Emergency department visits and hospital admissions for suicidal ideation, self-poisoning and self-harm among adolescents in Canada during the COVID-19 pandemic

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Abstract

Background: The COVID-19 pandemic had profound effects on the mental well-being of adolescents. We sought to evaluate pandemic-related changes in health care use for suicidal ideation, self-poisoning and self-harm.

Methods: We obtained data from the Canadian Institute for Health Information on emergency department visits and hospital admissions from April 2015 to March 2022 among adolescents aged 10–18 years in Canada. We calculated the quarterly percentage of emergency department visits and hospital admissions for a composite outcome comprising suicidal ideation, self-poisoning and self-harm relative to all-cause emergency department visits and hospital admissions. We used interrupted time-series methods to compare changes in levels and trends of these outcomes between the prepandemic (Apr. 1, 2015–Mar. 1, 2020) and pandemic (Apr. 1, 2020–Mar. 31, 2022) periods.

Results: The average quarterly percentage of emergency department visits for suicidal ideation, self-poisoning and self-harm relative to all-cause emergency department visits was 2.30% during the prepandemic period and 3.52% during the pandemic period. The level (0.08%, 95% confidence interval [CI] −0.79% to 0.95%) or trend (0.07% per quarter, 95% CI −0.14% to 0.28%) of this percentage did not change significantly between periods. The average quarterly percentage of hospital admissions for the composite outcome relative to all-cause admissions was 7.18% during the prepandemic period and 8.96% during the pandemic period. This percentage showed no significant change in level (−0.70%, 95% CI −1.90% to 0.50%), but did show a significantly increasing trend (0.36% per quarter; 95% 0.07% to 0.65%) during the pandemic versus prepandemic periods, specifically among females aged 10–14 years (0.76% per quarter, 95% CI 0.22% to 1.30%) and females aged 15–18 years (0.56% per quarter, 95% CI 0.31% to 0.81%).

Interpretation: The quarterly change in the percentage of hospital admissions for suicidal ideation, self-poisoning and self-harm increased among adolescent females in Canada during the first 2 years of the COVID-19 pandemic. This underscores the need to promote public health policies that mitigate the impact of the pandemic on adolescent mental health.

The World Health Organization declared the global COVID-19 pandemic on Mar. 11, 2020. In response, Canada's governments restricted in-person education, limited public and private gatherings and closed nonessential businesses.[1,2]

During the pandemic, social isolation — compounded by fears of contagion and financial hardship — may have had greater emotional effects on children and adolescents than other age groups[3,4] as they are particularly vulnerable to the psychological distress associated with social isolation.[5] Several studies reported a decrease in emergency department visits and admissions for self-harm behaviour in adolescents during the first few months of the pandemic, followed by an increase in visits and admissions.[6–14] In many Canadian provinces, restrictions to community mental health resources diminished access to outpatient care. Evidence of the impact this had on use of mental health care through pandemic waves and after the initiation of vaccination programs is lacking. It also remains unclear whether specific age groups were more

strongly affected than others. The incidence of adolescent mental health visits to emergency departments was increasing before the pandemic.[15] Understanding which demographics accounted for increased health care use during the pandemic at a national level is fundamental to enabling public policymakers in Canada to focus resources and mitigate the impact of the pandemic on what may already be a growing problem among adolescents.

We sought to test the hypothesis that the observed percentage of emergency department visits and admissions for suicidal ideation, self-poisoning and self-harm increased during the COVID-19 pandemic relative to all-cause visits, compared with the expected percentage based on the prepandemic period.

Methods

We conducted a retrospective, interrupted time-series analysis using Canadian administrative health care databases. Our findings were reported using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.[16]

Data sources

To identify patients aged 10–18 years with emergency department visits and hospital admissions for suicidal ideation, self-poisoning and self-harm, we used the Canadian version of the *International Classification of Diseases and Related Health Problems, 10th Revision* (ICD-10-CA) codes R458 (suicidal ideation, except for Quebec where it maps to "other symptoms/troubles of the mood"), X60–69 (intentional self-poisoning) and X70–84 (intentional self-harm) from the National Ambulatory Care Reporting System (NACRS), Discharge Abstract Database (DAD) and Hospital Morbidity Database (HMDB), overseen by the Canadian Institute for Health Information. These codes encompass emotional symptoms, suicidal attempts and nonsuicidal self-injury.[15,17,18] We chose the lower age limit because of concerns that inclusion of younger children, who had a dramatic reduction in overall emergency department visits for viral illnesses,[10,14,19,20] would inflate our estimates for mental health visits. We were also concerned that the small number of emergency department visits for suicidal ideation and self-harm among children younger than 10 years would lead to extensive suppression of cell sizes less than 5. To account for seasonality and prepandemic trends, the model included data from Apr. 1, 2015, to Mar. 31, 2022. The NACRS data included all hospital- and community-based ambulatory visits, including emergency department visits, day surgeries, outpatient visits and community clinic visits, but reporting varied by province or territory and by year, and was only comprehensively mandated in Ontario, Alberta and the Yukon (Appendix 1, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220507/tab-related-content).[21] The DAD captured administrative, clinical and demographic information on hospital discharges, deaths and transfers. Data from the DAD and HMDB were available for all provinces and territories. Data from Quebec were appended to the DAD to create the HMDB. When more than 1 diagnostic code was recorded, we analyzed the first diagnosis recorded in the medical record.

