Emergency Department Presentations and Youth Suicide: A Case-Control Study

Présentations au service d'urgence et suicide des adolescents : une étude cas-témoin

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Abstract

Objective: We estimate associations between emergency department (ED) diagnoses and suicide among youth to guide ED care.

Method: This ED-based case-control study used data from the Office of the Chief Coroner and all EDs in Ontario, Canada. Cases ($n = 697$ males and $n = 327$ females) were aged 10 to 25 years who died by suicide in Ontario between April 2003 and March 2014, with an ED contact in the year before their death. Same-aged ED-based controls were selected during this time frame. Crude and adjusted odds ratios (aORs) and 95% confidence intervals were calculated.

Results: Among youth diagnosed with a mental health problem at their most recent ED contact (41.9% cases, 5% controls), suicide was elevated among nonfatal self-inflicted: 'other' injuries, including hanging, strangulation, and suffocation in both sexes (aORs > 14); cut/pierce injuries in males (aOR > 5); poisonings in both sexes (aORs > 2.2); and mood and psychotic disorders in males (aORs > 1.7). Among those remaining, 'undetermined' injuries and poisonings in both sexes (aORs > 5), 'unintentional' poisonings in males (aOR = 2.1), and assault in both sexes (aORs > 1.8) were significant. At least half of cases had ED contact within 106 days.

Conclusions: The results highlight the need for timely identification and treatment of mental health problems. Among those with an identified mental health problem, important targets for suicide prevention efforts are youth with self-harm and males

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with mood and psychotic disorders. Among others, youth with unintentional poisonings, undetermined events, and assaults should raise concern.

Abrégé

Objectif : Nous estimons les associations entre les diagnostics du service d'urgence (SU) et le suicide chez les adolescents afin de guider les soins des SU.

Méthode : Cette étude cas-témoin, basée dans les SU, a utilisé des données du Bureau du coroner en chef et de tous les SU de l'Ontario, au Canada. Les cas (*n* = 697 garçons et *n* = 327 filles), âgés entre 10 et 25 ans, sont décédés par suicide en Ontario entre avril 2003 et mars 2014, et avaient eu un contact avec un SU dans l'année précédant leur décès. Des témoins du même âge basés dans les SU ont été sélectionnés durant la même période. Des rapports de cotes bruts et ajustés (RCa) et des intervalles de confiance à 95% ont été calculés.

Résultats : Chez les adolescents ayant reçu un diagnostic de problème de santé mentale lors de leur visite la plus récente au SU (41,9% des cas, 5% des témoins), le suicide était élevé parmi des blessures non fatales auto-infligées: « d'autres » blessures, y compris la pendaison, la strangulation et la suffocation chez les 2 sexes (RCa > 14); des blessures par coupure/perçage chez les garçons (RCa > 5), l'empoisonnement chez les 2 sexes (RCa > 2,2) et des troubles de l'humeur et psychotiques chez les garçons (RCa > 1,7). Parmi ceux qui restent, des blessures « indéterminées » et l'empoisonnement chez les 2 sexes (RCa > 5); des empoisonnements « involontaires » chez les garçons (RCa: 2,1) et l'agression chez les 2 sexes (RCa > 1,8) étaient significatifs. Au moins la moitié des cas a eu un contact avec un SU dans les 106 jours précédents.

Conclusions : Les résultats soulignent le besoin d'une identification et d'un traitement en temps opportun des problèmes de santé mentale. Pour ceux chez qui un problème de santé mentale a été identifié, les initiatives de prévention du suicide peuvent d'abord cibler les adolescents qui s'automutilent et les garçons souffrant de troubles de l'humeur et psychotiques. Chez les autres, les adolescents qui ont des empoisonnements involontaires, des événements indéterminés et des agressions devraient susciter des inquiétudes.

The emergency department (ED) is a focus for suicide prevention policy and research.[1-4] Population-based studies confirm adults who later died by suicide were distinguished from their peers by their greater ED and inpatient mental health care contact.[5-7] This was recently verified for youth aged 10 to 25 years.[8] In total, 48% of youth who died by suicide were seen in the ED and/or inpatient setting (32% for mental health and 16% for other reasons), mainly the ED, in the year before their death. Increased rates of ED mental health visits among youth in the past decade make the development and piloting of ED-based preventive interventions targeting youth particularly important.[9,10]

Among youth diagnosed with a mental health problem in the ED, it is unclear which problems carry a higher risk for suicide. Hospital-based suicide prevention efforts have often focused on those with suicidal ideation, attempts, or self-harm (irrespective of intent), typically more frequent in females than males.[11-13] While these youth are at a higher risk for suicide,[14-17] the predictive value of other ED mental health problems[18] merits attention to guide ED-based care.[19] Furthermore, little is known about the suicide risk among the youth who account for the majority of ED contacts—those not diagnosed with a mental health problem.

