospitalization rate associated with self-harm in the country (~140–145 per 100,000 in 2015),8 secondary suicide prevention interventions are also urgently needed for Canadian youth.

For every suicide death there are at least 20 suicide attempts.9 There is strong evidence that an episode of self-harm is a robust predictor of death by suicide in youth.10–12 Moreover, North American high-school students demonstrate high rates of suicidal ideation, with 17% of 15,000 surveyed in the United States reporting that they had serious thoughts of ending their lives in the past 12-months,13 and similarly high lifetime prevalence rates (14–20%) among Canadian youth.14–16 As a result, clinicians are faced with the challenging task of determining suicide risk for youth in the context of a common risk factor (i.e., suicidal ideation, and self-harm) for a relatively uncommon but fatal outcome (i.e., death by suicide).12,17–19

Young people who engage in medically serious self-harm – such as those who require intensive care unit (ICU) level care – may inform our understanding of factors that lead to suicide, as these youth present a close proxy to those who die by suicide.20,21 For example, the Canterbury Suicide Project in New Zealand compared risk factors for suicide and medically serious suicide attempts among youth under 25 years of age and demonstrated that the same risk factors were present for both groups (history psychiatric care, educational disadvantage, stressful circumstances).22 The exception was mood disorder history and male gender, explained by male subjects’ use of more lethal methods in the suicide group.22 Data from China identified similar correlates amongst those who died by suicide vs. or versus a history of medically serious self-harm among ages 15 to 34 years.22 Notably, a study comparing psychological variables in medically serious versus non-medically serious suicide attempts in Israel reported that participants with depression and hopelessness who could not effectively communicate their distress was predictive of the severity of the attempt,
and this effect was stronger in younger individuals (although the mean age ∼37 years).24

In summary, characterizing youth with medically serious self-harm is important to facilitate risk stratification of high-risk groups, inform preventative interventions, guide resource allocation and service delivery, and ultimately support a national suicide prevention strategy for Canada. Although there are administrative data on youth who die by suicide,2,25,26 and research on youth who self-harm without suicidal intent,27,28 data on medically-serious self-harm among youth in Canada are largely absent. Thus, the primary objective of this study is to describe the patterns of presentation, clinical features and associated medical needs of adolescents presenting to the hospital with self-harm requiring ICU level care.

Methods

Study Design

A total of 2700 clinically active paediatricians, paediatric subspecialists (intensivists) and child and adolescent psychiatrists were surveyed monthly via email from January 1, 2017 to December 31, 2018, through the Canadian Pediatric Surveillance Program (CPSP), a public health surveillance network and joint initiative of the Public Health Agency of Canada and the Canadian Paediatric Society (CPS). In addition, 134 pediatric intensivists affiliated with a Pediatric Intensive Care Unit (PICU) at academic pediatric health centers were surveyed monthly with the same questionnaire used for CPSP members. The list of individuals was compiled by CPSP with assistance from A.J. (co-investigator and a member of the Canadian Critical Care Trials Group), using the email list generated for a different published survey.29

Participants were asked to record (yes/no) if they had been involved in the care of a young person who met the case definition for medically serious self-harm during the previous month (see case definition). Respondents indicating “yes” received a detailed questionnaire to complete. The questionnaire sought information on patterns of presentation, clinical features and associated medical needs of confirmed cases. The questionnaire was designed by the study authors and approved by the CPSP Scientific Steering Committee. The complete protocol can be accessed at www.cpsp.cps.ca/surveillance. The study was approved by the Research Ethics Board of the Hospital for Sick Children (University of Toronto, Toronto, Canada) and by the Research Ethics Board of Health Canada/Public Health Agency of Canada (Ottawa, Canada).

Children and Adolescents

The case definition/inclusion criteria were: less than 18 years of age (up to 18th birthday) meeting BOTH of the following criteria: (1) confirmed or suspected self-harm or suicide attempt; AND (2) admitted to an ICU at any time during a hospital admission (for any duration). Study exclusion criterion was accidental poisoning, and/or injury (e.g., intoxication). Respondents were instructed to use their best clinical judgment when determining if the injury was accidental and advised to report the case as “suspected” intentional self-harm if applicable.