Exposure

The exposure occurred in March 2020, when the World Health Organization declared the COVID-19 pandemic and the Public Health Agency of Canada implemented guidance to reduce transmission of SARS-CoV-2.[1,2] To enable analysis of events by quarter, we defined the prepandemic period as Apr. 1, 2015, to Mar. 31, 2020, and the pandemic period as Apr. 1, 2020, to Mar. 31, 2022.

Outcomes

The primary and secondary outcomes were the percentage of emergency department visits and hospital admissions, respectively, for a composite of suicidal ideation, intentional self-poisoning and intentional self-harm. We chose a composite variable to overcome the potential of too few events per diagnostic category.

Statistical analysis

We reported counts and percentages of emergency department visits and admissions by age, sex and reason for visit. To minimize suppression of small cell sizes, we divided the study period into 3-month time periods. We decided a priori to stratify data by age (10–14 yr and 15–18 yr) and sex, given the higher prevalence of suicidal behaviour among females[22] and older adolescents.[23] To evaluate the impact of the pandemic on quarterly percentage of outcomes, we applied an interrupted time-series analysis using autoregressive integrated moving average (ARIMA) models. The ARIMA models use *t*-ratios to test the significance of the difference between the regression slopes (change per quarter in the average number of emergency department visits or hospital admissions for the composite outcome as a percentage of all-cause visits or admissions) before and after March 2020. We compared the level (stepwise change) from the last quarter of the prepandemic period (Apr. 1, 2015 to Mar. 31, 2020) to the first quarter of the pandemic period (Apr. 1, 2020 to Mar. 31, 2022) and slope (differences between the prepandemic and pandemic periods in the quarterly change in percentage of emergency department visits and admissions for the composite outcome relative to all-cause visits and admissions). We conducted a sensitivity analysis of emergency department visits including only jurisdictions where submission to NACRS was mandated. We accounted for heteroscedasticity and used correlograms depicting autocorrelation, partial autocorrelation and inverse autocorrelation functions to guide initial model selection, adjusting nonseasonal and additive seasonal ARIMA model parameters to account for best model fit. We evaluated the presence of white noise by the autocorrelations at various lags using the Ljung–Box χ^2 statistic. We assessed stationarity using the augmented Dickey–Fuller test. The date of the exposure and subsequent outcome events were reflected as ramp functions in the regression models. We analyzed data using SPSS version 27 (IBM).

Ethics approval

This study was approved by the Western University Health Sciences Research Ethics Board.

Table 1: Emergency department visits for suicidal ideation, intentional self-poisoning, self-harm and all causes by age and sex among adolescents before and during the COVID-19 pandemic

	Prepandemic period (Apr. 1, 2015, to Mar. 31, 2020)		Pandemic period (Apr. 1, 2020, to Mar. 31, 2022)	
Variable	No. (%) of visits	Average no. of visits per quarter	No. (%) of visits	Average no. of visits per quarter
Suicidal ideation, total no. of visits	72 173	3609	31 800	3975
Males aged 10–14 yr	7127 (9.9)	356	2765 (8.7)	346
Females aged 10–14 yr	16 566 (23.0)	828	9511 (29.9)	1189
Males aged 15–18 yr	15 418 (21.4)	771	5715 (18.0)	714
Females aged 15–18 yr	33 062 (45.8)	1653	13 809 (43.4)	1726
Intentional self-poisoning, total no. of visits	23 701	1185	12 335	1542
Males aged 10–14 yr	691 (2.9)	35	381 (3.1)	48
Females aged 10–14 yr	5270 (22.2)	264	4017 (32.6)	502
Males aged 15–18 yr	3542 (14.9)	177	1375 (11.1)	172
Females aged 15–18 yr	14 198 (59.9)	710	6562 (53.2)	820
Intentional self-harm, total no. of visits	9988	499	4347	543
Males aged 10–14 yr	482 (4.8)	24	203 (4.7)	25
Females aged 10–14 yr	2180 (21.8)	109	1073 (24.7)	134
Males aged 15–18 yr	1794 (18.0)	90	707 (16.3)	88
Females aged 15–18 yr	5532 (55.4)	277	2364 (54.4)	296
Composite*, total no. of visits	105 862	5293	48 482	6060
Males aged 10–14 yr	8300 (7.8)	415	3349 (6.9)	419
Females aged 10–14 yr	24 016 (22.7)	1201	14 601 (30.1)	1825
Males aged 15–18 yr	20 754 (19.6)	1038	7797 (16.1)	975
Females aged 15–18 yr	52 792 (49.9)	2640	22 735 (46.9)	2842
Total no. of all-cause visits	4 601 598	230 080	1 377 439	172 180
Males aged 10–14 yr	1 124 580 (24.4)	56 229	320 455 (23.3)	40 057
Females aged 10–14 yr	1 045 659 (22.7)	52 283	318 834 (23.1)	39 854
Males aged 15–18 yr	1 078 020 (23.4)	53 901	322 541 (23.4)	40 318
Females aged 15–18 yr	1 353 339 (29.4)	67 667	415 609 (30.2)	51 951