To inform future suicide prevention efforts, we conducted a population-based case-control study to estimate the associations, separately for males and females, between specific ED diagnoses documented at the most recent contact and suicide among youth with or without a mental health problem.

Methods

Study Sample and Data Collection

This study builds on our prior research.[8,18,20] Decedents were youth (aged 10 to 25) who died by suicide in Ontario, Canada, between April 2003 and March 2014, inclusive. Decedents were individually linked to their administrative health care records in the year prior to their death[8] and cases identified as having an ED contact in the year before their death through the National Ambulatory Care Reporting System (NACRS)[21] after exclusion of health care contact(s), related to their death (e.g., dead or died on arrival). Live controls (ages 10 to 25) with an ED contact in NACRS during the study years were selected for comparison.

This study was approved by the Hamilton Integrated Research Ethics Board and the Health Canada and Public Health Agency of Canada's Research Ethics Board.

Study Measures

We measured the following characteristics: age, sex, neighbourhood income, and community size.

Type of ED contact: In Ontario EDs, a physician diagnosis is a mandatory field in NACRS with up to 9 additional

fields recorded. The most recent ED contact was chosen to reflect all cumulative information available up to that date to guide care and classified as follows:

1. A mental health problem: presence of a mental disorder and/or) self-harm: a self-inflicted injury or poisoning. Types of mental disorders were alcohol, other substance, schizophrenia/schizotypal/delusional, mood, anxiety, or all other mental disorders. Self-harm was specified by method: self-poisoning; cut/pierce, or an 'other' injury. Youth diagnosed with both a mental health problem and an 'other' (non–mental health) problem were also categorized.

2. An 'other' health problem only: where no mental health problem was recorded. The presence of injuries and poisonings that were not self-inflicted—an unintentional injury or poisoning, assault, or event of undetermined intent was specified.[17]

The most recent ED contact was also described by its timing, acuity, and prior medical care in the form of a recent mental health contact (past 30 days) or a prior ED contact for any reason (past year).

Days to death: Among cases, we counted the number of days from the most recent ED contact to their death.

Supplemental Table S1 provides a fuller description of study measures.

Statistical Analyses

Cases and controls were described and then stratified by type of ED contact and sex for subsequent analyses. Youth with missing data, about 1% in each subgroup, were excluded to ensure consistent comparisons. Differences between cases and controls were tabulated and tested using chi-square statistics. Among cases, we depicted the days to death by the mean, the 25th percentile, 50th percentile (median), and 75th percentile. To estimate associations between specific ED diagnoses and suicide, we conducted 4 logistic regressions stratified by type of ED contact and sex. We examined crude and adjusted odds ratios (aORs) and respective 95% confidence intervals (CIs). Post hoc differences by sex were identified by nonoverlapping CIs.

Results

Sample Characteristics

A total of 1024 ($n = 697$ males; $n = 327$ females) cases and over 2 million controls ($n = 1,318,145$ males; $n = 1,217,608$ females) were identified. At the most recent ED contact, fewer than half of cases ($n = 273$ [39.2%] males; $n = 156$ [47.7%] females) were diagnosed with a mental health problem compared to an 'other' health problem only (424 males [60.8%]; 171 females [52.3%]). In contrast, 95% of controls ($n = 1,252,102$ males; $n = 1,156,218$ females) were diagnosed with an 'other' health problem only. Notably, less than 5% of subjects were diagnosed with both a mental health problem and an 'other' health problem: male cases ($n = 28$, 4.0%) and controls ($n = 9645$, 0.7%); female cases ($n = 9$, 2.8%) and controls ($n = 6874$, 0.6%).

With some exceptions (Tables 1 and 2), cases were older than controls and more likely to live in rural areas and lower-income neighbourhoods. For cases, the most recent ED contact was of higher acuity and preceded by more medical care but was less likely to occur in the latter 2 study years. Cases also differed from controls on the weekday and month of this contact among females with a mental health problem (Table 1) and on registration after midnight among males without a mental health problem (Table 2).

