Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Original article

Acute Care Visits for Eating Disorders Among Children and Adolescents After the Onset of the COVID-19 Pandemic

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A B S T R A C T

Purpose: Anecdotal reports suggest a significant increase in acute presentations of eating disorders among children and adolescents. Our objective was to compare the rates of emergency department visits and hospitalizations for pediatric eating disorders before and during the first 10 months of the COVID-19 pandemic.

Methods: Using linked health administrative databases, we conducted a population-based repeated cross-sectional study of emergency department visits and hospitalizations for eating disorders among all children and adolescents aged 3–17 years, residing in Ontario, Canada. We defined the pre-COVID period from January 1, 2017, to February 29, 2020, and the post-COVID period from March 1, 2020, to December 26, 2020. Poisson generalized estimating equations were used to model 3-year pre-COVID trends to predict expected post-COVID trends and estimate the relative change from expected rates.

Results: In our population of almost 2.5 million children and adolescents, acute care visits for eating disorders increased immediately after the onset of the pandemic, reaching a 4-week peak

IMPLICATIONS AND CONTRIBUTION

Emergency department visits and hospitalizations for eating disorders among children and adolescents have increased significantly (66% and 37%, respectively) after the onset of the COVID-19 pandemic compared with prepandemic expected rates. This has important implications for ongoing

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annualized rate of 34.6 (emergency department visits) and 43.2 per 100,000 population (hospitalizations) in October 2020. Overall, we observed a 66% (adjusted relative rate: 1.66, 95% confidence interval: 1.41–1.96) and 37% (adjusted relative rate: 1.37, 95% confidence interval: 1.25–1.50) increase in risk for emergency department visit and hospitalization, respectively.

Conclusions: Acute care visits for pediatric eating disorders increased significantly in Ontario after the onset of COVID-19 pandemic and remained well above expected levels during the first 10 months of the pandemic. Further research is needed to understand the social and neurobiological mechanisms underlying the observed changes in health system utilization.

surveillance as the pandemic evolves as well as resource allocation for pediatric eating disorders.

Early indications from pediatric hospitals in high-income countries suggest a substantial increase in acute presentations of eating disorders among children and adolescents after the onset of the COVID-19 pandemic [1,2]. Several factors including increased stress and anxiety, social isolation, pressure to exercise, disruption of routines, increased free time and time spent with family, as well as decreased access to in-person care are likely contributing to young peoples' feelings of loss of control, which may trigger disordered eating behaviors, exacerbate problematic behaviors among those with pre-existing illness, and disrupt treatment and recovery of eating disorders [3–7].

Several health jurisdictions including Western Australia, the UK, and the US have shown increases in eating disorder presentations among children and adolescents during the COVID-19 pandemic, as well as evidence for a more symptomatic clinical population [1,6,8,9]. These findings are particularly notable against a backdrop of stagnant or decreasing admissions or emergency department (ED) visits generally for pediatric hospitals and adolescent medicine departments during the pandemic [1,8,10]. Understanding eating disorder presentations during the COVID-19 pandemic in a Canadian context with a publicly funded single-payer health insurance program and in the province with the longest school closures and lockdown is important for health system planning, surveillance, and policy development.

These data are important and needed to inform for potential shifts in eating disorder resources and acute care capacity during and after the COVID-19 pandemic. Our objective was to compare the rates of ED visits and hospitalizations for pediatric eating disorders in Ontario, Canada, before and after the onset of the COVID-19 pandemic.

Methods

Ontario is Canada's most populous province, with approximately 2.9 million children and youth younger than 18 years. Physician- and hospital-based services are insured through the universal, publicly funded Ontario Health Insurance Plan. Specialized pediatric eating disorder programs provide region-based care to children and adolescents across the province of Ontario. Patients enter these programs through referrals by their primary care provider (family physician or pediatrician) or visit the ED for urgent care. Patients are generally admitted for medical stabilization, nutritional rehabilitation, failure of outpatient management, or acute social or mental crises [11,12].

