Trends in Acute Mental Health Service Use Following Onset of the COVID-19 Pandemic in Ontario, Canada.

Natasha R. Saunders MD[1-6], Alene Toulany MD[1-6], Bhumika Deb MPH[6], Rachel Strauss MPH[6], Simone Vigod MD[4,6,7,8], Astrid Guttmann MDCM[1-6], Maria Chiu PhD[4,6], Anjie Huang MSc[6], Kinwah Fung MSc[6], Simon Chen MPH[6], Paul Kurdyak MD [4, 7, 8,9]

Affiliations: [1]The Hospital for Sick Children, 555 University Avenue, Toronto, Canada, M5G 1X8; [2]Department of Pediatrics, The University of Toronto, 555 University Avenue, Toronto, Canada, M5G 1X8; [3]Child Health Evaluative Sciences, SickKids Research Institute, 686 Bay Street, Toronto, Canada, M5G 0A4; [4]Institute of Health Policy, Management and Evaluation, The University of Toronto, 155 College Street, Toronto, Canada M5T 1P8; [5]Edwin S.H. Leong Centre for Healthy Children, University of Toronto, 555 University Avenue, Toronto, Canada, M5G 1X8; [6]ICES, 2075 Bayview Avenue, Toronto, Canada, M4N 3M5; [7]Women's College Hospital and Women's College Research Institute, Women's College Hospital, 76 Grenville Street, Toronto, Ontario, M5S 1B2, [8]Department of Psychiatry, Temerty Faculty of Medicine, University of Toronto, Toronto Canada [9]Centre for Addiction and Mental Health, 1001 Queen St. W. Toronto, Canada, M6J 1H1

Corresponding Author:

Natasha Saunders, The Hospital for Sick Children, 555 University Avenue, Toronto, Ontario, M5G 1X8. Natasha.saunders@sickkids.ca. (t) 416-813-7654 x203076, (f) 416-813-5663.

Contributors Statement: N. Saunders, A Toulany and P Kurdyak conceptualized and designed the study, analyzed and interpreted the results, drafted the initial manuscript, revised the manuscript, and approved the final manuscript as submitted. B Deb and R Strauss, S Vigod, A Guttmann, M Chiu interpreted the results, revised the manuscript, and approved the final manuscript as submitted. A Huang, K Fung, and S Chen had access to, analysed, and verified the data, interpreted the results, revised the manuscript, and approved the final manuscript as submitted. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Financial Disclosure: N. Saunders reports receiving an editorial honorarium from Archives of Diseases in Childhood and an honorarium from M.S.I. Foundation, outside the submitted work. S. Vigod reports receiving royalties from Up To Date, outside of the submitted work.

Conflict of Interest: All authors have no conflicts of interest relevant to this article to disclose.

Financial Support: This study was supported by ICES, which is funded by an annual grant from the Ontario Ministry of Health (MOH). The opinions, results and conclusions reported in this paper are those of the authors and are independent from the funding sources. No endorsement by ICES or the Ontario MOH is intended or should be inferred. Parts of this material are based on data and information compiled and provided by the Canadian Institute for Health

Information (CIHI). However, the analyses, conclusions, opinions and statements expressed herein are those of the authors, and not necessarily those of CIHI.

Data sharing: The dataset from this study is held securely in coded form at ICES. Data-sharing agreements prohibit ICES from making the data set publicly available, but access may be granted to those who meet pre-specified criteria for confidential access, available at www.ices.on.ca/DAS. The full data set creation plan and underlying analytic code are available from the authors upon request, understanding that the programs may rely upon coding templates or macros that are unique to ICES.

Word Count: 2206

Abstract

Background

The extent to which heightened distress during the COVID-19 pandemic has translated into increased levels of severe mental health outcomes is unknown. We examined trends in psychiatric presentations to acute care settings following the onset of the pandemic.

Methods

In this population-based, repeated cross-sectional study, we examined rates of hospitalizations and emergency department (ED) visits for mental health concerns overall, by sex, age, and diagnostic grouping, and visits for intentional self-injury for all individuals 10-105 years in Ontario, Canada between January 2019, and September 30, 2020. Joinpoint regression was used to determine significant inflection points after the pandemic onset in March 2020.

Results

Hospitalization and ED visit rates declined immediately following the pandemic onset with significant inflection points (peak overall decline 30.4% [hospitalizations] and 36.8% [ED visits] from April 2019) and returned to near pre-pandemic levels by September 2020. Compared to April 2019, visits for intentional self-injury declined by 32.9% without a significant inflection but remained below pre-pandemic levels until September 2020. The largest declines in service use were observed among youth ages 14 to 24 years (31.5-54.9% hospitalizations, 40.8-58.4% ED visits, 38.8-44.1% self-injury) and for those with substance-related (32.9%, ED visits) and mood disorders (44.1%, hospitalizations).

Interpretation

The abrupt decline in acute mental health service use immediately following the pandemic onset and return to pre-pandemic levels only for adults suggests possible distress from the early phases of the pandemic has not translated into increased service utilization. Continued surveillance of acute mental health service utilization is warranted.

Introduction

There has been widespread concern about the mental health consequences of the COVID-19 pandemic(1). Social isolation, financial strain, school closures, and the stress of possible infection and its consequences all serve as risk factors for new onset or exacerbation of existing mental illnesses and addictions. Survey data and polling suggest that individuals are endorsing higher rates of distress, substance use, anxiety and depressive symptoms during the pandemic (2, 3). In multiple jurisdictions, early data demonstrate a universal decline in routine preventive health visits and acute care use for physical health concerns, likely driven by fear of infection risk and decreased accessibility of health services(4-6). Whether there have been changes in acute mental health and addictions-related service use is still largely unknown. One large population-based study in the United States showed that following an initial, brief decline, emergency department visits for mental health conditions and suicide attempts across all age groups increased in the first 28 weeks following the onset of the pandemic(7). Another large pediatric study in the United States showed an acute decline in mental health hospitalizations in the first three months following the onset of the pandemic compared to the decade prior(8). These contrasting data suggest there may be variation in the extent to which different age or diagnostic groups have been affected. Outside of the United States, acute mental health care utilization following the pandemic onset has not been reported at a population level, and different jurisdictions and health systems may have varying responses to the pandemic.