Days to Death

The number of days from the most recent ED contact to death among cases is illustrated by type of ED contact and sex (Figure 1). Means were higher than medians, but both were lower in females. Among male and female youth, medians were 54 and 23 among those with a mental health problem (Figure 1a) and 106 and 72 among those with no mental health problem (Figure 1b), respectively.

Mental Health Problems and Suicide

The number and proportion of youth with specific mental health problems and corresponding associations with suicide are shown in Table 3. Some adjusted associations with suicide were consistent in boys and girls. Significant associations were found for 'other' self-inflicted injuries (aOR, 14.97 in males; aOR, 30.63 in females) and self-inflicted poisonings (aOR, 3.03 in males; aOR, 2.23 in females). 'Other' self-inflicted injuries were largely the *International Statistical Classification of Diseases and Health Related Problems, Revision 10, Enhanced Canadian Version (ICD-10-CA)* code X70 intentional self-harm by hanging/strangulation/suffocation. Protective associations were observed for anxiety disorders (aOR, 0.49 in males; aOR, 0.43 in females). Alcohol and other substance use disorders were not significantly associated with suicide, nor were the following categories: other mental disorders and both a mental health problem and an 'other' problem.

Some associations varied by sex. After adjustments, schizophrenia/schizotypal/delusional disorders (aOR, 2.20), mood disorders (aOR, 1.74), and a self-inflicted cut/pierce injury (aOR, 5.54) were associated with suicide in males.

Other Health Problems and Suicide

The number and proportion of youth not diagnosed with a mental health problem but diagnosed with unintentional injuries and poisonings, assaults, or undetermined events are shown along with the corresponding associations in Table 4. After adjustments, an undetermined event was associated with suicide in both sexes (aOR, 5.68 in males; aOR, 5.18 in females) and an unintentional poisoning in males (aOR, 2.12). An assault was associated with suicide in both sexes; however, the association was stronger in females than males (aOR, 6.57 vs. 1.83). Otherwise, unintentional injuries were

Table 1. Youth Diagnosed with a Mental Health Problem at Most Recent Emergency Department Contact.

	Male				Female			
Variable	Cases ($n = 269$),[a] n (%)	Controls ($n = 65,137$),[a] n (%)	χ^2	P Value	Cases ($n = 151$),[a] n (%)	Controls ($n = 60,527$),[a] n (%)	χ^2	P Value
Age, y								
10 to 15	11 (4.1)	8254 (12.7)	19.55	<0.001	19 (12.6)	10,921 (18.0)	7.71	0.021
