Medical Admissions Among Adolescents With Eating Disorders During the COVID-19 Pandemic

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Abbreviations: COVID-19 = coronavirus disease 2019, ED(s) = eating disorder(s)

Table of Contents Summary
This study examines medical admission patterns among adolescents with restrictive eating disorders before and after the onset of the COVID-19 pandemic.

What’s Known on This Subject
Limited data suggest the COVID-19 pandemic has been associated with worsening mental health outcomes, including worsening symptoms of eating disorders. Little is known about the potential effects of the pandemic on medical admission patterns among adolescents with eating disorders.

What This Study Adds
Medical admissions among adolescents with eating disorders at our institution increased significantly during the COVID-19 pandemic, with the number of admissions during the first twelve months of the pandemic more than double the mean for the previous three years.
Dr. Otto conceptualized and designed the study, designed the data collection instruments, coordinated and supervised data collection, collected data, drafted the initial manuscript, and reviewed and revised the manuscript.

Dr. Jary designed the data collection instruments, collected data, drafted the initial manuscript, and reviewed and revised the manuscript.

Ms. Sturza carried out the initial analyses and reviewed and revised the manuscript.

Drs. Miller, Prohaska, and Van Huysse conceptualized and designed the study, collected data, and reviewed and revised the manuscript.

Dr. Bravender conceptualized and designed the study and reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.
Abstract

**Background and Objectives:** Emerging data suggest the COVID-19 pandemic has been associated with worsening symptoms of eating disorders among both adults and adolescents. This study sought to determine whether medical admission patterns among adolescents admitted to our institution for restrictive eating disorders changed during the pandemic, relative to pre-pandemic counts of admissions per month.

**Methods:** We performed a chart review of patients ages 10-23 admitted to our children’s hospital for restrictive eating disorders from March 2017 through March 2021 and completed an interrupted time series analysis of admission counts per month. Demographic variables for admitted patients were compared using χ², Fisher's Exact, and two-sample t-tests.

**Results:** Eating disorder-related medical admissions at our institution increased significantly during the COVID-19 pandemic. The total number of admissions during the first twelve months of the COVID-19 pandemic (April 1, 2020 through March 31, 2021, n = 125) was more than double the mean number of admissions per year for the same time frame (April 1 through March 31) for the previous three years (mean = 56). Patient demographics were similar before and during the pandemic, with the exception that patients admitted during the COVID-19 pandemic were less likely than those admitted prior to the pandemic to have public insurance.

**Conclusions:** Medical admissions related to restrictive eating disorders among adolescents increased significantly during the COVID-19 pandemic. Pediatric providers in a variety of settings should be prepared to care for adolescents with restrictive eating disorders during the pandemic.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic and related public health precautions have been associated with negative psychological effects among adults as well as adolescents. Early in the pandemic, eating disorder (ED) experts hypothesized these effects could be particularly profound among individuals with EDs. Initial data suggest the pandemic has been associated with worsening symptoms, including increases in restriction, bingeing, and/or purging, among adults with EDs. Given the unique developmental context of adolescence, adolescents may be especially vulnerable to negative social consequences of the pandemic, including social isolation, and adolescents with EDs may be at risk for worsening symptoms as well. Indeed, emerging data indicate worsening restriction and compensatory behaviors aimed at...
losing weight among adolescents with EDs during the pandemic. Furthermore, there have been international reports of increases in both outpatient referrals to child and adolescent eating disorder services and inpatient admissions related to anorexia nervosa among adolescents during the pandemic.

The COVID-19 pandemic has also been associated with delayed care for non-COVID-19 conditions. In many settings, in-person clinical care has been significantly disrupted and/or limited as a result of measures enacted to reduce the risk of transmission of COVID-19; such disruptions are likely to increase the longstanding unmet need for eating disorder treatment among adolescents. Several centers have described efforts to rapidly transition from in-person to virtual care for adolescents with eating disorders as a result of the COVID-19 pandemic. Given the unique needs and risks of this population, adolescents with EDs may be particularly negatively impacted by reduced availability of in-person care; for example, clinical assessment and management of patients with EDs and malnutrition generally require measurement of weight and vital signs, and in many cases, a full physical examination, laboratory studies, and/or electrocardiography may be indicated. Furthermore, confidentiality—a critical component of clinical care for adolescents—may be limited in virtual settings. Long-term outcomes among adolescents receiving virtual care for eating disorders remain largely unknown.

For adolescents with restrictive EDs, worsening symptoms, delayed diagnosis and/or treatment, limited access to evidence-based care, and/or disruptions to existing treatment as a result of the COVID-19 pandemic may result in worsening malnutrition and subsequent medical deterioration
requiring hospital admission. This study aimed to determine whether admission patterns among adolescents with restrictive EDs at our institution changed during the pandemic.