The objective of this study was to describe trends in acute mental health and addictions-related service use prior to and following the onset of the COVID-19 pandemic in Ontario, Canada's

most populous province. Specifically, we describe trends in mental health and addictions-related emergency department (ED) visits, hospitalizations, and ED visits for intentional self-injury across the lifespan.

Methods

Study Design and Setting

In this population-based, repeated cross-sectional study, we included all individuals between the ages of 10 and 105 years living in Ontario, Canada with a valid health card and for whom information on sex and age was available, between January 1, 2019, and September 30, 2020.

Data Sources

The Registered Persons Database, the central population registry file that enables linkage across population-based health administrative data sets, was used to identify all Ontario residents who were insured under Ontario's universal health coverage and to ascertain age and sex information at the time of the acute care visit. The National Ambulatory Care Reporting System was used to identify mental health or addictions–related ED visits, and the Canadian Institute for Health Information's Discharge Abstract Database and Ontario Mental Health Reporting System were used to capture psychiatric hospitalizations. The National Ambulatory Care Reporting System and the Discharge Abstract Database use the International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, with Canadian enhancements (ICD-10-CA), and the Ontario Mental Health Reporting System uses the multiaxial Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5). For all

ED visits, we only included unscheduled ED visits because in rural settings, primary care is occasionally provided via the ED; such visits are coded as "scheduled" and were therefore excluded. Datasets were linked using unique coded identifiers and analyzed at ICES (formerly known as the Institute for Clinical Evaluative Sciences), an independent, nonprofit research institute, whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and demographic data without consent for health system evaluation and improvement.

Outcomes

Mental health and addictions-related ED visits and hospitalizations were ascertained through a primary diagnosis of ICD-10 codes F06–F99. Any DSM-5 codes in the Ontario Mental Health Reporting System, excluding 290.x and 294.x (neurocognitive disorders without mental health and addictions-related diagnosis), were considered mental health or addiction hospitalizations. We further classified mental health or addictions–related ED visits and hospitalizations into the most common broad diagnostic categories on the basis of the primary or main diagnosis: substance-related and addictive disorders, schizophrenia spectrum and psychotic disorders, anxiety disorders, mood disorders, trauma and stressor-related disorders (see online appendix exhibit 1 for more details). For ED visits and hospitalizations, we also ascertained visits for intentional self-injury where diagnostic codes included ICD-10 codes X60–X84, Y10–Y19, and Y28. Among visits to the ED for self-injury, as proxies for illness severity, we further measured the proportion that resulted in a hospitalization, an intensive care unit admission, or death during the index ED visit.

Statistical Analysis

We calculated crude monthly rates for mental health or addictions–related ED visits and hospitalizations (per 1000 people) and ED visits for self-injury (per 10,000 people) between January 1, 2019 to September 30, 2020 overall, by sex, age, and diagnostic grouping. We used Joinpoint analysis software(9), version 4.7.0.0, to identify significant inflection points in 2020 in the time trends for overall mental health or addiction ED visits and hospitalizations, and statistical significance was tested using the Monte Carlo permutation method(9).

Results

Among the 14,418,681 individuals living in Ontario, there was a decrease in mental health and addictions related ED visits in March and April 2020, followed by a rapid return to pre-pandemic rates in July 2020 (Figure 1). Rates dropped by 36.8%, from 1.66 to 1.05 visits per 1000 population in April 2020 compared to April in the year prior (Table 1). Joinpoint regression analysis revealed significant changes in slope in April 2020 and then again in July 2020 (p-value $\leq$ 0.05). Similarly, there was a sharp decrease of 30.4% in mental health and addictions-related hospitalizations in April 2020 (from 0.46 to 0.32 hospitalizations per 1000 in April 2019 to April 2020) and a return to pre-pandemic levels in June 2020 (joinpoint regression June 2020; P<0.01) (Figure 1, Table 1). The rate of ED visits for intentional self-injury dropped by 32.9% following March 2020 and returned to near pre-pandemic levels by August 2020, though the inflection point was not significant (Figure 2, Table 1). However, the proportion of ED visits for intentional self-injury that resulted in hospitalization or in intensive care unit admission or

death was lower following March 2020 and remained well below pre-pandemic levels through September 2020 (Figure 2).

Although females generally had lower rates of ED visits and hospitalizations than males, the patterns by sex mirrored those of the main analysis (Figure 1). For males, the rates of mental health and addictions-related ED visits and hospitalizations had returned to pre-pandemic levels by June 2020 whereas for females, it remained below the pre-pandemic levels through July 2020.

By age, the observed decrease in ED visits for April 2020 was greatest among youth between the ages of 10 and 21 years, and among 14- to 21-year-olds, utilization did not return to pre-pandemic levels by September 2020 (Figure 3, Table 1 and 2). For mental health and addiction-related hospitalizations, among children and youth (10 to 24 years) hospitalizations decreased early in the pandemic by a range of 31.5% to 68.5% (Table 1) and by September 2020 did not return to pre-pandemic levels (Figure 3, Table 2). Among adults aged 25 and older, the rate of hospitalizations dropped by between 21.4% and 34.7% in April 2020 and returned to pre-pandemic levels by June 2020. For ED visits for intentional self-injury, the greatest year over year decrease was observed among 10- to 24-year-olds (30.4 to 56.4%) and rates generally returned to pre-pandemic levels by July 2020.