16 to 17	28 (10.4)	7672 (11.8)	2 df		15 (9.9)	9144 (15.1)	2 df	
18 to 25	230 (85.5)	49,211 (75.5)			117 (77.5)	40,462 (66.8)		
Community size								
≥1,500,000	82 (30.5)	24,156 (37.1)	15.19	<0.001	52 (34.4)	23,390 (38.6)	3.11	0.212
10,000 to 1,499,000	141 (52.4)	34,279 (52.6)	2 df		79 (52.3)	31,466 (52.0)	2 df	
Rural <10,000	46 (17.1)	6702 (10.3)			20 (13.2)	5671 (9.4)		
Neighbourhood income quintile								
Lowest (Q1)	80 (29.7)	15,460 (23.7)	5.33	0.021	43 (28.5)	14,027 (23.2)	2.38	0.123
Higher (Q2-Q5)	189 (70.3)	49,677 (76.3)	1 df		108 (71.5)	46,500 (76.8)	1 df	
Most recent ED contact: registration time								
9 a.m. to 5 p.m.	103 (38.3)	23,828 (36.6)	4.48	0.106	57 (37.7)	23,022 (38.0)	3.43	0.18
5 p.m. to midnight	98 (36.4)	21,074 (32.4)	2 df		61 (40.4)	20,783 (34.3)	2 df	
After midnight, before 9 a.m.	68 (25.3)	20,235 (31.1)			33 (21.9)	16,722 (27.6)		
Day of week								
Weekday	167 (62.1)	38,427 (59.0)	1.06	0.304	106 (70.2)	37,273 (61.6)	4.73	0.03
Weekend	102 (37.9)	26,710 (41.0)	1 df		45 (29.8)	23,254 (38.4)	1 df	
Month								
January	23 (8.6)	6026 (9.3)	10.83	0.371	16 (10.6)	5754 (9.5)	19.58	0.034
February	29 (10.8)	5803 (8.9)	10 df		10 (6.6)	5929 (9.8)	10 df	
March	23 (8.6)	6991 (10.7)			10 (6.6)	7086 (11.7)		
April	14 (5.2)	4682 (7.2)			16 (10.6)	4184 (6.9)		
May	30 (11.2)	4905 (7.5)			16 (10.6)	4371 (7.2)		
June	23 (8.6)	4862 (7.5)			10 (6.6)	4381 (7.2)		
July	23 (8.6)	4799 (7.4)			15 (9.9)	4089 (6.8)		
August	19 (7.1)	4826 (7.4)			13 (8.6)	4176 (6.9)		
September	18 (6.7)	5303 (8.1)			17 (11.3)	4767 (7.9)		
October	26 (9.7)	5847 (9.0)			12 (7.9)	5322 (8.8)		
November and December	41 (15.2)	11,093 (17.0)			16 (10.6)	10,468 (17.3)		
Fiscal year								
2002/2003 to 2011/2012	219 (81.4)	37,165 (57.1)	64.9	<0.001	121 (80.1)	31,518 (52.1)	47.52	<0.001
2012/2013 and 2013/2014	50 (18.6)	27,972 (42.9)	1 df		30 (19.9)	29,009 (47.9)	1 df	
Acuity								
Resuscitation	45 (16.7)	932 (1.4)	431.69	<0.001	30 (19.9)	613 (1.0)	511.99	<0.001
Emergent	85 (31.6)	19,282 (29.6)	2 df		43 (28.5)	18,156 (30.0)	2 df	
Urgent, semiurgent, nonurgent	139 (51.7)	44,923 (69.0)			78 (51.7)	41,758 (69.0)		
Mental health contact past 30 days								
ED and/or inpatient	55 (20.5)	5142 (7.9)	68.73	<0.001	39 (25.8)	4530 (7.5)	88.12	<0.001
Outpatient only	56 (20.8)	10,187 (15.6)	2 df		40 (26.5)	10,844 (17.9)	2 df	
None	158 (58.7)	49,808 (76.5)			72 (47.7)	45,153 (74.6)		
ED contact past year								
No	84 (31.2)	34,815 (53.4)	53.16	<0.001	38 (25.2)	31,564 (52.1)	43.94	<0.001
Yes	185 (68.8)	30,322 (46.6)	1 df		113 (74.8)	28,963 (47.9)	1 df	