*Composite outcome of emergency department visits for suicidal ideation, intentional self-poisoning and intentional self-harm.

Results

The prepandemic period had an average of 5293 emergency department visits per quarter for the composite of suicidal ideation, self-poisoning and self-harm among adolescents aged 10–18 years. This increased to 6060 emergency department visits per quarter during the pandemic period. The average quarterly number of all-cause emergency department visits decreased from 230 080 during the prepandemic period to 172 180 during the pandemic period (Table 1).

The prepandemic period had an average of 1590 hospital admissions per quarter for the composite of suicidal ideation, self-poisoning and self-harm among adolescents aged 10–18 years. This increased to 1770 admissions per quarter during the pandemic period. The average quarterly number of all-cause hospital admissions decreased from 22 137 during the prepandemic period to 19 762 during the pandemic period (Table 2).

Emergency department visits

Among all adolescents aged 10–18 years, an average of 3.52% of all emergency department visits per quarter during the pandemic period were for the composite outcome, compared with 2.30% during the prepandemic period (Table 3). The percentage of emergency department visits for the composite, relative to all-cause visits, did not have a significant, immediate stepwise change from the last quarter of the prepandemic period to the first quarter of the pandemic period (level change 0.08%, 95% confidence interval [CI] −0.79% to 0.95%). The percentage of emergency department visits for the composite outcome increased very slightly over time during the prepandemic period and this trend did not change significantly during the pandemic

Table 2: Hospital admissions for suicidal ideation, intentional self-poisoning, self-harm and all causes by age and sex among adolescents before and during the COVID-19 pandemic

Variable	Prepandemic period (Apr. 1, 2015, to Mar. 31, 2020)		Pandemic period (Apr. 1, 2020, to Mar. 31, 2022)	
	No. (%) of admissions	Average no. of admissions per quarter	No. (%) of admissions	Average no. of admissions per quarter
Suicidal ideation, total no. of admissions	14 008	700	6041	755
Males aged 10–14 yr	1110 (7.9)	56	385 (6.4)	48
Females aged 10–14 yr	3792 (27.1)	190	1937 (32.1)	242
Males aged 15–18 yr	2585 (18.5)	129	927 (15.3)	116
Females aged 15–18 yr	6521 (46.6)	326	2792 (46.2)	349
Intentional self-poisoning, total no. of admissions	15 996	800	7440	930
Males aged 10–14 yr	461 (2.9)	23	220 (3.0)	28
Females aged 10–14 yr	4013 (25.1)	201	2535 (34.1)	317
Males aged 15–18 yr	2332 (14.6)	117	804 (10.8)	101
Females aged 15–18 yr	9190 (57.5)	460	3881 (52.2)	485
Intentional self-harm, total no. of admissions	1803	90	680	85
Males aged 10–14 yr	71 (3.9)	4	13 (1.9)	2
Females aged 10–14 yr	346 (19.2)	17	148 (21.8)	19
Males aged 15–18 yr	478 (26.5)	24	175 (25.7)	22
Females aged 15–18 yr	908 (50.4)	45	344 (50.6)	43
Composite*, total no. of admissions	31 807	1590	14 161	1770
Males aged 10–14 yr	1642 (5.2)	82	618 (4.4)	77
Females aged 10–14 yr	8151 (25.6)	408	4620 (32.6)	578
Males aged 15–18 yr	5395 (17.0)	270	1906 (13.5)	238
Females aged 15–18 yr	16 619 (52.2)	831	7017 (49.6)	877
Total no. of all-cause admissions	442 732	22 137	158 095	19 762
Males aged 10–14 yr	87 697 (19.8)	4385	30 412 (19.2)	3802
Females aged 10–14 yr	94 746 (21.4)	4737	38 468 (24.3)	4809
Males aged 15–18 yr	102 237 (23.1)	5112	34 600 (21.9)	4325
Females aged 15–18 yr	158 052 (35.7)	7903	54 615 (34.5)	6827

*Composite outcome of hospital admissions for suicidal ideation, intentional self-poisoning and intentional self-harm.

period (change in trend 0.07% per quarter, 95% CI −0.14% to 0.28%) (Table 3 and Appendix 2, Supplementary Table 1, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220507/tab-related-content).

