







Near-Fatal Self-Harm Among Canadian Adolescents

Rachel HB Mitchell, MD, MSc, FRCPC¹ ,
Cornelius Ani, MBBS, MSc, DCH, MRCP, FRCPsych, MD²,
Claude Cyr, MD, MSc, FRCPC³, James Irvine⁴ ,
Ari R Joffe, MD, FRCPC⁵, Robin Skinner, BSc, MSP⁶,
Sam Wong, BSc, BEd, MD, FRCPC^{5,7} ,
Antonia S Stang, MD, MBA, MSc, FRCPC⁸,
Melanie Laffin, BCom⁹ and
Daphne J Korczak, MD, MSc, FRCPC (peds), FRCPC (psych)¹⁰ 

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; $\chi^2 = 7.8$ (1), $p = .005$), whereas hanging was more common in males (35% males vs. 15.1% females, $\chi^2 = 3.9$ (1), $p = .04$). More females than males had a past psychiatric diagnosis (79% vs. 58%; $\chi^2 = 4.1$ (1), $p = .06$), a previous suicide attempt (55.9% vs. 29.4%, $\chi^2 = 3.8$ (1), $p = .05$), and prior use of mental health service (69.7% vs. 27.8%, $\chi^2 = 10.4$ (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.

¹ Department of Psychiatry, Sunnybrook Health Science Centre, University of Toronto, Toronto, ON, Canada

² Division of Psychiatry, Imperial College London Hammersmith Hospital Campus, London, United Kingdom

³ Département de Pédiatrie, Université de Sherbrooke, CHUS – Hôp Fleurimont, Sherbrooke, QC, Canada

⁴ Department of Family Medicine, Community Health and Epidemiology, University of Saskatchewan, La Ronge, SK, Canada

⁵ Division of Critical Care Medicine, Department of Pediatrics, Stollery Children's Hospital, University of Alberta, Edmonton, AB, Canada

⁶ Public Health Agency of Canada, Ottawa, ON, Canada

⁷ Stanton Territorial Hospital, Yellowknife, NT, Canada

⁸ Department of Pediatrics, Alberta Children's Hospital, University of Calgary, Calgary, AB, Canada

⁹ Canadian Paediatric Surveillance Program, Ottawa, ON, Canada

¹⁰ Department of Psychiatry, Hospital for Sick Children, Toronto, ON, Canada

Corresponding Author:

Daphne J. Korczak, 1145 Burton Wing, Department of Psychiatry, Hospital for Sick Children, 555 University Avenue, Toronto ON, Canada, M5G 1X8.
Email: daphne.korczak@sickkids.ca

Abrégé

Objectif: Évaluer les caractéristiques cliniques des adolescents hospitalisés dans une unité de soins intensifs pour une auto-destruction 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 $15,2 \pm 1,5$) répondaient 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 a eu 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; $X^2 = 7,8$ (1), $p = ,005$), alors que la pendaison était plus commune chez les hommes (35 % hommes c. 15,1 % femmes; $X^2 = 3,9$ (1), $p = ,04$). Plus de femmes que d'hommes avaient un diagnostic psychiatrique passé (79 % c. 58 %; $X^2 = 4,1$ (1), $p = ,06$), une tentative de suicide précédente (55,9 % c. 29,4 %, $X^2 = 3,8$ (1), $p = ,05$), et une utilisation antérieure des services de santé mentale (69,7 % c. 27,8 %, $X^2 = 10,4$ (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.²³ 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 at 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 time-frame, 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.

Variable	Total, n (%) (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 ^a (N = 92)	14 (15.2)
Child protection services involved	26 (27.9)
Abuse or maltreatment ^b history (confirmed/suspected) (n = 92)	31 (33.7)

^aUnstable 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.

^bAbuse 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 female¹ (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 reported as First nations, Inuit and/or Métis. A large proportion (84.7%) were living in stable housing, without a known history of abuse (66.3%), and no involvement of child protection services (72%).

The clinical features of the self-harm episode are presented in Table 2. Overdose was the most common method of self-harm (n = 69; 74.2%) and attributed to 80.8% of female cases versus 50.0% of male cases ($\chi^2 = 7.8(1)$, $p = .005$). Hanging was the second most common method of self-harm (n = 18; 19.4%), and attributed to 35.0% of male cases versus 15.1% of female cases ($\chi^2 = 3.9(1)$, $p = .04$) with a 50% lethality rate of nine deaths.