ED, emergency department.
[a]Individuals with missing data (1%) are not reported on to ensure their privacy and consistent comparisons.

negatively associated with suicide in males (aOR, 0.75) and not associated with suicide in females.

Discussion

To our knowledge, this is the first report of associations between ED-based diagnoses and a subsequent suicide among youth presenting to the ED. Among youth diagnosed with a mental health problem at their most recent ED contact, those with self-inflicted 'other' injuries—largely hanging/strangulation/suffocation—stood out with adjusted ORs exceeding 14 in both sexes. In males, self-inflicted cut/pierce injuries were also striking with an adjusted OR exceeding 5. Mood disorders were associated with suicide in males and females before

Table 2. Youth Diagnosed With an 'Other' Health Problem Only at Most Recent Emergency Department Contact.

	Male				Female			
Variable	Cases (n = 407),[a] n (%)	Controls (n = 1,239,462),[a] n (%)	χ^2	P Value	Cases (n = 158),[a] n (%)	Controls (n = 1,143,219),[a] n (%)	χ^2	P Value
Age, y								
10 to 15	24 (5.9)	341,223 (27.5)	95.8	<0.001	25 (15.8)	266,027 (23.3)	18.08	<0.001
16 to 17	50 (12.3)	125,507 (10.1)	2 df		29 (18.4)	105,527 (9.2)	2 df	
18 to 25	333 (81.8)	772,732 (62.3)			104 (65.8)	771,665 (67.5)		
Community size								
≥1,500,000	105 (25.8)	463,486 (37.4)	50.92	<0.001	45 (28.5)	416,051 (36.4)	14.15	<0.001
10,000 to 1,499,000	201 (49.4)	605,612 (48.9)	2 df		76 (48.1)	572,121 (50.0)	2 df	
Rural <10,000	101 (24.8)	170,364 (13.7)			37 (23.4)	155,047 (13.6)		
Neighbourhood income quintile								
Lowest (Q1)	107 (26.3)	249,745 (20.1)	9.53	0.002	46 (29.1)	249,514 (21.8)	4.92	0.027
Higher (Q2-Q5)	300 (73.7)	989,717 (79.9)	1 df		112 (70.9)	893,705 (78.2)	1 df	
Most recent ED contact: registration time								
9 a.m. to 5 p.m.	170 (41.8)	564,623 (45.6)	8.56	0.014	79 (50.0)	536,416 (46.9)	3.05	0.217
5 p.m. to midnight	146 (35.9)	464,648 (37.5)	2 df		48 (30.4)	419,570 (36.7)	2 df	
After midnight, before 9 a.m.	91 (22.4)	210,191 (17.0)			31 (19.6)	187,233 (16.4)		
Day of week								
Weekday	255 (62.7)	787,794 (63.6)	0.144	0.704	96 (60.8)	723,848 (63.3)	0.44	0.505
Weekend	152 (37.3)	451,668 (36.4)	1 df		62 (39.2)	419,371 (36.7)	1 df	
Month								
January	38 (9.3)	101,745 (8.2)	16.34	0.09	21 (13.3)	100,824 (8.8)	17.16	0.071
February	31 (7.6)	99,808 (8.1)	10 df		6 (3.8)	99,129 (8.7)	10 df	
March	22 (5.4)	110,725 (8.9)			15 (9.5)	112,507 (9.8)		
April	40 (9.8)	87,073 (7.0)			11 (7.0)	80,109 (7.0)		
May	40 (9.8)	105,333 (8.5)			12 (7.6)	90,433 (7.9)		
June	37 (9.1)	107,557 (8.7)			18 (11.4)	91,064 (8.0)		
July	44 (10.8)	110,915 (8.9)			11 (7.0)	97,465 (8.5)		
August	26 (6.4)	109,256 (8.8)			18 (11.4)	97,013 (8.5)		
September	33 (8.1)	105,210 (8.5)			8 (5.1)	91,310 (8.0)		
October	34 (8.4)	105,555 (8.5)			18 (11.4)	95,194 (8.3)		
November and December	62 (15.2)	196,285 (15.8)			20 (12.7)	188,171 (16.5)		
Fiscal year								
2002/2003 to 2011/2012	339 (83.3)	791,516 (63.9)	66.58	<0.001	129 (81.6)	703,567 (61.5)	26.98	<0.001
2012/2013 and 2013/2014	68 (16.7)	447,946 (36.1)	1 df		29 (18.4)	439,652 (38.5)	1 df	
Acuity								
Resuscitation	25 (6.1)	4475 (0.4)	386.17	<0.001	11 (7.0)	2168 (0.2)	385.66	<0.001
Emergent	50 (12.3)	104,149 (8.4)	2 df		19 (12.0)	90,238 (7.9)	2 df	
Urgent, semiurgent, nonurgent	332 (81.6)	1,130,838 (91.2)			128 (81.0)	1,050,813 (91.9)		
Mental health contact past 30 days								
ED and/or inpatient	34 (8.3)	3775 (0.3)	979.61	<0.001	12 (7.6)	3668 (0.3)	365.58	<0.001
Outpatient only	48 (11.8)	36,214 (2.9)	2 df		31 (19.6)	45,453 (4.0)	2 df	
None	325 (79.9)	1,199,473 (96.8)			115 (72.8)	1,094,098 (95.7)		
ED contact past year								
No	163 (40.0)	780,853 (63.0)	91.93	<0.001	41 (25.9)	672,802 (58.9)	70.62	<0.001
Yes	244 (60.0)	458,609 (37.0)	1 df		117 (74.1)	470,417 (41.1)	1 df	

ED, emergency department.
[a]Individuals with missing data (1%) are not reported on to ensure their privacy and consistent comparisons.