**Methods**

We completed a chart review of adolescents ages 10-23 years admitted to C.S. Mott Children’s Hospital in Ann Arbor, Michigan, between March 1, 2017 and March 31, 2021 for medical complications of restrictive eating disorders, including anorexia nervosa, atypical anorexia nervosa, and avoidant/restrictive food intake disorder as well as other specified feeding and eating disorders and unspecified feeding or eating disorders marked by restriction. Patients with EDs admitted for unrelated conditions, those admitted only to inpatient psychiatry, and those seen for weight loss without a diagnosis of ED were excluded. Patients with bulimia nervosa or other non-restrictive EDs were also excluded as they are less likely to develop malnutrition and medical complications thereof and more likely to be admitted for behavioral reasons.

Demographics (age at the time of first admission, sex, race/ethnicity, and insurance type) and specific ED diagnoses were extracted from the medical record. We included data on race and ethnicity in our analysis to evaluate whether any observed changes in counts of admissions over time varied by race or ethnicity, as such changes may reflect inequities in access to care and/or differential effects of the pandemic on ED symptoms as a result of systemic racism. Race and ethnicity were categorized in the manner used in our electronic medical record using the variables given in Table 1. To evaluate for potential changes in demographics over time prior to the onset of the COVID-19 pandemic, we used Fisher's Exact and two-sample t-tests to determine if demographic variables differed between patients admitted each year prior to the
pandemic. As there were no significant differences between years, all data from March 2017 through March 2020 (prior to the COVID-19 pandemic) were pooled and compared to data from April 2020 through March 2021 (during the COVID-19 pandemic) using χ², Fisher's Exact, and two-sample t-tests.

Sequential counts of admissions per month were compared before and after April 1, 2020 using interrupted time series analysis.²⁰ We chose this date as the time point of interest as admissions were measured per month, and April was the first full month of the pandemic in our state after the first confirmed cases in the state were diagnosed on March 10. Schools across the state closed on March 16, 2021. Subsequently, a state-wide stay-at-home order went into effect in Michigan on March 24, 2020; the stay-at-home order lasted until June 1, 2020. We used Durbin-Watson tests to assess autocorrelation between months. We hypothesized that admissions would decrease precipitously in April 2020 as a result of stay-at-home orders and decreases in both clinic availability and patient demand for care, then increase over time during the COVID-19 pandemic; our impact model therefore proposed an immediate level change (i.e., a change in the number of admissions per month) followed by a slope change (i.e., a difference in the month-to-month rate of change in admissions per month). In our regression model, β₁ represents the underlying trend in admission counts per month prior to the COVID-19 pandemic, whereas β₂ indicates the level change between March and April 2020 and β₃ indicates the slope change over time. All analyses were conducted in SAS software, version 9.4.

This study was deemed exempt from review by the University of Michigan Institutional Review Boards as secondary research for which consent is not required.
Results
There were 297 ED-related admissions among 248 patients during the study period. Demographics at the time of each patient’s first admission during the study period are summarized in Table 1. Demographics and specific diagnoses were similar before and during the COVID-19 pandemic, with the exception of insurance type (see Table 1). There was a significant change in the distribution of insurance types during the COVID-19 pandemic ($p = 0.005$), and the proportion of patients with public insurance decreased significantly ($p = 0.02$). The majority of patients, both before and during the pandemic, were female and White.

Results of the interrupted time series analysis are shown in Figure 1. Durbin-Watson tests indicated no autocorrelation. Counts of ED-related admissions per month were stable over time prior to the COVID-19 pandemic ($\beta_1 = 0.03 \ [95\% \text{ CI} -0.03 – 0.09]; p = 0.37$). There was a significant level change when the pandemic began, with total admissions decreasing in April 2020 ($\beta_2 = -5.04 \ [95\% \text{ CI} -7.78 – -2.29]; p < 0.001$). Counts of admissions per month then increased significantly over time during the COVID-19 pandemic ($\beta_1 + \beta_3 = 1.58 \ [95\% \text{ CI} 1.25 – 1.91]; p < 0.001$). The total number of admissions between April 1, 2020 and March 31, 2021 (n = 125) was more than double (123% increase) the mean number of admissions for the same time frame (April 1 through March 31) for the previous three years (mean = 56).