Over one third of cases (34.5%) had confirmed evidence of substance use at the time of self-harm. Almost half (47.3%) left evidence of suicidal intent with a suicide note (n = 12), social media post/diary disclosure/text or telephone call (n = 9), or disclosure to a third party prior to (n = 12), or

during/after (n = 7) the self-harm incident. Evidence of suicidal intent, without a specified method of communication, was reported in a further six cases, with two conveying intent via more than one method (e.g., note and social media). Among cases of overdose, 31.8% (22/69) used their own prescribed psychotropic medication.

Interpersonal conflict was the most commonly identified precipitant of self-harm (~70%). Family conflict was the most frequently reported (46.2%), with romantic relationship and/or peer conflicts (including bullying and cyberbullying) reported in similar proportions (23.7% and 22.6%). Other reported stressors included academic difficulty (9.7%), suicide in the community/school (6.5%), difficulties related to sexuality and/or gender identity (7.5%), suspected/confirmed abuse (8.6%) and others such as legal problems and/or death in the family (33.3%). Parents/caregivers of youth were reported as aware that their child was considering suicide in only 26% of cases.

Psychiatric history and mental health care use are presented in Table 3. Almost 75% of youth were reported to have a known psychiatric disorder, more commonly among females vs. males (79.1% vs. 55.6%; $p = .06$). More than half of cases (54.8%) were identified as under the care of a mental health professional,² and more commonly among females vs. males (69.7% vs. 27.8%, $\chi^2 = 10.4(1)$, $p = .001$). Depression was the most reported psychiatric disorder (41.9%), followed by anxiety (32.5%), and substance use (33.8%).

Table 2. Clinical Features of Self-Harm.

Clinical Feature	Total (N = 93) n (%)	Female (n = 73) n (%)	Male (n = 20) n (%)	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					
Death by hanging	10 (10.7)	—	—	—	—
Characteristics of self-harm					
Evidence of suicidal intent ^a (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)	—	—	—	—

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

^bDue 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) (Fisher's exact test = 16.7, $p = .001$). All cases of permanent impairment by hanging occurred in females (median age 12.7

years). Seventy-eight percent of discharged cases were referred or already receiving psychiatric follow-up (Figure 1).

Discussion

Ninety-three cases of medically serious self-harm requiring ICU admission among youth (<18 years) were reported. 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,³⁰⁻³⁶ 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.^{26,37} 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.

	Total, (n = 93) n (%)	Female (n = 73)	Male (n = 20)	Statistic (df)	P value
Diagnosis of psychiatric disorder^a (N = 85)	63 (74.1)	53 (79.1)	10 (55.6)	4.1(1)	.06
Depression (N = 81)	34 (41.9)	—	—	—	—
Anxiety (N = 80)	26 (32.5)	—	—	—	—
Bipolar disorder (N = 81)	—	—	—	—	—
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 (76.5)	4/5 (80.0)	.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