The percentage of emergency department visits for the composite outcome, relative to all-cause visits, was higher among females than among males and among older than younger adolescents during both the prepandemic and pandemic periods (Figure 1). We did not observe any significant immediate stepwise changes or changes in trend between the prepandemic and pandemic periods in any sex and age group (Table 3).

A sensitivity analysis limited to jurisdictions where comprehensive reporting of emergency department visits in NACRS was mandated showed similar results to the primary analysis (Appendix 3, Supplementary Table 2 and Appendix 4, Supplementary Table 3, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220507/tab-related-content). However, an analysis of absolute numbers of emergency department visits for the composite outcome, without adjustment for trends in all-cause emergency department visits, showed a significant immediate decrease of 2624 (95% CI −4306 to −942) emergency department visits in the first quarter of the pandemic period, compared with the last quarter of the prepandemic period. Emergency department visits for the composite outcome increased significantly during the pandemic period by an average of 436 (95% CI 90 to 782) visits per quarter (Appendix 5, Supplementary Table 4, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220507/tab-related-content).

Hospital admissions

Among all adolescents aged 10–18 years, an average of 8.96% of all hospital admissions per quarter during the pandemic period were for the composite outcome, compared with 7.18% during the prepandemic period (Table 4). The percentage of admissions for the composite outcome, relative to all-cause

Table 3: Change in average quarterly percentage of emergency department visits for suicidal ideation, intentional self-poisoning and self-harm by age and sex before and during the COVID-19 pandemic*

	Prepandemic period (Apr. 1, 2015, to Mar. 31, 2020)		Pandemic period (Apr. 1, 2020, to Mar. 31, 2022)		Difference between the prepandemic and pandemic periods	
Variable	Average quarterly % of all-cause visits†	Quarterly change in % of all-cause visits (95% CI)‡	Average quarterly % of all-cause visits†	Quarterly change in % of all-cause visits (95% CI)§	Change in level, % (95% CI)¶	Change in trend, % (95% CI)**
Suicidal ideation	1.57	0.04 (0.02 to 0.06)	2.31	0.05 (−0.05 to 0.15)	0.11 (−0.37 to 0.59)	0.01 (−0.11 to 0.13)
Males aged 10–14 yr	0.63	0.02 (0.02 to 0.02)	0.86	0.00 (−0.06 to 0.06)	−0.02 (−0.35 to 0.31)	−0.02 (−0.08 to 0.04)
Females aged 10–14 yr	1.58	0.04 (0.02 to 0.06)	2.98	0.13 (−0.04 to 0.30)	0.41 (−0.36 to 1.18)	0.09 (−0.10 to 0.28)
Males aged 15–18 yr	1.43	0.03 (0.01 to 0.05)	1.77	0.02 (−0.04 to 0.08)	−0.12 (−0.43 to 0.19)	−0.01 (−0.09 to 0.07)
Females aged 15–18 yr	2.44	0.05 (0.03 to 0.07)	3.32	0.06 (−0.07 to 0.18)	0.01 (−0.65 to 0.67)	0.01 (−0.14 to 0.15)
Intentional self-poisoning	0.52	0.01 (0.01 to 0.01)	0.90	0.02 (−0.02 to 0.06)	0.20 (0.03 to 0.37)	0.01 (−0.03 to 0.05)
Males aged 10–14 yr	0.06	–	0.12	–	–	–
Females aged 10–14 yr	0.50	0.01 (0.01 to 0.01)	1.26	0.10 (0.08 to 0.12)	0.31 (0.19 to 0.43)	0.09 (0.07 to 0.11)
Males aged 15–18 yr	0.33	0.00 (−0.01 to 0.01)	0.43	−0.03 (−0.04 to −0.02)	0.18 (0.04 to 0.32)	−0.03 (−0.05 to −0.01)
Females aged 15–18 yr	1.05	0.01 (−0.01 to 0.03)	1.58	−0.01 (−0.01 to 0.03)	0.34 (0.09 to 0.59)	0.00 (−0.04 to 0.05)
Intentional self-harm	0.22	0.00 (0.00 to 0.00)	0.32	0.00 (0.00 to 0.01)	0.07 (0.03 to 0.11)	0.00 (0.00 to 0.01)
Males aged 10–14 yr	0.04	–	0.06	–	–	–
Females aged 10–14 yr	0.21	0.00 (0.00 to 0.00)	0.34	0.01 (−0.01 to 0.03)	0.04 (−0.04 to 0.12)	0.01 (−0.01 to 0.03)
Males aged 15–18 yr	0.17	–	0.22	–	–	–
Females aged 15–18 yr	0.41	0.00 (0.00 to 0.00)	0.57	0.02 (0.00 to 0.04)	0.10 (0.02 to 0.18)	0.02 (0.00 to 0.04)
Composite††	2.30	0.05 (0.03 to 0.07)	3.52	0.12 (−0.07 to 0.31)	0.08 (−0.79 to 0.95)	0.07 (−0.14 to 0.28)
Males aged 10–14 yr	0.74	0.03 (0.02 to 0.04)	1.05	0.02 (−0.06 to 0.09)	−0.02 (−0.37 to 0.33)	−0.01 (−0.09 to 0.07)
Females aged 10–14 yr	2.30	0.05 (0.03 to 0.07)	4.58	0.24 (0.01 to 0.47)	0.78 (−0.30 to 1.86)	0.19 (−0.06 to 0.44)
Males aged 15–18 yr	1.93	0.04 (0.02 to 0.06)	2.42	−0.03 (−0.11 to 0.05)	0.13 (−0.33 to 0.59)	−0.07 (−0.17 to 0.03)
Females aged 15–18 yr	3.90	0.06 (0.04 to 0.08)	5.47	0.06 (−0.10 to 0.23)	0.46 (−0.39 to 1.31)	0.00 (−0.18 to 0.19)