adjustments and after adjustments in males. Schizophrenia/schizotypal/delusional disorders were associated with suicide in males. Alcohol and other substance use disorders were not associated with suicide, and anxiety disorders were negatively associated in both sexes. Among youth not diagnosed with a mental health problem, an undetermined event and an assault were associated with suicide in both sexes, with the assault association stronger in females. Unintentional poisonings were associated with suicide in both sexes and remained in males after adjustments. The time from the most recent ED contact to death for half of the cases ranged from within 3 weeks (23 days among females with a mental health
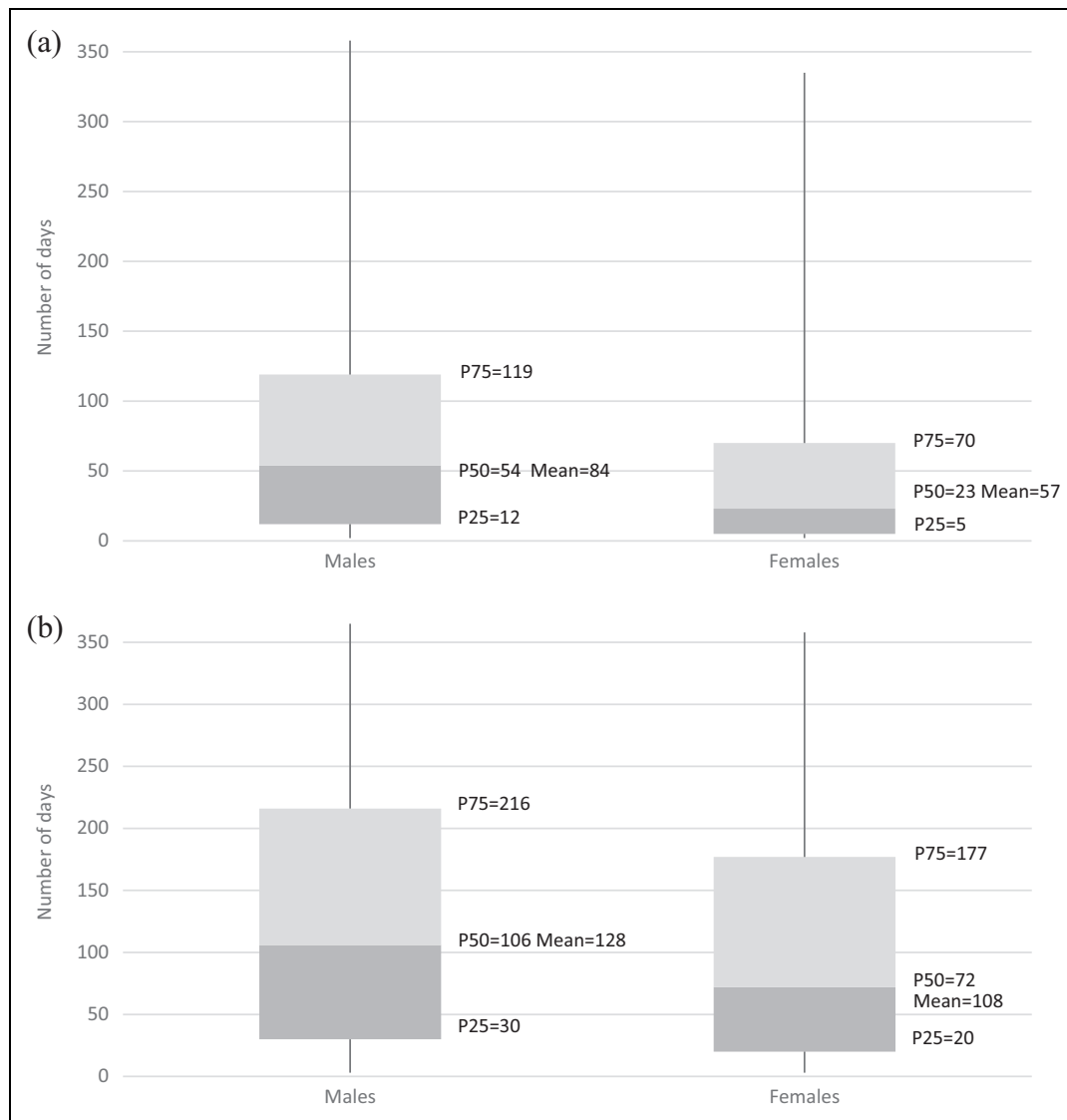
Figure 1. (a) Youth diagnosed with a mental health problem at most recent emergency department contact and time to death by suicide. (b) Youth diagnosed with an 'other' problem only at most recent emergency department contact and time to death by suicide. P = percentile.

problems) to within 3 months (106 days among males not diagnosed with a mental health problem).

Limitations

ED diagnoses were based on physician judgement, not validated through expert review or standardized, structured interviews. Further, *ICD* codes lack information on suicidal intent. Nevertheless, these diagnoses are real world and, therefore, pertinent to clinical and system-level decision making. Given almost all youth who died by suicide would have had a mental disorder[15] and self-harm is underdetected in the ED among youth,[22] underascertainment of mental health problems is considerable—less than half of cases were diagnosed with a mental health problem. Due to small cells, we were unable to estimate associations with suicide for certain diagnoses (e.g.,

child maltreatment or posttraumatic stress disorder) within broader categories or test statistical interactions between specific diagnoses and/or other correlates. Moreover, the timing of events needs refinement. Our study—spanning ages 10 to 25 with a 1-year look-back period—was not designed to examine possible mediators of diagnostic associations with suicide. Some mental health problems likely precede and contribute to the onset of others.[23] Adjusting for mental health problems that occurred more distally together with more proximal ones may have attenuated associations with suicide.