Discussion
Medical admissions among adolescents with EDs at our institution increased significantly during the COVID-19 pandemic. Notably, counts of ED-related admissions per month at our institution increased throughout the COVID-19 era, with the highest counts observed near the end of the
study period, 9-11 months after the pandemic began. It is not clear whether this increase is a function of delayed care and/or an increase in incident cases; further study to determine the factor(s) driving this observation is needed. Although our findings reflect the experience of a single institution, they are in keeping with emerging reports suggesting a developing epidemic within the pandemic – one with the potential to have profound negative effects on the mental and physical health of adolescents around the globe. This study, which examines patient-level data, both provides context to recent reports indicating an increase in the number of patients presenting for ED care\textsuperscript{11,12} and indicates a need for future larger-scale studies of the effects of the pandemic on adolescents with EDs.

Our findings suggest the COVID-19 pandemic and related precautions may be associated with worsening symptoms among adolescents with EDs – or with the emergence of symptoms among adolescents at risk for these disorders. This is in keeping with our recent clinical experience, in which ED patients seen in various clinical settings (inpatient units, outpatient clinics, eating disorder partial hospitalization program) at our institution have described new or worsening symptoms associated with pandemic precautions. While the pathogenesis of EDs is incompletely understood, current evidence suggests the development of EDs may be conceptualized through a biopsychosocial model, with influences of genetics, psychological factors, and social influences. Psychologically, adolescents with low self-esteem or depressive symptoms are more likely to develop EDs,\textsuperscript{21} and many describe worsening of these factors during the pandemic. Additionally, changes to adolescents’ day-to-day lives, such as school closures and cancellation of organized sports, may disrupt routines related to eating and exercise, and such disruptions may be an impetus for the development of ED behaviors in those at risk for these disorders. Indeed, though
anecdotal, our recent clinical experience suggests adolescents with new EDs frequently report their ED behaviors began when pandemic precautions were implemented because, for example, they found themselves with nothing else to do or with more time to engage in diet and/or exercise behaviors they had previously considered but not acted on. Furthermore, the pandemic has impacted social relationships among adolescents, who may be turning to social media in greater numbers to stay connected. Social media use itself has been suggested to contribute to the development of EDs.

Profound changes to adolescents’ day-to-day lives related to the COVID-19 pandemic may also affect the number of adolescents admitted for eating disorders independent of their direct effects on ED symptoms. For example, an adolescent with significant eating disorder symptoms and severe malnutrition that predated the pandemic may have only come to medical attention when they moved back in with their parents after their college closed unexpectedly as a result of the pandemic. Thus, in some cases, although ED symptoms themselves may not have been related to the pandemic, per se, an increase in inpatient admissions may in part reflect changes in housing or access to medical care. On the other hand, many consequences of the pandemic, including large-scale job losses associated with loss of employer-sponsored health insurance, decreased availability of outpatient medical services, and increased social isolation, might limit adolescents’ access to ED care, including emergency and/or inpatient care, suggesting our results, while significant, may be only a conservative estimate of the effects of the pandemic on adolescents with EDs.
In this study, the distribution of insurance types among adolescents admitted for restrictive EDs changed significantly during the COVID-19 era, with patients admitted during the pandemic less likely to have public insurance. The reason for this finding is not entirely clear. In our experience, patients with public insurance are less likely than those with private insurance to have insurance coverage for ED treatment, particularly psychotherapy, and may therefore experience delayed medical care or have no access to medical care, as therapists are an important source of referrals for medical assessment. It is possible that healthcare system-level changes during the COVID-19 pandemic, such as outpatient clinic closures and rapid widespread transitions to virtual care, as well as broader societal effects of the pandemic, including large-scale job losses, may have further limited access to medical care among adolescents with public insurance, meaning fewer adolescents with complications of restrictive EDs requiring admission came to medical attention during the pandemic. Eating disorders affect adolescents of all socioeconomic statuses; that the proportion of patients in this study with public insurance decreased during the COVID-19 pandemic again suggests our findings, while significant, may represent a conservative estimate of the number of adolescents experiencing severe medical illness related to EDs during the pandemic.

Early in the COVID-19 pandemic, some in-person outpatient services at our institution, including some types of eating disorder care, were limited as a result of state-wide restrictions; these services were largely transitioned to telehealth until restrictions were lifted. The effects of this transition to large-scale telehealth services on outcomes among adolescents with ED receiving care at our institution are largely unknown. Restrictions on in-person outpatient clinic appointments ended in June 2020, while inpatient admissions continued to increase significantly
through March 2021, suggesting these brief limitations in in-person outpatient appointments were not a significant driver of the increase in admissions. Our institution uses the indications for medical admission described by the Society for Adolescent Health and Medicine, including physiologic instability (e.g., heart rate <50 beats per minute while awake, blood pressure <90/40 mm Hg, temperature <35.6° C), electrolyte derangements (e.g., hypokalemia, hypophosphatemia), acute medical complications of malnutrition (e.g., syncope), uncontrolled purging, body mass index less than 75% of the median for age and sex, acute food refusal of 24 hours or more, and failure of outpatient treatment. Our criteria for admission did not change during the pandemic.