Note: CI = confidence interval, ICD-10-CA = *International Classification of Diseases and Related Health Problems, 10th Revision*, Canadian version.
*For some strata, numbers were too few to run the time-series model.
†Average quarterly percentages expressed as number of emergency department visits for a given ICD-10-CA code per 100 all-cause visits.
‡Average change in outcome event for every subsequent quarter from Apr. 1, 2015, to Mar. 31, 2020.
§Average change in outcome event for every subsequent quarter from Apr. 1, 2020, to Mar. 31, 2022.
¶Immediate stepwise change from the last quarter of the prepandemic period to the first quarter of the pandemic period in the percentage of the outcome event.
**The difference between the pandemic and prepandemic periods in the quarterly change in percentage of the outcome event.
††Composite outcome of emergency department visits for suicidal ideation, intentional self-poisoning and intentional self-harm.

admissions, did not have a significant, immediate stepwise change from the last quarter of the prepandemic period to the first quarter of the pandemic period (level change −0.70%, 95% CI −1.90% to 0.50%). However, in contrast to the prepandemic period, the percentage of admissions for the composite outcome increased significantly over time during the pandemic period (change in trend 0.36% per quarter, 95% CI 0.07% to 0.65%) (Table 4 and Appendix 6, Supplementary Table 5, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220507/tab-related-content). This increasing trend was seen primarily among females aged 10–14 years (change in trend 0.76% per quarter, 95% CI 0.22% to 1.30%) and females aged 15–18 years (change in trend 0.56% per quarter, 95% CI 0.31% to 0.81%) (Table 4 and Figure 2). Changes over time in the composite outcome were driven by increases in intentional self-poisoning (change in trend 0.24% per quarter, 95% CI 0.07% to 0.41%) and suicidal ideation (change in trend 0.12%, 95% CI 0.02% to 0.22%) (Table 4).

An analysis of absolute numbers of hospital admissions for the composite outcome, without adjustment for trends in all-cause admissions, showed a significant immediate decrease of 694 (95% CI −1296 to −91) admissions in the first quarter of the pandemic period, compared with the last quarter of the prepandemic period (Appendix 7, Supplementary Table 6, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220507/tab-related-content). Admissions for the composite outcome increased significantly during the pandemic period by an average of 150 (95% CI 2 to 297) visits per quarter.

Figure 1: Emergency department (ED) visits for composite outcome of suicidal ideation, self-poisoning and self-harm per 100 all-cause visits in Canada, stratified by age and sex, from Apr. 1, 2015, to Mar. 31, 2022.

Interpretation

This Canadian population-based study found that the percentage of hospital admissions for suicidal ideation and self-harm among female adolescents increased significantly during the COVID-19 pandemic. Our findings highlight the importance of understanding the drivers of mental health concerns among female adolescents that lead to increased use of health care resources during pandemics. Our work may also inform policies to support sustained access to services for adolescents with mental illness and rationalize the development of screening programs for suicide risk that include younger adolescents.