Using the linked health administrative databases available at the Institute for Clinical Evaluative Sciences, we conducted a population-based repeated cross-sectional study of acute care visits for eating disorders among children and adolescents (aged 3–17 years) from January 1, 2017, to December 26, 2020, in Ontario, Canada. The Institute for Clinical Evaluative Sciences is an independent, non-profit research institute, whose legal status under Ontario's health information privacy law allows it to collect and analyze healthcare and demographic data, without consent, for health system evaluation and improvement. The Registered Persons Database is a province-wide registry of individuals eligible for Ontario's publicly funded universal health insurance plan and contains demographic and vital statistic data, including an encoded unique identifier that allows for linkage between data sets. We used this to identify population denominators. We identified those with eating disorders using validated diagnostic codes from hospital (Canadian Institute of Health Information Discharge Abstract Database and Ontario Mental Health Reporting System) and ED (National Ambulatory Care Reporting System) data sets (eTable 1) [13].

Outcomes

The primary outcomes were eating disorder–related ED visits and hospitalizations. We considered acute care visits to be related to an eating disorder if their primary discharge diagnosis was any of the following diagnostic codes: (1) *International Classification of Diseases, Ninth Revision (clinical modification)* codes 307.1 and 307.5; (2) *International Classification of Diseases, Tenth Revision (clinical modification)* codes F50, F98.21, and F98.3; (3) *International Classification of Diseases, Tenth Revision (Canadian Enhancement)* code F50. Detailed descriptions of the included diagnostic codes are provided in eTable 1. These codes have previously been shown to have high sensitivity and specificity for eating disorder presentations [13]. In Ontario, ambulatory care physician visits are not specific for eating disorders and, therefore, were not included in our analyses.

Statistical analysis

We calculated the monthly rates of eating disorder–related ED visits or hospitalizations for an eating disorder and the denominator being the Ontario population aged 3 to 17 years as of January 1st of each respective year through the duration of the study period. We used multivariable Poisson regression with generalized estimating equations for clustered count data to model the pre-COVID trends in acute eating disorder visit rates. The unit of analysis was the age group-sex-week stratum. The dependent variable was the stratum-specific count of acute visits for an eating disorder of the population in the stratum; the offset was *log* (stratum-specific population). The model included age group-sex

indicators, and a continuous linear term measured as weeks since January 1, 2017, to estimate any overall trend in pre-COVID visit rates. Models included an autoregressive working correlation with a lag of 1. March 1, 2020, was deemed the start of COVID restrictions. To account for seasonality and changing patterns over time, the model used 3 years of prepandemic baseline trends to compute the predicted monthly rates of eating disorder–related ED visits and hospitalizations. The relative change in visit rates, that is, between the observed and expected rates, after restrictions and confidence intervals were obtained by exponentiating the linear combination of regression parameters corresponding to the difference in the observed and predicted postrestriction terms, as in previous work [14]. Statistical analyses were conducted using SAS statistical software, version 9.4.

The use of these data was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require any review by a Research Ethics Board.

Results

In 2020, there were 2,444,559 children and adolescents (mean [standard deviation] age, 10.07 [4.29] years; 1,190,238 [48.7%] female; 2,201,305 [90.0%] urban) eligible for provincial health insurance (Table 1). From January 1, 2017, to February 29, 2020, there were 1,064 eating disorder–related ED visits and 1,637 hospitalizations (population-weighted yearly rates of 14.0 and 21.6 per 100,000 population, respectively). After the onset of the pandemic, March 1, 2020 to December 26, 2020, there were 478 ED visits and 663 hospitalizations (annualized rates of 23.7 and 32.9 per 100,000 population, respectively). For the duration of the study period, 36.2% of eating disorder–related ED visits resulted in hospitalization. In contrast, 46.4% of all eating disorder–related admissions came from the ED.

Acute care visits increased immediately after the onset of the pandemic, reaching a 4-week peak annualized rate of 34.6 per 100,000 population (ED visits) and annualized rate of 43.2 per 100,000 population (hospitalizations) in October 2020. Acute care visits for eating disorders remained well above the 3-year prepandemic average through to December 26, 2020.

The overall relative change in the observed rate of eating disorder visits as compared with the expected during the post-COVID onset period was significant for ED visits (adjusted relative rate [aRR] = 1.66, 95% confidence interval [CI] = 1.41–1.96) and hospitalizations (aRR = 1.37, 95% CI =1.25–1.50) (Figures 1 and 2). Observed rates of ED visits and hospitalizations for eating disorders remained significantly higher than expected between June and November, 2020.