Decreases in ED visit rates were observed across most diagnostic groups, except for schizophrenia and other psychotic disorders. For these conditions, there were two significant inflection points (p-value $\leq$ 0.05) with a decrease in March and an increase in June 2020. (Figure 4, Table 1). For substance-related and anxiety disorders, the visit rates returned to pre-pandemic levels by September 2020, however, ED visit rates for mood disorders and trauma-

and stressor-related disorders did not. Hospitalizations were most common for mood disorders and this diagnostic group had the greatest absolute drop in hospitalization rate that, by June 2020, had not returned to pre-pandemic levels (Figure 4). Trauma and stressor-related hospitalizations, while less common, followed a similar pattern to mood disorders. For the two other most prevalent hospitalization types by diagnosis (schizophrenia spectrum and psychotic disorders, substance-related and addictive disorders), the rates dropped following March 2020 and, by June 2020, had returned to pre-pandemic levels.

Discussion

With the onset of the COVID-19 pandemic came concerns about infection and related consequences, social isolation as part of public health measures, school closures, impacts on economies with related financial stress, and other factors that could contribute to increased incidence of and worsening of existing mental illnesses and addictions. There has also been a massive shift in the way mental health and addictions services are delivered, with a rapid transition from mostly in-person to virtual care. Our study found that the rates of acute mental health and addictions-related service use in the form of ED visits, hospitalizations and intentional self-injury experienced a drop immediately following the onset of the pandemic and related public health measures, followed by a return to pre-pandemic levels six months following March 2020. Exceptions were observed among youth ages 14-24 years where rates of ED visits and hospitalizations did not return to pre-pandemic levels by September 2020 and for those who were either admitted to an intensive care unit or died during the ED visit following intentional self-injury. The persistently low rate of hospitalizations and ICU admissions/deaths

following the pandemic suggests that there may be a reduction in the lethality of presentations, change in admission threshold, or system capacity.

Taken together, our findings suggest that the mental health and addictions-related concerns associated with the COVID-19 pandemic have not translated into increased ED visits, hospitalizations, or ED visits for intentional self-injury, at least in the six months following the onset of the pandemic in Ontario, Canada. The absence of increased acute mental health and addictions service use following March 2020 does not mean there has been no mental health impact of the pandemic. Indeed, the vast majority of mental health and addictions services are provided in ambulatory and community settings; there may be increased demand for ambulatory services that is not observed in our acute care-focused outcomes. Our finding of no increase in acute care use above the pre-pandemic baseline could also be due to individuals choosing to avoid using acute care services such as EDs and hospitals, as has been observed with physical health conditions(4, 5, 10-12). If true, this acute treatment avoidance could be another adverse consequence of the COVID-19 pandemic.

The factors contributing to the persistent reduction in rates of acute care use in younger populations is less clear. Adolescents have lost contact with many protective adults such as teachers, coaches, and clinicians who may notice early signs of distress and mental illness. There is a substantial school-related seasonality to acute care mental health and addictions-related service use among youth, with service use dropping substantially in summer months and holidays when children are not in school. If teachers and other non-parental adults are critical to mental health and addiction-related case ascertainment amongst children and youth,

the shift to virtual schooling, where students are no longer in classrooms and observed by teachers or peers, may partly explain the persistent reduction in acute care utilization rates following the pandemic. Whether this reflects a short-term reduction in true demand or whether the school setting serves as a critical environment for recognition of distress in this population is unknown. Among those who had ED visits for intentional self-injury, our finding of reduced admission and, more importantly, ICU admissions or deaths may suggest a change in admission threshold and/or that the lethality of intentional self-injury presentations had reduced following the pandemic. Despite widespread reports of increased population wide mental illness burden associated with the COVID-19 pandemic(2), our findings show no increase in acute mental health or addictions-related service use following the pandemic, and, in the case of youth, a persistent reduction. It is possible, and perhaps even likely, the mental health effects of the pandemic may be slower to present or more chronic in nature.

There are a number of limitations related to this study. First, we only measure trends through the 'first wave' of the pandemic. It is difficult to project trends beyond the time frame of our study; further monitoring will be important. Second, our diagnostic categories are based on health administrative data and, as such, reflect diagnoses provided based on the routine delivery of care and hospital coding, and not validated assessments. We do not report mental health ambulatory care utilization where much of the purported pandemic-related need may have been met. With the rapid shift to virtual modes of mental health care delivery, we speculate that access to services may be adequately meeting demand and appropriately supporting primary care to keep patients out of the acute care setting.

There has been justified concern about the impact of the COVID-19 pandemic on the mental health of populations. In our study, we found an abrupt drop in acute mental health services use immediately following the onset of the pandemic in Ontario, followed by a return to pre-pandemic levels in adults and rates slightly below pre-pandemic levels in youth. Our findings suggest that distress from the early phases of the pandemic has not translated into increased utilization of acute mental health and addictions services in the short term. The need for ongoing monitoring of acute mental health services trends, and indeed, all mental health services trends, is critical as the pandemic and its expected impact on population mental health continues.

References

1. Galea S, Merchant RM, Lurie N. The Mental Health Consequences of COVID-19 and Physical Distancing: The Need for Prevention and Early Intervention. JAMA Intern Med. 2020;180(6):817-8.

2. Cost KT, Crosbie J, Anagnostou E, Birken CS, Charach A, Monga S, et al. Mostly worse, occasionally better: impact of COVID-19 pandemic on the mental health of Canadian children and adolescents. European child & adolescent psychiatry. 2021.