Our findings parallel global reports of increased emergency department visits for mental health[14] and self-harm[20,24] among children, particularly for suicide attempts among adolescent females.[8,25] Limited data are available for all of Canada, but in Ontario, outpatient visits for mental health initially decreased then rose to 10%–15% above prepandemic levels,[6] with the greatest increase (39.7%) among females aged 10–14 years. Similarly, Saunders and colleagues[6] found the greatest increase in Ontario emergency department visits and admissions for mental health during the pandemic was among females 7–12 years. It is unclear whether this increase was owing to a reduction in outpatient services or an increased severity of mental health presentations. During the pandemic, emergency department visits for mental health increased in the United States, with a greater proportion of visits resulting in admission.[14,26] Although the global prevalence of depressive and anxiety symptoms among children and adolescents increased during the pandemic,[27] the proportion of emergency department visits shifted away from depression and anxiety toward suicide and self-injury,[26] concerns that are more likely to prompt admission. These increases mirror a prepandemic trend of increasing admissions[28] and emergency department visits for self-harm among younger adolescents in the US[29,30] and Canada.[31] The reasons are unclear; however, the launch of several social media platforms in 2013 has been postulated as a contributing factor.[30] Associations between mental health and developmentally inappropriate social media content[32] and cyberbullying[33] have been described, alongside increased access to these platforms and worsening mental health during the pandemic.[34] Several studies have found a greater increase in emergency department visits for mental health among females than males.[35] Several explanations have been postulated, including an increased prevalence of affective symptoms among females during the pandemic,[25,36,37] and greater vulnerability to stressful life events[38] such as domestic violence and child maltreatment.[25,39] Our results and those of other studies suggest that public policies should ensure that mental health initiatives involve adolescents of all ages.

Among adolescents, the mental health morbidity associated with the pandemic has been postulated to result from reduced interactions with peers, teachers, counsellors and

Table 4: Change in average quarterly percentage of hospital admissions for suicidal ideation, intentional self-poisoning and self-harm by age and sex strata before and during the COVID-19 pandemic*

	Prepandemic period (Apr. 1, 2015, to Mar. 31, 2020)		Pandemic period (Apr. 1, 2020, to Mar. 31, 2022)		Difference between the prepandemic and pandemic periods	
Variable	Average quarterly % of all-cause admissions†	Quarterly change in % of all-cause admissions (95% CI)‡	Average quarterly % of all-cause admissions†	Quarterly change in % of all-cause admissions (95% CI)§	Change in level, % (95% CI)¶	Change in trend, % (95% CI)**
Suicidal ideation	3.16	0.02 (0.00 to 0.04)	3.82	0.14 (0.06 to 0.22)	−0.23 (−0.73 to 0.27)	0.12 (0.02 to 0.22)
Males aged 10–14 yr	1.27	–	1.27	–	–	–
Females aged 10–14 yr	4.00	0.02 (−0.04 to 0.08)	5.04	0.34 (0.11 to 0.57)	−0.84 (−2.25 to 0.57)	0.32 (0.03 to 0.61)
Males aged 15–18 yr	2.53	0.02 (0.00 to 0.04)	2.68	−0.01 (−0.09 to 0.07)	−0.04 (−0.60 to 0.52)	−0.03 (−0.13 to 0.07)
Females aged 15–18 yr	4.13	0.04 (0.02 to 0.06)	5.11	0.18 (−0.03 to 0.39)	−0.25 (−1.45 to 0.95)	0.14 (−0.09 to 0.37)
Intentional self-poisoning	3.61	0.01 (−0.01 to 0.03)	4.71	0.25 (0.11 to 0.39)	−0.23 (−1.20 to 0.74)	0.24 (0.07 to 0.41)
Males aged 10–14 yr	0.53	–	0.72	–	–	–
Females aged 10–14 yr	4.24	−0.02 (−0.06 to 0.02)	6.59	0.50 (0.31 to 0.69)	0.25 (−1.01 to 1.51)	0.52 (0.29 to 0.75)
Males aged 15–18 yr	2.28	0.02 (0.00 to 0.04)	2.32	0.01 (−0.49 to 0.51)	−0.43 (−3.00 to 2.14)	−0.01 (−0.53 to 0.51)
Females aged 15–18 yr	5.81	0.03 (−0.03 to 0.09)	7.11	0.35 (0.25 to 0.45)	−0.56 (−1.57 to 0.45)	0.32 (0.15 to 0.49)
Intentional self-harm	0.41	0.00 (−0.01 to 0.00)	0.43	−0.01 (−0.05 to 0.03)	0.05 (−0.30 to 0.40)	−0.01 (−0.05 to 0.03)
Males aged 10–14 yr	0.08	–	0.04	–	–	–
Females aged 10–14 yr	0.37	–	0.38	–	–	–
Males aged 15–18 yr	0.47	–	0.51	–	–	–
Females aged 15–18 yr	0.57	–	0.63	–	–	–
Composite††	7.18	0.03 (−0.01 to 0.07)	8.96	0.39 (0.14 to 0.64)	−0.70 (−1.90 to 0.50)	0.36 (0.07 to 0.65)
Males aged 10–14 yr	1.87	0.04 (0.02 to 0.06)	2.03	0.17 (0.05 to 0.29)	−1.13 (−1.79 to −0.47)	0.13 (−0.01 to 0.27)
Females aged 10–14 yr	8.60	−0.01 (−0.09 to 0.07)	12.01	0.75 (0.29 to 1.21)	−0.20 (−2.72 to 2.32)	0.76 (0.22 to 1.30)
Males aged 15–18 yr	5.28	0.03 (0.01 to 0.05)	5.51	0.08 (−0.38 to 0.54)	−0.72 (−3.33 to 1.89)	0.05 (−0.43 to 0.53)
Females aged 15–18 yr	10.51	0.06 (0.04 to 0.08)	12.85	0.62 (0.39 to 0.85)	−1.54 (−2.68 to −0.40)	0.56 (0.31 to 0.81)