ED visits and hospitalizations were stratified by age (Figures 3 and 4). After the onset of the pandemic, ED visit rates for children and adolescents aged 3–13 years were lower than expected in April and May before returning to expected levels in June, 2020 (aRR = 1.04, 95% CI = .66–1.63). ED visit rates continued to be higher than expected before peaking in December, 2020 (aRR = 2.40, 95% CI = 2.08–2.77). ED visits for adolescents aged 14–17 years were higher than expected for all the months after the onset of the pandemic, with the exception of May, 2020. Hospitalizations followed a similar pattern. In children and adolescents aged 3–13 years, hospitalizations were higher than expected after the onset of the pandemic, with the exception of April, May, and August, 2020. Overall, hospitalizations for those aged 3–13 years were higher than expected (aRR = 1.29, 95% CI = 1.03–1.61). Observed rates of hospitalizations for eating disorders of adolescents aged 14–17 years remained significantly higher than expected after the onset of the pandemic and peaked in October, 2020 (aRR = 1.94, 95% CI = 1.92–1.96). Overall, hospitalizations for these adolescents were higher than expected (aRR = 1.43, 95% CI = 1.33–1.53).

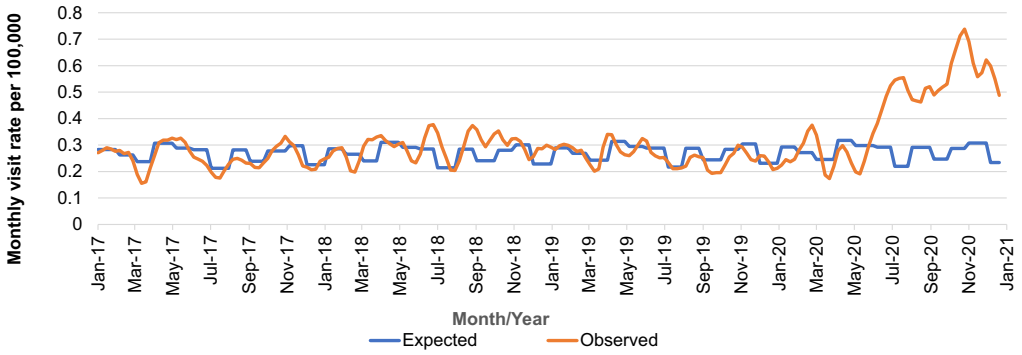
Discussion

After the onset of the COVID-19 pandemic, we observed a 66% overall relative increase in the rate of ED visits and 37% increase

Table 1
Baseline demographic characteristics of children and adolescents aged 3–17 years in Ontario, 2017–2020

Year	2017	2018	2019	2020
Children and adolescents on January 1st, N	2,378,297	2,394,995	2,417,492	2,444,559
Age				
Mean ± SD	10.1 ± 4.3	10.1 ± 4.3	10.1 ± 4.3	10.1 ± 4.3
Median (IQR)	10 [6–14]	10 [6–14]	10 [6–14]	10 [6–14]
Age group n (%)				
3–12 years	1,572,470 (66.1)	1,585,355 (66.2)	1,599,480 (66.2)	1,616,490 (66.1)
13–17 years	805,438 (33.9)	809,253 (33.8)	817,711 (33.8)	828,069 (33.9)
Sex, n (%)				
Female	1,157,748 (48.7)	1,166,083 (48.7)	1,177,335 (48.7)	1,190,238 (48.7)
Male	1,220,549 (51.3)	1,228,912 (51.3)	1,240,157 (51.3)	1,254,321 (51.3)
Rurality, n (%)				
No	2,140,054 (90.0)	2,155,952 (90.0)	2,176,672 (90.0)	2,201,305 (90.0)
Yes	232,901 (9.8)	233,952 (9.8)	235,741 (9.8)	238,336 (9.7)
Deprivation quintile, n (%)				
1 (least deprived)	554,885 (23.3)	566,428 (23.7)	579,356 (24.0)	590,607 (24.2)
2	511,020 (21.5)	514,894 (21.5)	520,752 (21.5)	526,819 (21.6)
3	437,466 (18.4)	438,996 (18.3)	441,366 (18.3)	445,267 (18.2)
4	399,001 (16.8)	399,500 (16.7)	401,234 (16.6)	404,117 (16.5)
5 (most deprived)	448,860 (18.9)	448,101 (18.7)	447,368 (18.5)	450,308 (18.4)
Immigration status, n (%)				
Immigrants	142,519 (6.0)	128,080 (5.3)	112,356 (4.6)	98,243 (4.0)
Refugees or other immigrants	40,343 (1.7)	37,281 (1.6)	33,588 (1.4)	29,987 (1.2)
Non-immigrant	2,195,433 (92.3)	2,204,055 (92.0)	2,204,132 (91.2)	2,200,437 (90.0)

IQR = interquartile range; SD = standard deviation.