Statistical Analysis

Data were expressed as means, standard deviations (SD), and proportions. Between group differences were calculated using chi-square analyses, Fisher’s exact test, and Mann-Whitney U test (p < 0.05), as appropriate. Analyses were performed using IBM SPSS Statistics for Windows, Version 27.0.

Results

The average monthly response rate was 81% and the questionnaire completion rate was 83%. Over the study period, 140 cases were notified to the CPSP. 39 were labelled as unable to confirm and/or reported outside of the study timeframe, and 101 were eligible for analysis. When more than one CPSP member reported the same case, it was considered a duplicate and only the most complete questionnaire was included. Three duplicate cases and five cases reported as “suspected” intentional self-harm (see case definition) were removed yielding 93 eligible cases. The suitability of the data for inclusion was determined by the Public Health Agency of Canada with an additional variable for recording issues during the data entry process, including reinterpretation of responses. All 93 eligible cases were included in the final analysis. For each variable, missing data is acknowledged in the first column of the Table (e.g., in Table 3, data on depression are available in 81 cases). There were

| Table 1. Demographic Information. | Total, n (%) |
|------------------------------|-------------|
| Variable                      | (N = 93)    |
| Age, median (range)           | 15.5 (11.2–17.9) |
| Female                        | 73 (78.5) |
| Born in Canada                | 71 (76.3) |
| Caucasian (N = 92)            | 64 (69.6) |
| First Nations, Inuit, Métis (N = 92) | 8 (8.6) |
| Unstable housing* (N = 92)    | 14 (15.2) |
| Child protection services involved | 26 (27.9) |
| Abuse or maltreatment* history (confirmed/ suspected) (n = 92) | 31 (33.7) |

*Unstable housing defined as living in group home, non-parental guardian, residential treatment, detention centre, no fixed address; other; Stable housing defined as living with one or more biological/adoptive parent, with or without a step-parent/partner.

*Abuse includes physical or sexual; maltreatment includes verbal abuse or neglect.
no repeat episodes of self-harm in the same individual reported to the CPSP during the study period.

Demographic information regarding the 93 cases is presented in Table 1. Four provinces reported the majority (88.2%) of cases: Quebec (n = 27), Ontario (n = 26), Alberta (n = 21), and British Columbia (n = 8). Eleven cases (11.8%) were from the other provinces combined.

The majority of cases were female (78.5%), under the age of 16 years (65%; range 11.7–17.9 years) and Canadian-born (76.3%). Eight percent of the sample were −

Table 2. Clinical Features of Self-Harm.

| Clinical Feature                  | Total (N = 93) | Female (n = 73) | Male (n = 20) | Statistic (df) | P value |
|----------------------------------|----------------|-----------------|---------------|----------------|---------|
| **Method of self-harm**          |                |                 |               |                |         |
| Overdose                         | 69 (74.2)      | 59 (80.8)       | 10 (50.0)     | 7.8 (1)        | .005    |
| Hanging                          | 18 (19.4)      | 11 (15.1)       | 7 (35.0)      | 3.9 (1)        | .04     |
| Other                            | 6 (6.5)        |                 |               |                |         |
| **Death from self-harm**         | 10 (10.7)      |                 |               |                |         |
| Death by hanging                 | 9 (90.0)       |                 |               |                |         |
| **Characteristics of self-harm** |                |                 |               |                |         |
| Evidence of suicidal intent (N = 73) | 44 (47.3) | 34 (46.6)       | 10 (50.0)     | 0.02 (1)       | .87     |
| Evidence of substance use during episode (N = 87) | 30 (34.5) | 24 (34.8)       | 6 (33.3)      | 0.13 (1)       | .90     |
| Used own prescribed psychotropic medication for overdose (N = 69) | 22 (31.8) |                 |               |                |         |
| Parent/guardian/caregiver aware patient considering suicide (N = 92) | 24 (26.0) |                 |               |                |         |
| **Precipitant of self-harm**     |                |                 |               |                |         |
| Interpersonal conflict (all)     | 64 (68.8)      | 51 (69.9)       | 13 (65.0)     | 0.17 (1)       | .67     |
| Family conflict                  | 40 (43.0)      | 31 (42.5)       | 9 (45.0)      | 0.04 (1)       | .83     |
| Peer conflict                    | 22 (23.7)      | 16 (22.2)       | 6 (28.6)      | 0.36 (1)       | .56     |
| Romantic conflict/break-up       | 21 (22.6)      |                 |               |                |         |
| Academic difficulty              | 9 (9.7)        |                 |               |                |         |
| Suicide in school/community      | 6 (6.5)        |                 |               |                |         |
| Sexuality/gender identity concern | 7 (7.5)     |                 |               |                |         |
| Abuse/Neglect                    | 8 (8.6)        |                 |               |                |         |
| Other (e.g. death in family)     | 31 (33.3)      |                 |               |                |         |