Note: CI = confidence interval, ICD-10-CA = *International Classification of Diseases and Related Health Problems, 10th Revision*, Canadian version.
*For some strata, numbers were too few to run the time-series model.
†Average quarterly percentages expressed as number of ambulatory care visits for a given ICD-10-CA code per 100 all-cause visits.
‡Average change in outcome event for every subsequent quarter from Apr. 1, 2015, to Mar. 31, 2020.
§Average change in outcome event for every subsequent quarter from Apr. 1, 2020, to Mar. 31, 2022.
¶Immediate stepwise change from the last quarter of the prepandemic period to the first quarter of the pandemic period in percentage of outcome event.
**The difference between the pandemic and prepandemic periods in the quarterly change in percentage of the outcome event.
††Composite outcome of hospital admissions for suicidal ideation, intentional self-poisoning and intentional self-harm.

coaches, as well as decreased access to mental health support.[40] A meta-analysis found that the prevalence of depressive and anxiety symptoms increased into the first quarter of 2021, and posited that ongoing social isolation, financial constraints and education disruptions may have had a cumulative effect on adolescents.[27] Among adolescents with reduced in-person social interactions, etiological models have suggested that emotional stress associated with the pandemic was associated with self-harm[41] and decreased access to support was a social stressor that may have exacerbated the risk of self-harm.[42] Limited in-person access to health care providers and greater help-seeking behaviour have been suggested as possible explanations for increased self-harm presentations.[20] Understanding the causes of suicidal ideation and self-harm during pandemics is fundamental to guiding effective strategies to mitigate mental health effects.

The US Centers for Disease Control and Prevention now supports mental health as part of its public health mission,[43] underscoring the importance of galvanizing regional bodies to allocate resources to optimize mental health during pandemics. Given proposed links between depression and emergency department visits for suicidal ideation and self-harm among adolescents,[44] one approach is to ensure sustained access to existing supports. Many North American schools provide mental health services to children.[45] National advocacy supported retaining in-person education in Canada.[46] Sustained access to services where adolescents with mental illness can continue to receive support is an important component of mitigating