3. Mental health during COVID-19 outbreak: poll #5 of 13 in series. Canada: Health Canada; 2021 February 2021.

4. Williams TC, MacRae C, Swann OV, Haseeb H, Cunningham S, Davies P, et al. Indirect effects of the COVID-19 pandemic on paediatric healthcare use and severe disease: a retrospective national cohort study. Arch Dis Child. 2021.

5. Williams R, Jenkins DA, Ashcroft DM, Brown B, Campbell S, Carr MJ, et al. Diagnosis of physical and mental health conditions in primary care during the COVID-19 pandemic: a retrospective cohort study. Lancet Public Health. 2020;5(10):e543-e50.

6. Glazier RH, Green ME, Wu FC, Frymire E, Kopp A, Kiran T. Shifts in office and virtual primary care during the early COVID-19 pandemic in Ontario, Canada. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne. 2021;193(6):E200-E10.

7. Holland KM, Jones C, Vivolo-Kantor AM, Idaikkadar N, Zwald M, Hoots B, et al. Trends in US Emergency Department Visits for Mental Health, Overdose, and Violence Outcomes Before and During the COVID-19 Pandemic. JAMA psychiatry. 2021.

8. Pelletier JH, Rakkar J, Au AK, Fuhrman D, Clark RSB, Horvat CM. Trends in US Pediatric Hospital Admissions in 2020 Compared With the Decade Before the COVID-19 Pandemic. JAMA Netw Open. 2021;4(2):e2037227.

9. Joinpoint Trend Analysis Software: National Cancer Institute; [Available from: https://surveillance.cancer.gov/joinpoint/

10. Cordoba M, Anteby R, Zager Y, Barash Y, Klang E, Nadler R, et al. The Effect of the COVID-19 Outbreak on Trauma-Related Visits to a Tertiary Hospital Emergency Department. Isr Med Assoc J. 2021;23(2):82-6.

11. Steinman M, de Sousa JHB, Tustumi F, Wolosker N. The burden of the pandemic on the non-SARS-CoV-2 emergencies: A multicenter study. Am J Emerg Med. 2021;42:9-14.

12. Stohr E, Aksoy A, Campbell M, Al Zaidi M, Ozturk C, Vorloeper J, et al. Hospital admissions during Covid-19 lock-down in Germany: Differences in discretionary and unavoidable cardiovascular events. PloS one. 2020;15(11):e0242653.

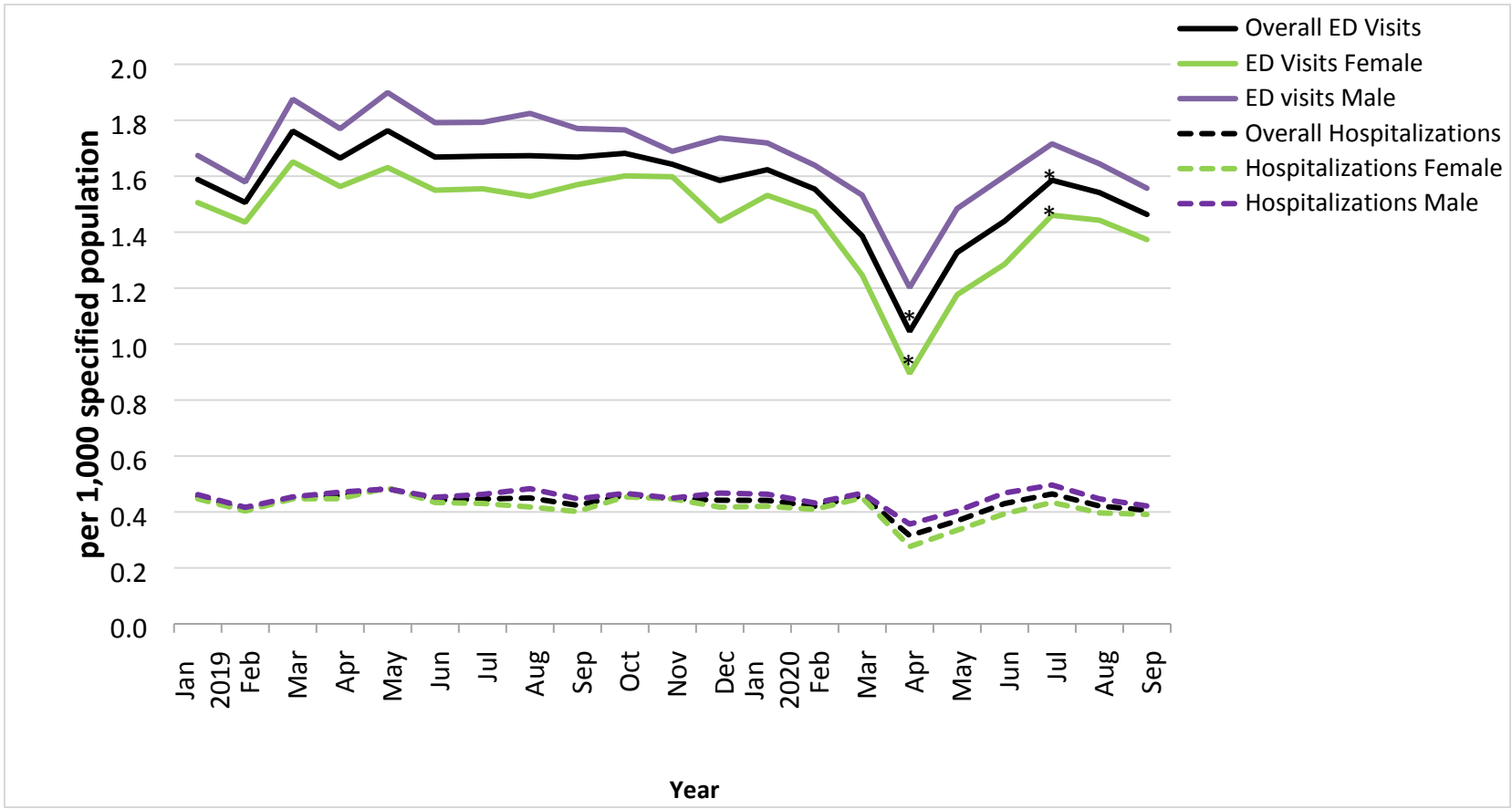


Figure 1: Mental health and addictions-related emergency department visits and hospitalizations per 1000 population aged 0 to 105 years.