*Express wish to die, leave a suicide note/text, social media post, advanced instructions/directives, evidence of planning.

Due to small size, cells are suppressed to preserve confidentiality; df = degrees of freedom.
More than half of females (55.9%) and less than a third of males (29.4%) had a history of previous suicide attempt ($\chi^2 = 3.8$ (1), $p = .05$), 70% of which occurred in the 12 months preceding the ICU admission for self-harm. More than 50% of cases had presented to an emergency department with psychiatric concerns within the 3 months prior to the reported self-harm, more commonly among females vs. males (60.3% vs. 31.3%; $\chi^2 = 4.3$ (1), $p = .03$).

There were 10 deaths reported (Figure 1); of these nine were due to hanging. Males were more likely than females to die as a result of self-harm ($\chi^2 = 9.6$ (1), $p = .006$). The mean age of adolescents who died by suicide was younger than adolescents who survived (14.3 ± 1.4 vs. 15.3 ± 1.5; Mann-Whitney $U = 1.9$, $p = .05$), although not statistically significant. Females were younger than males overall, (13.3 ± 1.5 vs. 15.02 ± 1.0, $t = 2.06$ (8), $p = .07$) and the majority of females were between the ages of 12 and 13 years.

The majority of cases were managed in a PICU (88%) with 43% of cases requiring invasive or non-invasive ventilator support. Among cases of overdose, an antidote was used in 29% and dialysis was required in 8%. There were nine suicide attempts that resulted in permanent impairment (Figure 1), most commonly from hanging (44% of cases) (Figure 1). Overdose and hanging were the most common methods of self-harm with the former more common among females and the latter among males. Family conflict was the most frequently identified stressor precipitating the suicide attempt in both females and males.

Findings from this CPSP survey are consistent with a gender paradox of suicide observed across the lifespan, wherein although females make a greater number of suicide attempts and engage psychiatric care more often, males are more likely to die by suicide and are less likely to be engaged in mental health services. Consistent with previous research involving youth who have died by suicide, this study found that younger females are more likely to have had contact with the mental health care system in close time proximity to the ICU admission for self-harm. Suicide prevention strategies in younger adolescent girls should therefore focus on suicide risk stratification among those engaged in psychiatric services, and

### Table 3. Psychiatric History.

| Diagnosis of psychiatric disorder$^a$ (N = 85) | Total, (n = 93) | Female (n = 73) | Male (n = 20) | Statistic (df) | $P$ value |
|----------------------------------------------|-----------------|----------------|--------------|----------------|-----------|
| Depression (N = 81)                          | 63 (74.1)       | 53 (79.1)      | 10 (55.6)    | 4.1(1)         | .06       |
| Anxiety (N = 80)                             | 34 (41.9)       | --             | --           | --             | --        |
| Bipolar disorder (N = 81)                    | 26 (32.5)       | --             | --           | --             | --        |
| Psychotic illness (N = 81)                   | --              | --             | --           | --             | --        |
| Personality disorder (N = 81)                | 19 (23.4)       | --             | --           | --             | --        |
| Substance use disorder (N = 80)              | 27 (33.8)       | --             | --           | --             | --        |
| Attention deficit and hyperactivity disorder (N = 81) | 14 (17.3)   | --             | --           | --             | --        |
| Behavioural disorders (oppositional defiant/conduct disorder) (N = 81) | 8 (9.9)        | --             | --           | --             | --        |
| Neurodevelopmental disorder (N = 81)         | --              | --             | --           | --             | --        |
| Trauma related disorder (N = 81)             | 6 (7.4)         | --             | --           | --             | --        |
| Eating disorder (N = 81)                     | 6 (7.4)         | --             | --           | --             | --        |
| Other psychiatric diagnosis (N = 82)         | 33 (40.2)       | --             | --           | --             | --        |
| Family history of suicide attempt            | 6 (6.4)         | --             | --           | --             | --        |