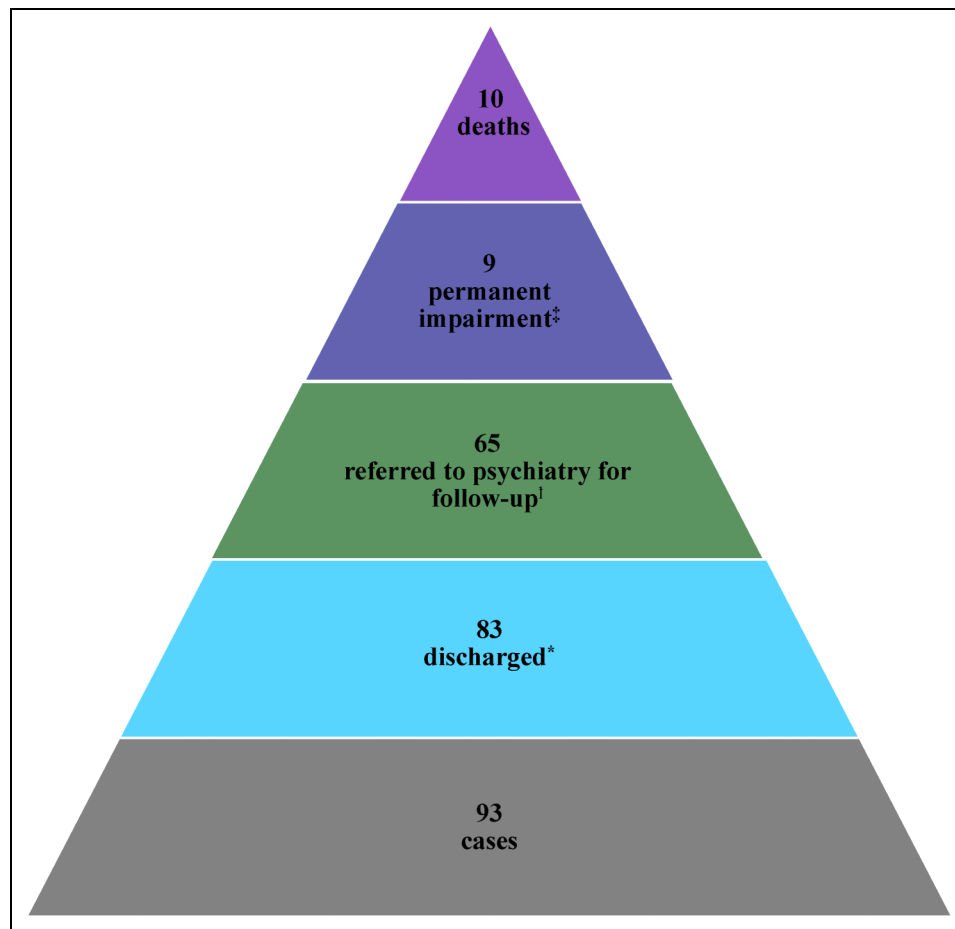


Figure 1. Outcome of intensive care unit admission.

*Including presumed discharge

¹Follow-up with a psychiatrist

‡neurological deficits, cognitive impairment or organ damage requiring long term treatment.

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).³⁰ 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,^{38–41} though not all,^{42,43}

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^{2,36,44,45}; however, consistent with recent reports of rising rates of suicide among younger teens,^{2,5} 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,^{36,46}

APPROACH	PRIMARY PREVENTION	SECONDARY PREVENTION
AGE, SEX AND GENDER-SPECIFIC	Target males in community settings to screen for suicide risk and to promote engagement in mental health services	Target females receiving psychiatric care for suicide risk stratification
FAMILY-FOCUSED	Encourage healthy communication and problem-solving strategies	Involve the family in the safety plan
METHOD-SPECIFIC	Reduce suicide contagion by adhering to media guidelines for reporting on suicide	
	Institute means restrictions and mandatory counselling on medication-safe practices through legislation	

Figure 2. Tenets to support a national suicide prevention strategy for youth in Canada.

*Adolescents with gender-identity concerns were too few to examine in the current study; however, research strongly supports a gender-informed approach to suicide prevention among adolescents.

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.

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Data Access

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





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ORCID iDs

Rachel HB Mitchell  <https://orcid.org/0000-0002-6361-0469>
James Irvine  <https://orcid.org/0000-0001-5104-903X>
Sam Wong  <https://orcid.org/0000-0002-2589-3891>
DJ Korczak  <https://orcid.org/0000-0002-0061-7495>

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.

References

1. Statistics Canada February 8, 2020. Table 13-10-039401. Leading causes of death, total population, by age group. <<https://www150-statcan.gc-ca.myaccess.library.utoronto.ca/t1/tb11/en/cv.action?pid=1310039401#timeframe>>. (February 8, 2020).
2. Varin M, Orpana HM, Palladino E, Pollock NJ, Baker MM. Trends in suicide mortality in Canada by Sex and Age group, 1981 to 2017: a population-based time series analysis: tendances de la mortalité par suicide au Canada selon le sexe et le groupe d'âge, 1981-2017 : une analyse de séries chronologiques dans la population. *Can J Psychiatry*. 2021 Feb;66(2):170-178.