Caption: Joinpoint regression analysis identified a statistically significant change in slope in April and July 2020 (p-values $\leq$ 0.05; indicated by *) among overall visits to the emergency department overall and among female visits to the emergency department. A decrease in mental health and addictions-related hospitalizations was observed among both sexes in April 2020. Joinpoint regression analysis did not yield any significant changes in slope.

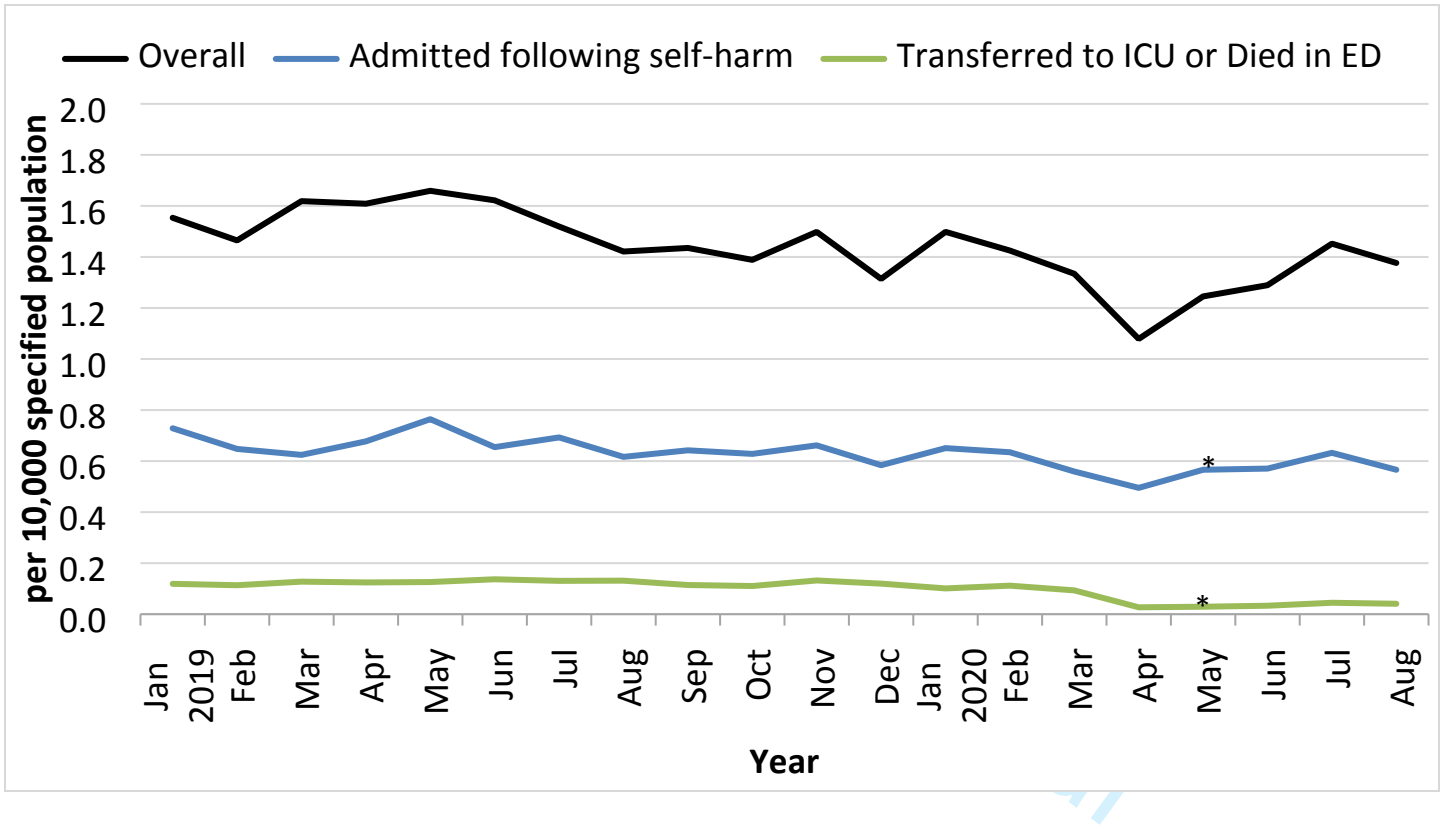
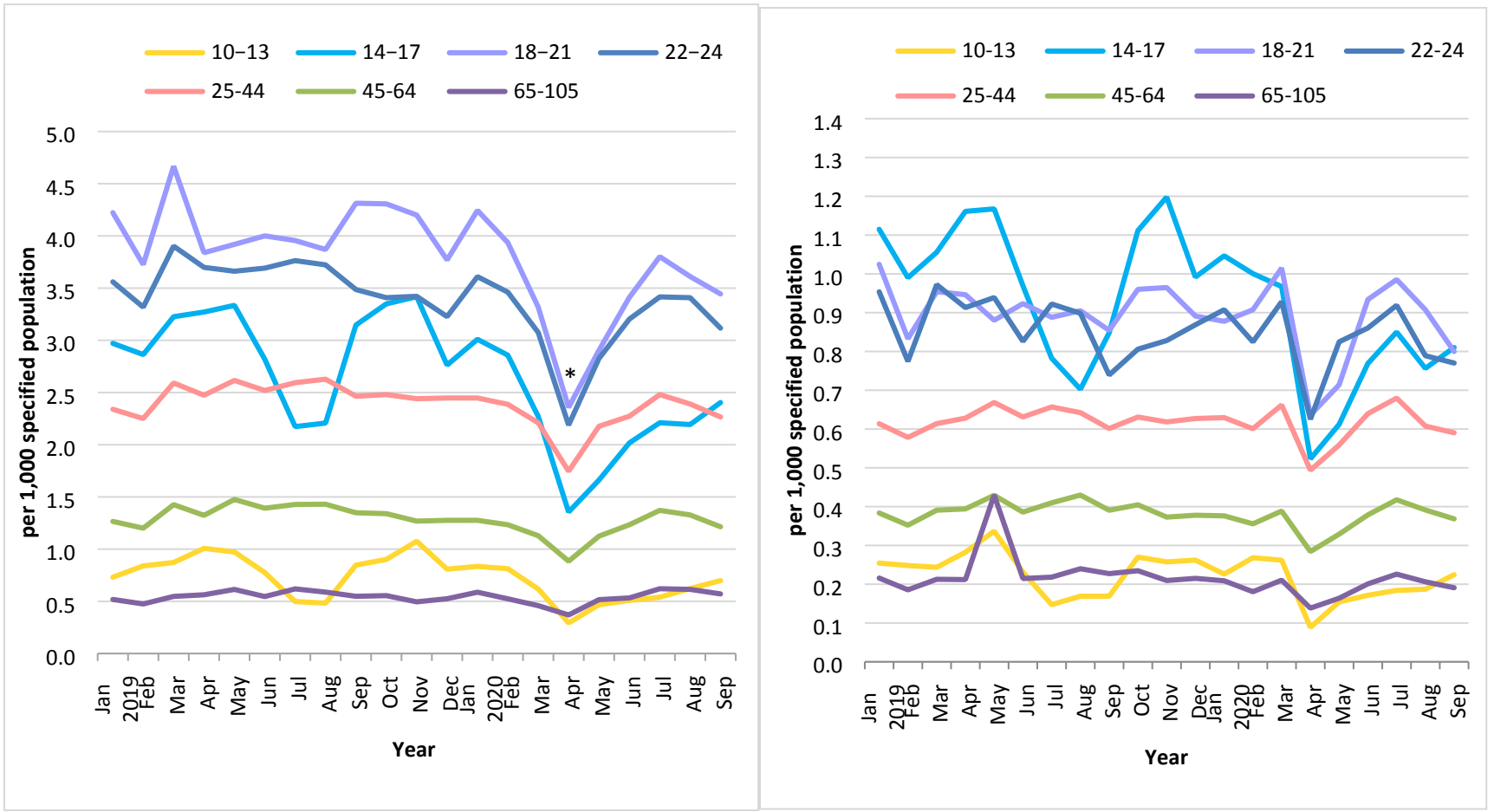