### Suicide-related behaviour

| Lifetime history of suicide attempt (N = 85) | 43 (50.6) | 38 (55.9) | 5 (29.4) | 3.8 (1) | .05       |
| Suicide attempt in last 12 months (N = 39)  | 30/93 (32.2) | 26/34 | 4/5 | .03 (1) | .86       |

### Psychiatric Services

| Emergency department within 3 months for psychiatric reasons (N = 74) | 40 (54.1) | 35 (60.3) | 5 (31.3) | 4.3 (1) | .03       |
| Under care of mental health professional$^b$ (N = 84) | 51 (60.7) | 46 (69.7) | 5 (27.8) | 10.4 (1) | .001      |
| On waitlist for psychiatric services (N = 74) | 8 (10.8) | -- | -- | -- | -- |
| On psychotropic medication (N = 90) | 53 (58.9) | 45 (63.4) | 8 (42.1) | 2.8 (1) | .09       |
particularly among those with a prior history of self-harm (i.e., secondary prevention). By contrast, suicide prevention strategies in young males should focus on increasing engagement with mental health services and/or psychiatric care and targeted screening for suicide risk in non-psychiatric community settings (e.g., schools, primary care) (i.e., primary prevention). The results of this study further underscore the need to incorporate sex-specificity when considering a National Youth Suicide Prevention Strategy for Canada (Figure 2).

This study highlights the importance of interpersonal conflict, particularly family conflict, as a critical target for adolescent suicide prevention interventions (Figure 2). It is notable that only a minority (25%) of parents of youth in this study were aware that their child was considering suicide. These findings reinforce the particularly devastating effects of parent-child conflict and poor parent-child communication for vulnerable youth, and are consistent with the positive outcomes of some, though not all, controlled trials of family-focused suicide prevention interventions in decreasing suicide risk behaviours. Our findings support closer examination of the putative components and moderators of effective family-based interventions, and the necessity for well-conducted, controlled trials in generalizable populations of adolescents at risk of death by suicide, and their families.

Although this study did not examine risk factors for suicide by age, findings from this study point towards the need for age- and developmental- considerations for youth suicide prevention interventions. Suicide rates have historically been higher among older adolescents, however, consistent with recent reports of rising rates of suicide among younger teens, death by suicide in this study occurred more commonly in younger adolescents (although just at the threshold of statistical significance). Indeed, there are differences in risk factors for suicide in older versus younger adolescents. For example, whereas psychopathologies are less prevalent among younger teens,
when present, they can be more severe.47,48 In addition, while family conflict is a risk factor for self-harm among all adolescents, younger adolescents may be more vulnerable to the consequences of parent-child conflict due to the greater relative importance of within-family relationships in their lives and the less well-developed coping mechanisms.49,50 Similarly, although the incidence of peer conflict/bullying and abuse are higher in all youth who die by suicide when compared with the general population,51 one recent study of 273 Australian youth who died by suicide found disproportionately higher rates of peer conflict/bullying and abuse in younger adolescents, particularly in females, when compared with older adolescents.52 Therefore, the findings tentatively add to the growing literature that suggests that suicide prevention efforts should incorporate strategies tailored to distinct developmental periods within adolescence.