Comparison with Other Studies

We found strong associations for 'other' injuries—largely hanging/strangulation/suffocation—in both sexes. Among Canadian youth, this is also the most common method of

Table 3. Types of Mental Health Problems and Suicide among Youth Diagnosed with a Mental Health Problem at Most Recent Emergency Department Contact.

Mental Health Problem Type	Cases, n (%)	Controls, n (%)	Crude OR (95% CI)	Adjusted OR (95% CI)[a,b]
Males	(n = 269)	(n = 65,137)		
Alcohol disorder	40 (14.9)	16,987 (26.1)	0.50 (0.35 to 0.69)	0.81 (0.52 to 1.26)
Other substance disorder	25 (9.3)	8257 (12.7)	0.71 (0.47 to 1.07)	0.81 (0.52 to 1.26)
Schizophrenia, schizotypal, and delusional disorders	57 (21.2)	6367 (9.8)	2.48 (1.85 to 3.33)	2.20 (1.48 to 3.27)
Mood disorders	69 (25.7)	11,743 (18.0)	1.57 (1.19 to 2.06)	1.74 (1.24 to 2.45)
Anxiety disorders	31 (11.5)	20,892 (32.1)	0.28 (0.19 to 0.40)	0.49 (0.31 to 0.76)
Self-inflicted self-poison	34 (12.6)	2278 (3.5)	3.99 (2.78 to 5.73)	3.03 (1.94 to 4.73)
Self-inflicted cut/pierce	18 (6.7)	757 (1.2)	6.10 (3.76 to 9.89)	5.54 (3.23 to 9.50)
Self-inflicted other	40 (14.9)	453 (0.7)	24.94 (17.61 to 35.34)	14.97 (9.23 to 24.26)
Other mental disorders	14 (5.2)	6190 (9.5)	0.52 (0.31 to 0.90)	0.79 (0.44 to 1.40)
Both mental and 'other' health problem	27 (10.0)	9517 (14.6)	0.65 (0.44 to 0.97)	1.15 (0.76 to 1.76)
Females	(n = 151)	(n = 60,527)		
Alcohol disorder	18 (11.9)	12,008 (19.8)	0.55 (0.33 to 0.90)	0.89 (0.48 to 1.67)
Other substance disorder	13 (8.6)	3959 (6.5)	1.35 (0.76 to 2.38)	1.34 (0.71 to 2.56)
Schizophrenia, schizotypal, and delusional disorders	s	2072 (3.4)	s	s
Mood disorders	48 (31.8)	14,520 (24.0)	1.48 (1.05 to 2.08)	1.44 (0.91 to 2.26)
Anxiety disorders	22 (14.6)	24,547 (40.6)	0.25 (0.16 to 0.39)	0.43 (0.25 to 0.75)
Self-inflicted self-poison	33 (21.9)	5214 (8.6)	2.97 (2.02 to 4.37)	2.23 (1.31 to 3.8)
Self-inflicted cut/pierce	s	1267 (2.1)	s	s
Self-inflicted other	26 (17.2)	208 (0.3)	60.32 (38.70 to 94.02)	30.63 (15.89 to 59.0)
Other mental disorders	11 (7.3)	5375 (8.9)	0.81 (0.44 to 1.49)	0.87 (0.45 to 1.70)
Both mental and 'other' health problem	9 (6.0)	6790 (11.2)	0.43 (0.20 to 0.92)	0.83 (0.42 to 1.67)

CI, confidence interval; OR, odds ratio; s, suppressed for privacy reasons.
[a] Adjusted for mental health problem types, age, community size, income quintile, date and time, and acuity of the most ED recent contact and prior medical care.
[b] Change >10% from crude OR for all adjusted ORs except in males (self-inflicted cut/pierce injury) and in females (other substance disorder, mood disorders, and other mental disorders).

Table 4. Other Health Problems and Suicide among Youth Not Diagnosed with a Mental Health Problem at Most Recent Emergency Department Contact.