3. Curtin S, Hedegaard H, Minino A, Warner M, Simon T. Quickstats: suicide rates for teens aged 15–19 years, by Sex - United States, 1975–2015. *MMWR Morb Mortal Wkly Rep*. 2017 Aug4;66(30):816.
4. Hedegaard H, Curtin SC, Warner M. Suicide rates in the United States continue to increase. *NCHS Data Brief*. 2018(309):1–8.
5. Ruch DA, Sheftall AH, Schlagbaum P, Rausch J, Campo JV, Bridge JA. Trends in suicide Among youth aged 10 to 19 years in the United States, 1975 to 2016. *JAMA Netw Open*. 2019;2(5):e193886.
6. Fazel S, Runeson B. Suicide. *N Engl J Med*. 2020;382(3):266–274.
7. Discharge Abstract Database, 2009–2010 to 2013–2014, Canadian Institute for Health Information.
8. Skinner R, McFaul S, Draca J, et al. Suicide and self-inflicted injury hospitalizations in Canada (1979 to 2014/15). *Health Promot Chronic Dis Prev Can*. 2016;36(11):243–251.
9. World Health Organization. Prevention S. 2018 July 26. https://www.who.int/mental_health/prevention/suicide/suicideprevent/en/. (Accessed 2020 July 26).
10. Hawton K, Saunders KE, O'Connor RC. Self-harm and suicide in adolescents. *Lancet*. 2012;379(9834):2373–2382.
11. Hawton K, Harriss L. Deliberate self-harm in young people: characteristics and subsequent mortality in a 20-year cohort of patients presenting to hospital. *J Clin Psychiatry*. 2007;68(10):1574–1583.
12. Mars B, Heron J, Klonsky ED, et al. Predictors of future suicide attempt among adolescents with suicidal thoughts or non-suicidal self-harm: a population-based birth cohort study. *Lancet Psychiatry*. 2019;6(4):327–337.
13. Kann L, McManus T, Harris WA, et al. Youth risk behavior surveillance - United States, 2017. *MMWR Surveill Summ*. 2018;67(8):1–114.
14. Cheung AH, Dewa CS. Canadian Community health survey: major depressive disorder and suicidality in adolescents. *Healthc Policy*. 2006;2(2):76–89.
15. Findlay L. Depression and suicidal ideation among Canadians aged 15 to 24. *Health Rep*. 2017;28(1):3–11.
16. Langille DB, Asbridge M, Kisely S, Rasic D. Suicidal behaviours in adolescents in Nova scotia, Canada: protective associations with measures of social capital. *Soc Psychiatry Psychiatr Epidemiol*. 2012;47(10):1549–1555.
17. Nock MK, Green JG, Hwang I, et al. Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: results from the national comorbidity survey replication adolescent supplement. *JAMA Psychiatry*. 2013;70(3):300–310.
18. May AM, Pachkowski MC, Klonsky ED. Motivations for suicide: converging evidence from clinical and community samples. *J Psychiatr Res*. 2020;123:171–177.
19. May A, Klonsky E. What distinguishes suicide attempters from suicide ideators? A meta-analysis of potential factors. *Clinical Psychology: Science and Practice*. 2016;23(1):5–20.
20. Korczak DJ, Skinner R, Dopko R. Serious self-harm requiring intensive care unit admission: understanding near-fatal suicide attempts. *Paediatr Child Health*. 2019;24(1):58–59.
21. Beautrais AL. Suicides and serious suicide attempts: two populations or one? *Psychol Med*. 2001;31(5):837–845.
22. Beautrais AL. Suicide and serious suicide attempts in youth: a multiple-group comparison study. *Am J Psychiatry*. 2003;160(6):1093–1099.
23. Zhang J, Sun L, Conwell Y, et al. Suicides and medically serious attempters are of the same population in Chinese rural young adults. *J Affect Disord*. 2015;176:176–182.
24. Trakhtenbrot R, Gvion Y, Levi-Belz Y, et al. Predictive value of psychological characteristics and suicide history on medical lethality of suicide attempts: a follow-up study of hospitalized patients. *J Affect Disord*. 2016;199:73–80.
25. Skinner R, McFaul S. Suicide among children and adolescents in Canada: trends and sex differences, 1980–2008. *CMAJ*. 2012;184(9):1029–1034.
26. Rhodes AE, Sinyor M, Boyle MH, et al. and others. Emergency department presentations and youth suicide: a case-control study. *Can J Psychiatry*. 2019;64(2):88–97.
27. Goodday SM, Bondy S, Sutradhar R, Brown HK, Rhodes A. The cumulative incidence of self-reported suicide-related thoughts and attempts in young Canadians. *Can J Psychiatry*. 2019;64(2):107–115.
28. Stewart SL, Baiden P, Theall-Honey L. Examining non-suicidal self-injury among adolescents with mental health needs, in Ontario, Canada. *Arch Suicide Res*. 2014;18(4):392–409.
29. Guerra G Garcia, Joffe AR, Cave D, et al. and others. Survey of sedation and analgesia practice Among Canadian pediatric critical care physicians. *Pediatr Crit Care Med*. 2016;17(9):823–830.
30. Rhodes A. Youth suicide in Canada: distinctions among boys and girls. *Healthc Q*. 2013;16(3):11–13.
31. Rhodes AE, Boyle MH, Bridge JA, et al. and others. Antecedents and sex/gender differences in youth suicidal behavior. *World J Psychiatry*. 2014;4(4):120–132.
32. Moore F, Taylor S, Beaumont J, Gibson R, Starkey C. The gender suicide paradox under gender role reversal during industrialisation. *PLoS One*. 2018;13(8):e0202487.
33. Canetto SS, Sakinofsky I. The gender paradox in suicide. *Suicide Life Threat Behav*. 1998;28(1):1–23.
34. Lewinsohn PM, Rohde P, Seeley JR, Baldwin CL. Gender differences in suicide attempts from adolescence to young adulthood. *J Am Acad Child Adolesc Psychiatry*. 2001;40(4):427–434.
35. Schrijvers DL, Bollen J, Sabbe BG. The gender paradox in suicidal behavior and its impact on the suicidal process. *J Affect Disord*. 2012;138(1–2):19–26.
36. McLoughlin AB, Gould MS, Malone KM. Global trends in teenage suicide: 2003–2014. *QJM*. 2015;108(10):765–780.
37. Rhodes AE, Khan S, Boyle MH, et al. Sex differences in suicides among children and youth: the potential impact of help-seeking behaviour. *Can J Psychiatry*. 2013;58(5):274–282.
38. Asamow JR, Hughes JL, Babeva KN, Sugar CA. Cognitive-Behavioral family treatment for suicide attempt prevention: a randomized controlled trial. *J Am Acad Child Adolesc Psychiatry*. 2017;56(6):506–514.
39. Diamond GS, Wintersteen MB, Brown GK, et al. Attachment-based family therapy for adolescents with suicidal