Youth suicide prevention interventions should target specific methods of suicide. In this study, 50% of attempts by hanging resulted in death, and 90% of deaths by suicide were by hanging, underscoring the lethality of this method of self-harm and possibly reflective of the rising incidence of suicide by hanging among youth in Canada and elsewhere, particularly among females.2,5,25,53 However, there are few points for intervention for suicide by hanging, due to its private nature, high degree of lethality54 and ease of accessibility of means.55,56 Strong primary and secondary suicide prevention efforts at a population level are urgently needed to reverse this trend (Figure 2). At the level of primary prevention, attention needs to be given to controlling suicide contagion among vulnerable adolescents.57 These efforts should include adherence to media guidelines for reporting on suicide,58 and monitoring of the portrayal of suicide in the entertainment industry/social media,59 as hanging was specifically associated with increased suicides among youth ages 10 to 19 years in the months following the release of 13 Reasons Why in 2017.60 Seventy-five percent of cases of medically serious self-harm in this study were by overdose, ~30% with a personal psychotropic prescription. National trends indicate the age-specific rate of suicide by poisoning among ages 10 to 19 has been decreasing slowly since 1981.53 However, self-poisoning accounts for two-thirds of self-harm presentations to the emergency department in some provinces,61,62 and 86% of hospitalizations for self-harm in youth nationally,8 with indicators that
rates are rising.8,63,64 A first poisoning episode is a strong predictor of subsequent suicide attempts and suicide.65 Taken together with the large proportion of suicide attempts by overdose in this study, there may be a role for restricting access to this type of lethal means.66,67 For example, the United Kingdom restricted the package size of acetaminophen to reduce the poisoning mortality associated with the drug, with resultant sustained benefit.68 A Canadian national suicide prevention strategy for youth should incorporate an evidence-based review of the role, if any, of legislatively-driven means restriction, and at minimum, mandatory counselling on medication-safe practices (Figure 2).

This study has several limitations. The use of clinician-based reporting, particularly from those associated with an ICU, may be less complete than youth or family report, and may have resulted in under-reporting of cases, affecting some provinces and populations (e.g., those in rural/remote areas, Indigenous youth) more than others. As such, the findings may not be representative of all adolescents with a history of suicide attempts or who die by suicide. In addition, the results are descriptive and do not account for the variability in the data captured by the questionnaire. Only a small proportion of adolescents in this study were reported as of Indigenous background (8.6% of cases while making up 7.2% of Canadian school-age population)69; thereby, limiting extrapolation of findings to Indigenous adolescents and their families. This study focused on near-fatal suicide attempts, and many required significant life-supporting interventions in order to survive. It is possible that youth who are transported to hospital are not representative of those who died by suicide in the community; further examination of potential differences between youth who present with near-fatal self-harm and those that die by suicide in the community may be needed. Finally, this study utilized sex as a biological variable assigned at birth, however our findings are also representative of socially constructed gender differences and gendered factors. Given the higher risk of suicide among trans and gender-diverse youth,70,71 and the imperative need for a gender-informed approach to suicide prevention, future research should incorporate the intersection of gender-identity, roles and relations, among adolescents with near fatal self-harm in Canada.

Conclusion

Sex differences among adolescents with near-fatal self-harm in this study are consistent with those reported across the lifespan. Sex differences in help-seeking and clinical history suggest that sex-specificity in adolescent suicide prevention efforts are warranted. Family conflict was the most common precipitant to the medically serious suicide attempt, suggesting a potential target for intervention. Taken together, these findings can inform an evidence-based National Suicide Prevention Strategy for adolescents in Canada.

Acknowledgments

The authors gratefully acknowledge the participating Canadian pediatricians and Xiaoquan Yao for her assistance with data analysis, and Jeremy Otto for his assistance with graphic design. The views, opinions, and/or conclusions expressed herein are those of the authors and do not necessarily reflect the views, opinions, and/or conclusions of the Canadian Paediatric Society, the Public Health Agency of Canada, or the Canadian Paediatric Surveillance Program.

Data Access

Data access will not be provided due to the sensitive nature of the content.

Declaration of Conflicting Interests

The author(s) declared the following potential conflicts of interest with respect to the research, authorship, and/or publication of this article: Dr. Daphne Korczak receives salary support from the Department of Psychiatry, University of Toronto Academic Scholar Award. Dr. Rachel Mitchell receives salary support from the Department of Psychiatry, University of Toronto Academic Scholar Award and Sunnybrook Health Sciences Centre Academic Scholar Award. She has received an honourarium from Medscape for appearing in a documentary.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This work was supported by the Public Health Agency of Canada and the Canadian Paediatric Society.

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Notes

1. Cases reported as transgender were included according to the identified biological sex to preserve confidentiality due to small cell size.
2. Care of any mental health professional: psychiatrist, psychologist, social worker, registered psychotherapist or other regulated professional.

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