Month (2020)	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Observed rate	0.25	0.29	0.24	0.47	0.56	0.44	0.56	0.66	0.60	0.57
Expected rate	0.25	0.32	0.30	0.29	0.22	0.29	0.25	0.29	0.31	0.23
RR (95% CI)	1.03 (0.96, 1.11)	0.90 (0.73, 1.11)	0.80 (0.64, 1.00)	1.61 (1.27, 2.04)	2.56 (2.44, 2.69)	1.52 (1.34, 1.71)	2.28 (1.81, 2.87)	2.32 (2.28, 2.35)	1.94 (1.73, 2.17)	2.45 (2.02, 2.97)

Figure 1. Monthly observed and expected rates of emergency department (ED) visits for eating disorders among children and adolescents during the COVID-19 pandemic, March to December 2020 (per 100,000 population).

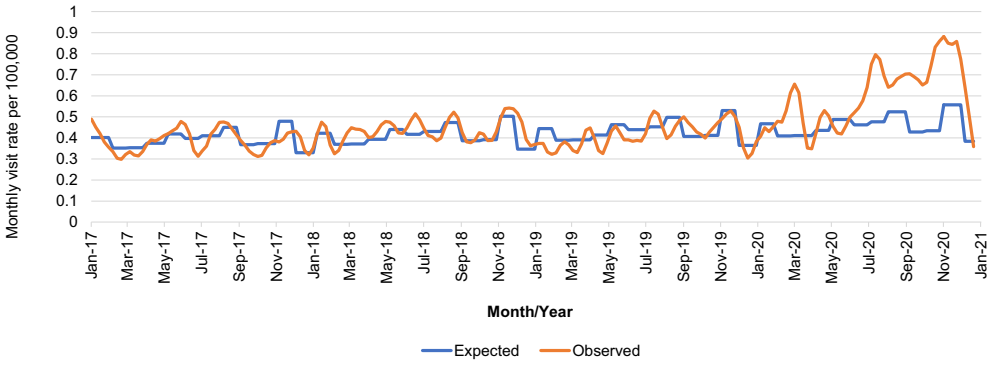
in hospitalizations for eating disorders among children and adolescents in Ontario, Canada. This trend persisted to the end of December, 2020.

Although some initial data exist, there is a dearth of literature that reports on quantitative findings related to the effect of the pandemic on eating disorders and related health service utilization among children and adolescents. Our findings support and align with those in other jurisdictions, such as Australia, where a 104% increase in children with anorexia nervosa requiring admission to hospital for nutritional rehabilitation compared with the three previous years has been observed [1]. Data from the UK National Health Service reveal a dramatic increase in ED treatments in 2020–2021 compared with 2019–2020 [7]. Studies from the United States have reported similar findings. A comparison of hospitalizations, hospital bed days, and eating disorder–related inquiries at a pediatric eating disorder program, Boston, Massachusetts, reported an increase across all the metrics after the pandemic onset [8]. Similarly, a 123% increase in admissions for complications of restrictive eating disorders was observed at a children's hospital in Ann Arbor, Michigan, from April 1, 2020, to March 31, 2021, compared with the average number of admissions in the three years before the COVID-19 pandemic [6]. Within a Canadian context, Spettigue et al. compared children with severe eating disorders referred to a tertiary pediatric hospital in 2019 and 2020. The authors found that the 2020 group presented with a lower average percent of treatment goal weight, were more medically unstable, displayed increased levels of functional impairment and eating restraint, and, ultimately, were more likely to require admission within four weeks of their initial assessment [9]. In addition, the National Eating Disorder Information Centre reported a doubling in the number of requests for support in November 2020 compared with 2019 [2], and the National Eating Disorders Association in the United States has reported a greater than 70% increase in the number of calls and online chats to their hotline than in the previous year [15].