Figure 2: Emergency Department visits for intentional self-injury, admission rates, and ICU/death rates per 10,000 population.

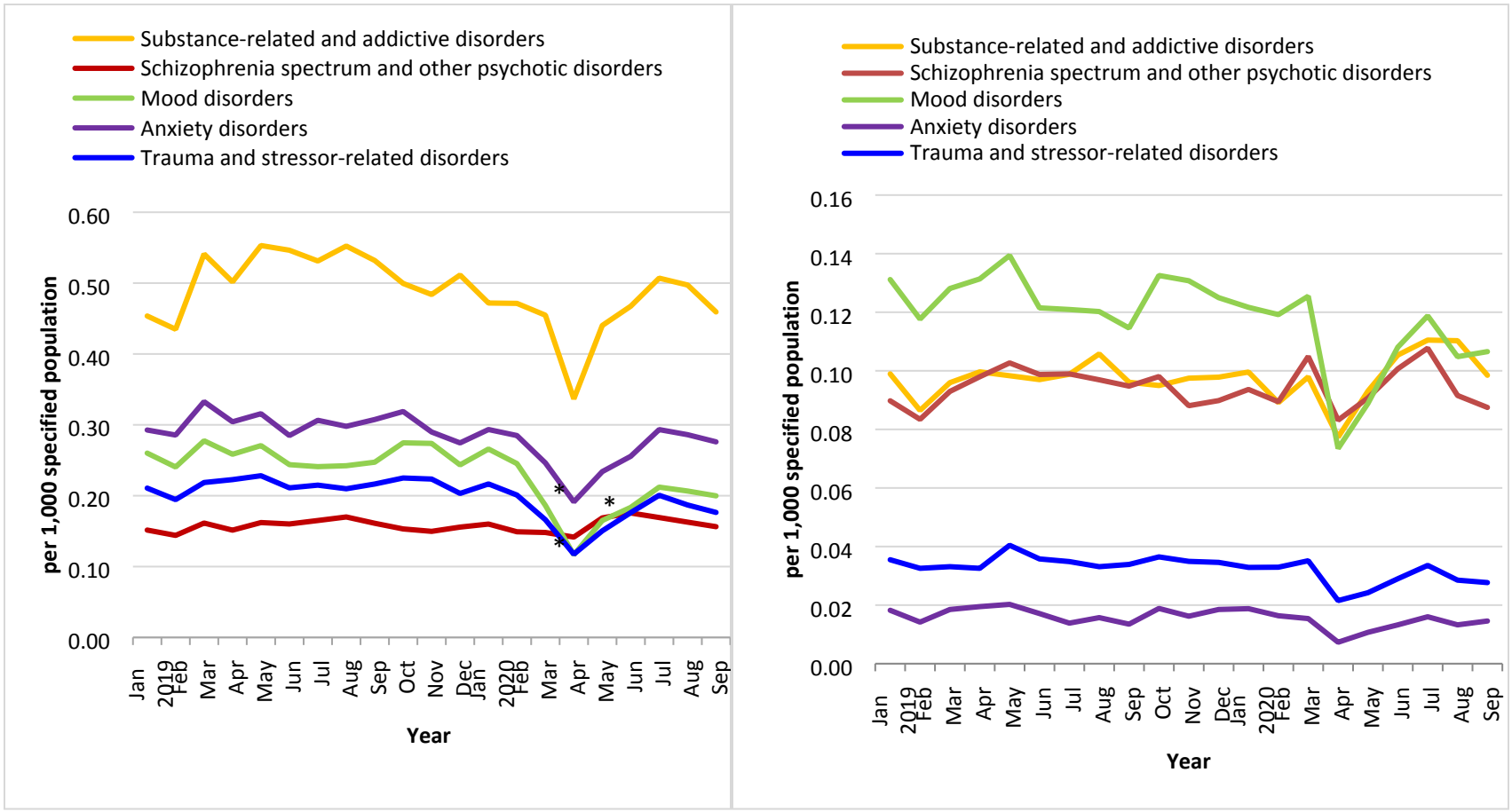
Caption: A decrease in emergency department visits for intentional self injury was observed in April 2020 among individuals admitted following self harm and among those who were transferred to the ICU/died in the emergency department. Joinpoint regression analysis identified a statistically significant changes in slope in May 2020 (p-values $\leq$ 0.05; indicated by *) among those who were transferred to ICU or died in ED.