Our findings suggest providers as well as healthcare systems who care for adolescents with EDs may need to rapidly adapt in response to increasing demands for care during the COVID-19 pandemic. Emerging data indicate some aspects of ED care, including psychotherapy, may be transitioned to telehealth, and others have described their experiences as well as lessons learned and best practices for such transitions; however, in-person medical evaluation to assess weight and nutrition status, vital signs, laboratory and other studies (e.g., electrolytes, electrocardiography), and for signs of medical complications requiring admission remains critical. Increasing cases of restrictive EDs among adolescents may lead to longer wait times for medical providers with expertise in EDs and move much of this care to the primary care setting; primary care pediatricians should therefore be familiar with the indications for medical admission among adolescents with EDs outlined by the Society for Adolescent Health and Medicine, e.g., severe bradycardia with heart <50 beats per minute or other signs of physiologic instability. Providers and healthcare systems should also be mindful of the potential for large-
scale shifts to virtual care to perpetuate inequities in ED care, for example, among patients who are uninsured or underinsured, those with limited access to the internet, and non-English speakers.27

This study is limited by its retrospective nature and small sample size. Findings reflect the experience of a single institution where patients were admitted to a general pediatric hospitalist service with multi-disciplinary team care, and generalizability may be limited to similar settings; however, emerging data as well as anecdotal and lay media reports suggest increases in adolescents presenting with EDs in a variety of clinical settings across the globe.11,12,28,30 This study examined only severely ill patients admitted for medical stabilization and did not capture adolescents with EDs presenting in different settings. Ongoing study of the effects of the pandemic on adolescents with EDs in a variety of clinical settings will be critical, particularly if it becomes clear that the impacts of COVID-19 are long lasting.

Conclusions

This study found a significant increase in medical admissions for restrictive EDs among adolescents at our institution during the COVID-19 pandemic. The increase in admissions appears to have occurred primarily among patients with private insurance. Our findings are consistent with emerging data suggesting the pandemic is associated with negative mental health outcomes, including worsening symptoms of EDs. Adolescents may be particularly vulnerable to negative effects of societal upheaval related to the pandemic and to developing EDs during the COVID-19 era. Providers who care for adolescents should be attuned to these risks and monitor patients for signs and symptoms of EDs. An increase in severely ill adolescents with EDs during
COVID-19 is likely to present challenges for patients, their families, and their providers, as demand for treatment – access to which is already limited by pandemic precautions as well as a lack of providers predating the pandemic – is likely to increase, perhaps dramatically. It is unclear how long these effects may last. Our findings suggest those who care for adolescents with EDs in the inpatient setting and beyond should be prepared to address challenges posed by increasing numbers of severely ill ED patients.

Acknowledgments

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References


Table 1. Patient demographics

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<tr>
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<th>Pre-COVID-19 pandemic n = 146</th>
<th>During COVID-19 pandemic n = 102</th>
<th>p value</th>
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<td>Age (yrs), mean (SD)</td>
<td>15.1 (2.8)</td>
<td>15.2 (2.2)</td>
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<tr>
<td>Sex, n (%)</td>
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<tr>
<td>Male</td>
<td>14 (9.6%)</td>
<td>8 (7.8%)</td>
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<td>Female</td>
<td>129 (88.4%)</td>
<td>92 (90.2%)</td>
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<td>1 (0.7%)</td>
<td>0 (0.0%)</td>
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<tr>
<td>Race</td>
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<tr>
<td>White</td>
<td>124 (84.9%)</td>
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<td>Asian</td>
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<td>American Indian and Alaska Native</td>
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<tr>
<td>Black or African American</td>
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<td>4 (3.9%)</td>
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<tr>
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<td>7 (4.8%)</td>
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<td>1 (1.0%)</td>
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<td>Public</td>
<td>29 (19.9%)</td>
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<tr>
<td>Anorexia nervosa</td>
<td>102 (69.9%)</td>
<td>75 (73.5%)</td>
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<td>Atypical anorexia nervosa</td>
<td>27 (18.5%)</td>
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<td>Avoidant restrictive food intake disorder</td>
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<td>7 (6.9%)</td>
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<td>2 (2.0%)</td>
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<tr>
<td>Other specified feeding or eating disorder</td>
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Figure 1. Interrupted time series analysis of monthly counts of eating disorder-related admissions, March 1, 2017, through March 31, 2021. Solid line = slopes; shaded areas = 95% confidence intervals for slopes, dashed line = onset of COVID-19 pandemic.
Medidas de admisión médica entre adolescentes con trastornos alimentarios durante la pandemia del COVID-19
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