The rise in acute eating disorder presentations may be related to increased anxiety, feelings of loss of control, and consequent triggering of eating disorder behaviors [3]. Others have suggested that changes in opportunities for exercise, fear of weight gain, increased time spent on social media, and increased stress within families may also contribute to the rising eating disorders presentations [4,5,16]. Increased contact at home between youth and their parents/caregivers during the pandemic may have provided a greater opportunity for detection of eating disorder symptomatology. There may also likely be other unmeasured factors such as socioeconomic status, race, ethnicity, and barriers to accessing care that may be contributing to our findings. The pandemic has differentially affected low-income and marginalized communities [17–19], and therefore, it is possible that mental health disorder presentations including eating disorders were also differentially affected. Although we did not look at the differential increase in eating disorder presentations by sociodemographic factors, this is an important area of future study as we aim to better understand the impact of the pandemic on the health of children and adolescents.

In addition, our data suggest possible barriers to accessing earlier outpatient care for those with urgent eating disorder concerns. During the first wave of the COVID-19 pandemic, some primary care clinics may have also closed to better allocate resources within the healthcare system. With this closure, the subsequent increase in ED visits may be explained by a lack of access to routine health care in the community. Patient needs that are not adequately met in ambulatory care settings may have implications for the ongoing surveillance, system capacity, and resource allocation for pediatric eating disorders.

Our study has several limitations. General limitations inherent to health administrative data include potential coding errors, lag in data transfer, and lack of clinical detail. Given the lag in data transfer, we were only able to examine the effects of the COVID-19 pandemic within a limited timeframe of 10 months. Future research should include a longer follow-up period to determine if the results are sustained over time during the pandemic. Another limitation of the databases used in the present study is that they do not capture events for patients who present to other allied health professionals (e.g., social workers,



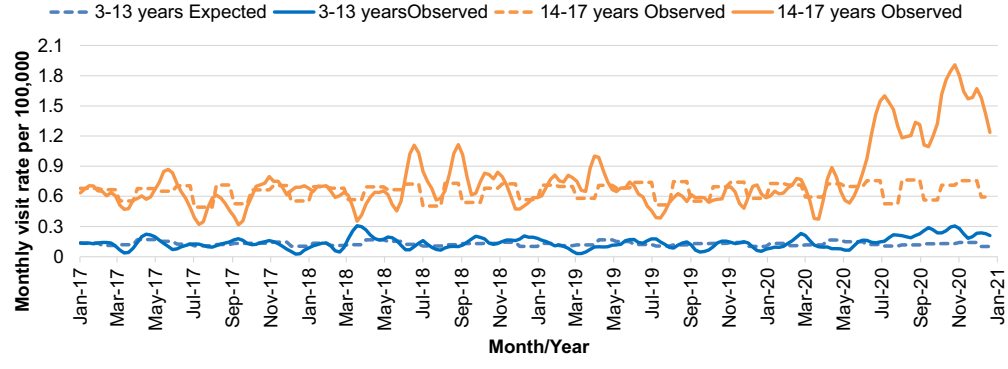
Month (2020)	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
Observed rate	0.51	0.52	0.44	0.57	0.77	0.65	0.70	0.83	0.83	0.48
Expected rate	0.41	0.44	0.49	0.46	0.48	0.52	0.43	0.43	0.56	0.38
RR (95% CI)	1.23 (1.17, 1.31)	1.20 (1.15, 1.25)	0.91 (0.85, 0.96)	1.24 (1.12, 1.37)	1.61 (1.47, 1.76)	1.23 (1.10, 1.38)	1.62 (1.42, 1.86)	1.91 (1.87, 1.95)	1.50 (1.36, 1.65)	1.24 (1.10, 1.41)

Figure 2. Monthly observed and expected rates of hospitalizations for eating disorders among children and adolescents during the COVID-19 pandemic, March to December 2020 (per 100,000 population).

psychologists, and other therapists). Furthermore, health administrative data may not denote disease severity, and it is not possible to accurately disentangle whether there was a pre-existing eating disorder before acute presentation. Although the reliability and validity of administrative data is sometimes a concern, Kurdyak et al. have demonstrated the utility of health administrative data to create clinically relevant eating disorder cohorts. Despite these limitations, this study provides evidence of an increase in the rate of ED visits and hospitalizations for eating disorders among children and adolescents in Ontario, Canada.