A – Emergency Department Visits **B - Hospitalizations**

Figure 3: Mental health and addictions-related emergency department visits (A) and hospitalizations (B) per 1000 population by age.

Caption: For emergency department visits, joinpoint regression analysis identified a statistically significant change in slope in April 2020 (p-values $\leq$ 0.05; indicated by *) among all age groups 14 to 105 years old. For hospitalizations, a decrease was observed among all age groups in April 2020. Joinpoint regression analysis did not yield any significant changes in slope.



A – Emergency Department Visits **B - Hospitalizations**

Figure 4: Mental health and addictions-related emergency department visits (**A**) and hospitalizations (**B**) per 1000 population by diagnosis.

Caption: Joinpoint regression analysis identified a statistically significant changes in slope in April 2020 (p-values $\leq$ 0.05; indicated by *) in emergency department visits for anxiety and mood disorders. Significant changes in slope were also observed for schizophrenia in March and June 2020. For hospitalizations, a decrease in mental health and additions-related hospitalizations was observed across all diagnostic categories in April 2020, however joinpoint regression analysis did not yield any significant changes in slope.

Table 1: Mean monthly number and percent relative change in mental health and addictions-related emergency department visits, hospitalizations, and intentional self-injury April 2019 to April 2020 (Ontario population 14,418,681)

	Mean monthly visits (2019-2020)	Apr 2019	Apr 2020	% Relative Change
	EMERGENCY DEPARTMENT VISITS			
	N	PER 1000 POPULATION, BY AGE		
ALL AGES	22,542	1.66	1.05	-36.75
10-13 years	466	1.01	0.29	-71.29
14-17 years	1,660	3.27	1.36	-58.40
18-21 years	2,462	3.84	2.36	-38.54
22-24 years	1,820	3.70	2.19	-40.81
25-44 years	9,342	2.47	1.75	-29.15
45-64 years	5,098	1.32	0.88	-33.33
65-105 years	1,528	0.56	0.37	-33.93
		HOSPITALIZATIONS		
	N	PER 1000 POPULATION, BY AGE		
ALL AGES	6,245	0.46	0.32	-30.43
10-13 years	142	0.28	0.09	-68.52
14-17 years	581	1.16	0.52	-54.93
18-21 years	580	0.95	0.64	-32.78
22-24 years	457	0.91	0.63	-31.53
25-44 years	2414	0.63	0.49	-21.37
45-64 years	1515	0.39	0.28	-27.91
65-105 years	556	0.21	0.14	-34.72
	INTENTIONAL SELF-INJURY			
	N	PER 10,000 POPULATION, BY AGE		
ALL AGES	1,854	1.61	1.08	-32.91
10-13 years	52	1.18	0.51	-56.36
14-17 years	272	5.16	3.16	-38.83
18-21 years	283	4.48	3.12	-30.38
22-24 years	171	4.21	2.35	-44.15
25-44 years	636	1.86	1.27	-31.73
45-64 years	346	0.85	0.67	-21.64
65-105 years	94	0.36	0.30	-16.00
	EMERGENCY DEPARTMENT VISITS			
	N	PER 1000 POPULATION, BY DIAGNOSIS		
Substance-related and addictive	7,034	0.50	0.34	-32.92
Schizophrenia/psychotic	2,277	0.15	0.14	-6.47
Mood	3,332	0.26	0.12	-54.89
Anxiety	4,099	0.30	0.19	-37.13
Trauma and stressor related	2,862	0.22	0.12	-47.24
	HOSPITALIZATIONS			
	N	PER 1000 POPULATION, BY DIAGNOSIS		
Substance-related and addictive	1,407	0.10	0.08	-22.38
Schizophrenia/psychotic	1,360	0.10	0.08	-15.14
Mood	1,702	0.13	0.07	-44.07
Anxiety	227	0.02	0.01	-62.43
Trauma and stressor related	469	0.03	0.02	-33.84

Table 2: Monthly rates of acute mental health are use during the COVID-19 pandemic, April to September 2020.