- ideation: a randomized controlled trial. *J Am Acad Child Adolesc Psychiatry*. 2010;49(2):122–131.
40. McCauley E, Berk MS, Asarnow JR, et al. and others. Efficacy of dialectical behavior therapy for adolescents at high risk for suicide: a randomized clinical trial. *JAMA Psychiatry*. 2018;75(8):777–785.
 41. Pineda J, Dadds MR. Family intervention for adolescents with suicidal behavior: a randomized controlled trial and mediation analysis. *J Am Acad Child Adolesc Psychiatry*. 2013;52(8):851–862.
 42. Cottrell DJ, Wright-Hughes A, Collinson M, et al. and others. A pragmatic randomised controlled trial and economic evaluation of family therapy versus treatment as usual for young people seen after second or subsequent episodes of self-harm: the self-harm intervention - family therapy (SHIFT) trial. *Health Technol Assess*. 2018;22(12):1–222.
 43. Diamond GS, Kobak RR, Krauthamer Ewing ES, et al. A randomized controlled trial: attachment-based family and nondirective supportive treatments for youth Who Are suicidal. *J Am Acad Child Adolesc Psychiatry*. 2019;58(7):721–731.
 44. Glenn CR, Kleiman EM, Kellerman J, et al. Annual research review: a meta-analytic review of worldwide suicide rates in adolescents. *J Child Psychol Psychiatry*. 2020;61(3):294–308.
 45. Rhodes AE, Bethell J, Carlisle C, Rosychuk RJ, Lu H, Newton A. Time trends in suicide-related behaviours in girls and boys. *Can J Psychiatry*. 2014;59(3):152–159.
 46. Brent DA, Baugher M, Bridge J, Chen T, Chiapetta L. Age- and sex-related risk factors for adolescent suicide. *J Am Acad Child Adolesc Psychiatry*. 1999;38(12):1497–1505.
 47. Pfeffer CR, Normandin L, Kakuma T. Suicidal children grow up: relations between family psychopathology and adolescents' lifetime suicidal behavior. *J Nerv Ment Dis*. 1998;186(5):269–275.
 48. Korczak D. Identifying depression in childhood: symptoms, signs and significance. *Paediatr Child Health*. 2012;17(10):572.
 49. Roche AM, Giner L, Zalsman G. Suicide in early childhood: a brief review. *Int J Adolesc Med Health*. 2005;17(3):221–224.
 50. DeVille DC, Whalen D, Breslin FJ, et al. Prevalence and family-related factors associated With suicidal ideation, suicide attempts, and self-injury in children aged 9 to 10 years. *JAMA Netw Open*. 2020;3(2):e1920956.
 51. Pelkonen M, Marttunen M. Child and adolescent suicide: epidemiology, risk factors, and approaches to prevention. *Paediatr Drugs*. 2003;5(4):243–265.
 52. Lee S, Dwyer J, Paul E, Clarke D, Treleaven S, Roseby R. Differences by age and sex in adolescent suicide. *Aust N Z J Public Health*. 2019 Jun;43(3):248–253.
 53. Liu L, Capaldi CA, Orpana HM, Kaplan MS, Tonmyr L. Changes over time in means of suicide in Canada: an analysis of mortality data from 1981 to 2018. *CMAJ*. 2021;193(10):E331–E338.
 54. Simounet C, Bourgeois M. [Suicides and attempted suicides by hanging]. *Ann Med Psychol (Paris)*. 1992;150(7):481–485.
 55. Kosky RJ, Dundas P. Death by hanging: implications for prevention of an important method of youth suicide. *Aust N Z J Psychiatry*. 2000;34(5):836–841.