Other only problem type	Cases, n (%)	Controls, n (%)	Crude OR (95% CI)	Adjusted OR (95% CI)[a,b]
Males	(n = 407)	(n = 1,239,462)		
Any unintentional injury	158 (38.8)	635,224 (51.2)	0.60 (0.50 to 0.74)	0.75 (0.61 to 0.94)
Any unintentional poisoning	22 (5.4)	7596 (0.6)	9.27 (6.03 to 14.25)	2.12 (1.14 to 3.95)
Assault	23 (5.7)	32,044 (2.6)	2.28 (1.48 to 3.44)	1.83 (1.16 to 2.89)
Undetermined injury or poisoning	17 (4.2)	2518 (0.2)	21.41 (13.16 to 34.86)	5.68 (2.85 to 11.35)
Females	n = 158	n = 1,143,219		
Any unintentional injury	43 (27.2)	338,897 (29.6)	0.89 (0.63 to 1.26)	1.08 (0.74 to 1.58)
Any unintentional poisoning	8 (5.1)	7032 (0.6)	8.62 (4.23 to 17.56)	1.90 (0.61 to 5.96)
Assault	8 (5.1)	7106 (0.6)	8.53 (4.19 to 17.37)	6.57 (3.08 to 14.03)
Undetermined injury or poisoning	6 (3.8)	1759 (0.2)	28.68 (12.62 to 65.13)	5.18 (1.43 to 18.77)

CI, confidence interval; OR, odds ratio.
[a] Adjusted for other only problem types, age, community size, income quintile, date and time, and acuity of the most emergency department (ED) recent contact and prior medical care in the year before the most recent ED contact.
[b] Change >10% from crude OR.

suicide.[24] Among male youth, cut/pierce injuries were also strongly associated with suicide. Cut/pierce injuries have been found more strongly associated with suicide than self-poisonings[25] and more medically serious among (all ages) males than females.[26]

The reduced risk of suicide for those with anxiety disorders and the lack of association between alcohol, other substance use disorders, and mood disorders (females only) deserve comment because these disorders are associated with suicide among youth in the general population.[15,27,28] The prevalence of these diagnoses among controls was relatively common, especially anxiety disorders (Table 3). Accordingly, among youth who are diagnosed with a mental health problem in the ED, these diagnostic patterns, on their

own, may not help hospitals and clinicians in the ED (e.g., consulting psychiatrists) identify those at more imminent risk for suicide.

This study also found that mood disorders as well as schizophrenia/schizotypal/delusional disorders were associated with suicide in males. The latter associations may reflect the younger age of onset of psychotic disorders in males[29] and, for first episodes, an increased risk of self-harm[30] and suicide in the year after initial hospital contact.[31] Studies investigating associations between hospital presentations for self-harm, mental disorders, and suicide among youth are scarce. One previous study[14] found inpatient diagnoses of nonorganic psychosis with self-harm increased the risk of suicide 7 times.

Unintentional poisonings were associated with suicide in both sexes and after adjustments in males. Given ED underdiagnosis of mental health problems and weak associations between ED-diagnosed mental and 'other' health problems, there is clinical value in investigating whether specific 'other' health problems only are associated with suicide among youth not identified with a mental health problem. Despite differences in sampling and methods,[17] we too found elevated risks among youth treated in hospital for poisonings and injuries with an undetermined intent. We also found higher risks for assault in both sexes but with a stronger association in females. Unintentional injuries, quite common among ED controls (Table 4), were not associated with suicide in females and negatively associated in males. Still, it is plausible that injuries and poisonings requiring hospital admission[17] confer a stronger risk. It remains uncertain, though, to what extent injuries and poisonings may be directly causal for suicide (e.g., through brain damage), in the causal pathway (e.g., a stressor), or a misclassification of self-harm.[17]

Conclusions

Our study provides findings directly relevant to hospitals and clinicians providing ED-based care to youth and contributes to growing evidence on how the ED can best act as a service delivery site for suicide prevention and access to mental health care more broadly.[1] It identified several high-risk groups:

1. Among youth with a mental health problem (41.9% of cases; 5% controls): those with self-harm and males with mood or psychotic disorders
2. Among youth with no mental health problem, those with injuries and poisonings not identified as self-inflicted: undetermined events, unintentional poisonings, and assaults

The underdetection of mental health problems among cases is troubling with implications for the training and availability of mental health professionals to EDs. Cultural expectations of EDs may need to shift from where to send these youth to how to best treat these youth,[32] and promising models of emergency mental health interventions deserve further study.[1,33-35] Those assessed as suicidal in the ED typically receive a risk assessment and are then triaged to inpatient or outpatient treatment. Safety planning, including removing access to lethal means, and active outreach are brief, promising preventive interventions that can be implemented in the ED.[36,37] Because the time intervals between youth being seen in the ED and their subsequent suicides are short, the opportunity to intervene is brief, demanding urgent attention from providers.

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