Age Strata	Apr	May	Jun	Jul	Aug	Sept
EMERGENCY DEPARTMENT VISITS, PER 1000 POPULATION						
10-13 years	0.29	0.47	0.51	0.54	0.62	0.70
14-17 years	1.36	1.66	2.02	2.21	2.19	2.40
18-21 years	2.36	2.90	3.41	3.80	3.61	3.4
22-24 years	2.19	2.83	3.20	3.42	3.41	3.12
25-44 years	1.75	2.18	2.27	2.48	2.39	2.27
45-64 years	0.88	1.12	1.23	1.37	1.33	1.21
65-105 years	0.37	0.52	0.53	0.62	0.61	0.57
HOSPITALIZATIONS, PER 1000 POPULATION						
10-13 years	0.09	0.15	0.17	0.18	0.19	0.22
14-17 years	0.52	0.61	0.77	0.85	0.76	0.81
18-21 years	0.64	0.71	0.93	0.99	0.91	0.80
22-24 years	0.63	0.82	0.86	0.92	0.79	0.77
25-44 years	0.49	0.56	0.64	0.68	0.61	0.59
45-64 years	0.28	0.33	0.38	0.42	0.39	0.37
65-105 years	0.14	0.16	0.20	0.23	0.21	0.19
INTENTIONAL SELF-INJURY, PER 10,000 POPULATION						
10-13 years	0.51	0.41	0.66	0.59	0.84	1.01
14-17 years	3.16	3.39	3.39	3.92	3.54	4.03
18-21 years	3.12	3.80	4.16	4.85	3.99	4.05
22-24 years	2.35	2.98	3.13	3.20	3.24	3.16
25-44 years	1.27	1.47	1.50	1.63	1.65	1.55
45-64 years	0.67	0.79	0.76	0.94	0.84	0.81
65-105 years	0.30	0.30	0.34	0.38	0.38	0.34

Appendix 1.

Mental Health Diagnostic Codes and Disease Groupings

Category	ICD-9-CM code (OMHRS)	ICD-10-CA (DAD/NACRS)
Any mental health and addictions	Any OMHRS record (including missing, except for 290.x, 294.x in primary diagnosis). Excluded if primary diagnosis missing and provisional=17.	A primary diagnosis of F06-F99 any diagnosis X60-X84, Y10-Y19, Y28 when the primary diagnosis is not F06-F99
Substance-Related and Addictive Disorders	291.x (all 291 codes), 292.x (all 292 codes), 303.x (all 303 codes), 304.x (all 304 codes), 305.x. Provisional=16	A primary diagnosis of F10-19, F55
Schizophrenia Spectrum and Other Psychotic Disorders	293.81/82, 295.x (all 295 codes), 297.x (all 297 codes), 298.x (all 298 codes). Provisional=2	A primary diagnosis of F06.0-2, F20, F22-F29, F53.1
Mood disorders	293.83, 296.x (all 296 codes), 300.4x, 301.13, 311.x, 625.4. Provisional=3, 4	A primary diagnosis of F06.3, F30.x-F34.x, F38.x, F39.x, F53.0
Anxiety disorders	293.84, 300, 300.0x, 300.2x, 309.21, 313.23. Provisional=5	A primary diagnosis of F06.4, F40, F41, F93.0-2, F94.0
Trauma/stressor-related disorders	308.3x, 309, 309.0x, 309.24, 309.28, 309.3x, 309.4x, 309.81, 309.89, 309.9x, 313.89. Provisional=7	A primary diagnosis of F43.x, F94.1, F94.2
OCD & related disorders	300.3x, 300.7x, 312.39, 698.4x. Provisional=6	A primary diagnosis of F42.x, F45.2, F63.3
Personality disorders	301, 301.0x, 301.2x, 301.4x, 301.5x, 301.6x, 301.7x, 301.81-3, 301.89, 301.9x 310.1. Provisional=18	A primary diagnosis of F07.x (all F07 codes), F21, F60, F61, F62, F68, F69
Intentional self-injury	N/A (DAD/NACRS only)	A secondary diagnosis of X60-X84, Y10-Y19, Y28 when the primary diagnosis is not F06-F99

OMHRS=Ontario Mental Health Reporting System, DAD=Discharge Abstract Database, NACRS=National Ambulatory Care Reporting System, OCD=obsessive compulsive disorder, ICD-9-CM=International Classification of Diseases, 9th Revision, clinical modification, ICD-10-CA=International Classification of Diseases, 10th Revision, with Canadian enhancements

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1, 4
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	4
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	6
Objectives	3	State specific objectives, including any prespecified hypotheses	6, 7
Methods			
Study design	4	Present key elements of study design early in the paper	7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7,8
Bias	9	Describe any efforts to address potential sources of bias	9
Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	9
		(*b*) Describe any methods used to examine subgroups and interactions	9
		(*c*) Explain how missing data were addressed	na
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	na
		(*e*) Describe any sensitivity analyses	na
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	9
		(b) Give reasons for non-participation at each stage	na
		(c) Consider use of a flow diagram	na
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7, 9
		(b) Indicate number of participants with missing data for each variable of interest	na
Outcome data	15*	Report numbers of outcome events or summary measures	9-11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11

		(*b*) Report category boundaries when continuous variables were categorized	na
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	na
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	na
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11-12
Generalisability	21	Discuss the generalisability (external validity) of the study results	14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	2

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.