 56. Gunnell D, Bennewith O, Hawton K, Simkin S, Kapur N. The epidemiology and prevention of suicide by hanging: a systematic review. *Int J Epidemiol*. 2005;34(2):433–442.
 57. Marchant A, Hawton K, Stewart A, et al. A systematic review of the relationship between internet use, self-harm and suicidal behaviour in young people: the good, the bad and the unknown. *PLoS One*. 2017;12(8):e0181722.
 58. Sinyor M, Schaffer A, Heisel MJ, et al. Media guidelines for reporting on suicide: 2017 update of the Canadian psychiatric association policy paper. *Can J Psychiatry*. 2018;63(3):182–196.
 59. National Action Alliance for Suicide Prevention. National Recommendations for Depicting Suicide. <https://theactionalliance.org/messaging>. (Accessed 2020 August 28).
 60. Niederkrotenthaler T, Stack S, Till B, et al. Association of increased youth suicides in the United States With the release of 13 reasons Why. *JAMA Psychiatry*. 2019 Sep;76(9):933–940.
 61. Bethell J, Bondy SJ, Lou WY, Guttman A, Rhodes AE. Emergency department presentations for self-harm among Ontario youth. *Can J Public Health*. 2013;104(2):e124–e130.
 62. Discharge Abstract Database, 2009–2010 to 2013–2014. Canadian Institute for Health Information, population estimates, Statistics Canada.
 63. Pauer S, Rajabali F, Zheng A, Smith J, Pursell R, Pike I. Analyses of child and youth self-poisoning hospitalizations by substance and socioeconomic Status. *Int J Environ Res Public Health*. 2021 Jun 30;18(13):7003.
 64. Chafe R, Aslanova R, Hamud O, Gregory P, Newhook LA. Hospitalizations due to self-poisoning at a Canadian paediatric hospital. *Paediatr Child Health*. 2018;23(2):101–105.
 65. Finkelstein Y, Macdonald EM, Hollands S, et al. Risk of suicide following deliberate self-poisoning. *JAMA Psychiatry*. 2015;72(6):570–575.
 66. Zalsman G, Hawton K, Wasserman D, et al. and others. Suicide prevention strategies revisited: 10-year systematic review. *The Lancet Psychiatry*. 2016;3(7):646–659.
 67. Pirkis J, Spittal MJ, Cox G, Robinson J, Cheung YTD, Studdert D. The effectiveness of structural interventions at suicide hot-spots: a meta-analysis. *International Journal of Epidemiology*. 2013;42(2):541–548.
 68. Hawton K, Bergen H, Simkin S, et al. Long term effect of reduced pack sizes of paracetamol on poisoning deaths and liver transplant activity in england and wales: interrupted time series analyses. *BMJ : British Medical Journal*. 2013;346:f403.
 69. Statistics Canada. Table 37-10-0098-01 Proportion of School age population, by selected characteristics, in and out of census metropolitan areas (CMA). 2016.
 70. Virupaksha HG, Muralidhar D, Ramakrishna J. Suicide and suicidal behavior among transgender persons. *Indian J Psychol Med*. 2016;38(6):505–509.
 71. Marshall E, Claes L, Bouman WP, Witcomb GL, Arcelus J. Non-suicidal self-injury and suicidality in trans people: a systematic review of the literature. *Int Rev Psychiatry*. 2016;28(1):58–69.