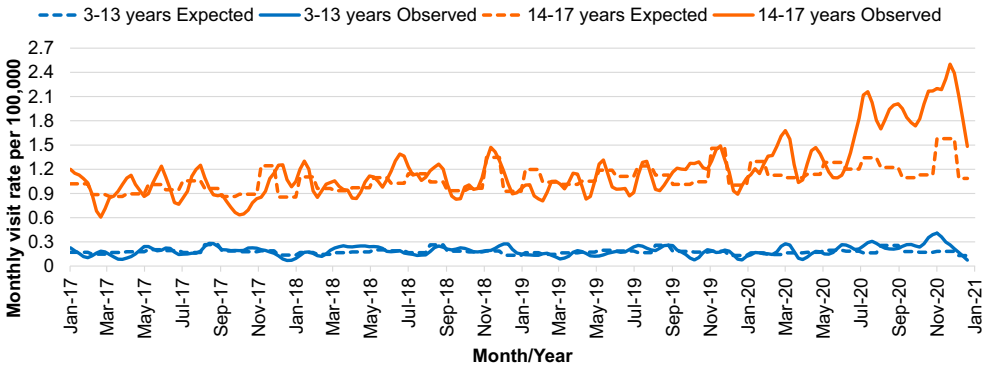
Conclusion

ED visits and hospitalizations for eating disorders among children and adolescents have increased significantly during the first 10 months of the COVID-19 pandemic compared with pre-pandemic expected rates. This has important implications for the ongoing surveillance as the pandemic evolves as well as resource allocation for pediatric eating disorders. Future research is needed to better understand the neurobiological and social contributing factors to this observed surge and the proportion of children and adolescents with acute presentations who have



3-13 years										
Month (2020)	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Observed rate	0.16	0. 07	0.0012	0.13	0.21	0.18	0.29	0.27	0.21	0.24
Expected rate	0.12	0.17	0.0015	0.12	0.11	0.12	0.13	0.13	0.14	0.10
RR (95% CI)	1.34 (1.07, 1.68)	0.42 (0.33, 0.54)	0.82 (0.45, 1.50)	1.04 (0.66, 1.63)	2.00 (1.79, 2.23)	1.53 (1.16, 2.02)	2.29 (1.86, 2.80)	2.04 (1.69, 2.45)	1.51 (0.99, 2.30)	2.40 (2.08, 2.77)
14-17 years										
Observed rate	0.51	0.87	0.55	0.14	1.51	1.15	1.29	1.74	1.64	1.46
Expected rate	0.59	0.72	0.70	0.76	0.53	0.76	0.56	0.71	0.76	0.59
RR (95% CI)	0.87 (0.75, 1.00)	1.20 (0.93, 1.55)	0.78 (0.66, 0.93)	1.85 (1.67, 2.06)	2.87 (2.78, 2.97)	1.51 (1.46, 1.56)	2.28 (1.79, 2.91)	2.45 (2.23, 2.68)	2.16 (2.07, 2.25)	2.47 (1.86, 3.28)

Figure 3. Monthly observed and expected rates of emergency department (ED) visits for eating disorders among children and adolescents by age during the COVID-19 pandemic, March to December 2020 (per 100,000 population).



3-13 years										
Month (2020)	**March**	**April**	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**
Observed rate	0.19	0.17	0.19	0.22	0.31	0.20	0.27	0.34	0.29	0.13
Expected rate	0.16	0.17	0.20	0.19	0.16	0.26	0.18	0.17	0.18	0.13
RR (95% CI)	1.17 (1.04, 1.31)	0.98 (0.88, 1.08)	0.97 (0.74, 1.28)	1.21 (1.01, 1.45)	1.88 (1.79, 1.98)	0.79 (0.64, 0.97)	1.48 (1.04, 2.11)	1.95 (1.84, 2.07)	1.60 (1.25, 2.04)	1.00 (0.68, 1.48)
14-17 years										
Observed rate	1.36	1.48	1.12	1.55	2.01	1.85	1.86	2.20	2.30	1.72
Expected rate	1.10	1.14	1.28	1.20	1.34	1.22	1.09	1.13	1.58	1.09
RR (95% CI)	1.24 (1.07, 1.45)	1.30 (1.29, 1.30)	0.87 (0.86, 0.89)	1.29 (1.23, 1.36)	1.49 (1.48, 1.51)	1.51 (1.49, 1.53)	1.69 (1.61, 1.79)	1.94 (1.92, 1.96)	1.46 (1.37, 1.55)	1.58 (1.41, 1.77)

Figure 4. Monthly observed and expected rates of hospitalizations for eating disorders among children and adolescents by age during the COVID-19 pandemic, March to December 2020 (per 100,000 population).

pre-existing disease compared with the new-onset eating disorders during the COVID-19 pandemic.

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Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jadohealth.2021.09.025.

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