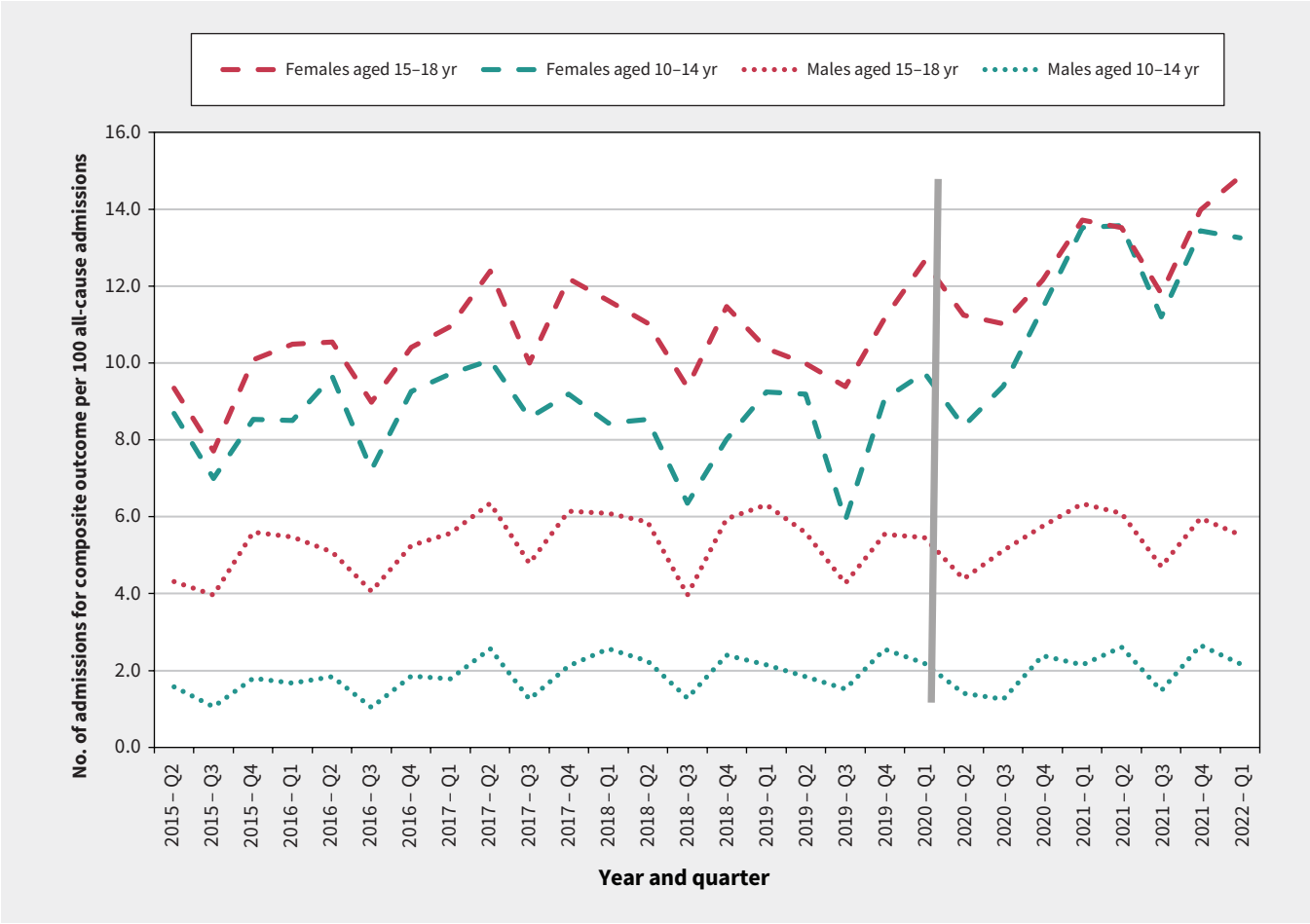

Figure 2: Hospital admissions for suicidal ideation, self-poisoning and self-harm per 100 all-cause admissions in Canada, stratified by age and sex, from Apr. 1, 2015, to Mar. 31, 2022.

suicidal ideation and self-harm, particularly during the pandemic.

Our finding that the largest proportional increase in admissions was among younger females aligns with reports of increasing self-harm behaviour among young adolescents.[29–31,47] This highlights the importance of including younger adolescents in screening programs for suicide risk that are developmentally appropriate and can be implemented in primary care settings. Age-based recommendations from The American Academy of Pediatrics include evidence-based, publicly available, and validated tools commonly used in youth 10 years and older.[48]

To minimize possible inflation of our estimates by lower numbers of non–mental health conditions among children younger than 10 years, we focused on adolescents aged 10–18 years. We found that average quarterly all-cause emergency department visits and admissions decreased during the pandemic for almost all strata. Future directions include developing robust etiological models and exploring the long-term impact of pandemics on mental health may better inform the breadth and duration of support required.

Limitations

This was an observational study using administrative databases, constrained by the limitations of aggregate data. Many ICD-10-CA codes for self-harm and other mental health conditions likely undercount both conditions in the emergency department setting.[49] Recent destigmatization campaigns surrounding mental health may have led to increased clinician awareness of self-harm, leading to increased mental health diagnoses. We lacked information on motivations for seeking care and other factors influencing self-harm behaviour during the pandemic, such as economic disadvantage, gender dysphoria,[50] Indigenous status[51] and urban residence.[52] Because visits to the emergency department and admissions to hospital for all causes decreased among adolescents during the early phase of the pandemic, some of the change in the percentage of all visits was owing to a decrease in all-cause visits and admissions, in addition to an increase in composite events. It remains unclear whether the increased percentage of visits reflected greater prevalence of morbidity or a decline in access to outpatient resources. The NACRS database records only the primary problem leading to the visit, and other diagnoses related to mental health, such as disordered eating, were not included in our targeted ICD-10-CA code search. Similarly, we could not collect data on completed suicides that did not involve a health care visit. Regional variations in suicide have been reported in Canada; however, given grouping of provinces and regions to minimize the need to suppress small cell sizes, we were unable to explore these in our study.

Conclusion

Our Canadian population-based study showed that the quarterly change in hospital admissions for suicidal ideation, self-poisoning and self-harm increased among adolescent females during the first 2 years of the COVID-19 pandemic, relative to all-cause admissions. Our findings underscore the importance of understanding drivers behind health care use for mental health and the need to promote public health policies and intervention strategies to mitigate the impact of the ongoing COVID-19 pandemic on the mental health of adolescents.

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