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Higher admission and rapid readmission rates among medically hospitalized youth with anorexia nervosa/atypical anorexia nervosa during COVID-19

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ABSTRACT

The COVID-19 pandemic has had sweeping and deleterious effects on the well-being of individuals worldwide. Eating disorders (EDs) are no exception, with incidence and prevalence of EDs rising since COVID-19 onset. The current study examined inpatient census and readmission rates among youth (aged 8–18) hospitalized for medical complications of anorexia nervosa (AN) or atypical anorexia nervosa (AAN) throughout distinct periods of the COVID-19 pandemic, including pre-COVID-19 ($n = 136$), COVID-19 lockdown ($n = 3$), and post COVID-19 lockdown ($n = 24$). Data from the COVID-19 lockdown period was excluded from analyses due to low sample size. Youth hospitalized during post COVID-19 lockdown were over 8-times more likely to be readmitted within 30-days of discharge compared to patients hospitalized before the pandemic ($p = .002$). Further, the inpatient census of youth with AN/AAN was significantly higher during post COVID-19 lockdown compared to pre-COVID-19 ($p = .04$). One-third of patients hospitalized since the pandemic identified COVID-19 consequences as a primary correlate of their ED. Our findings, although not causal, suggest an association between COVID-19 and AN/AAN development and exacerbation in youth, thus prompting more medical admissions and rapid readmissions among this demographic. This study has important implications for understanding how AN/AAN onset and exacerbation in youth has been affected by the COVID-19 pandemic and can inform new efforts to support individuals navigating treatment during a global crisis.

1. Introduction

Individuals with eating disorders (EDs) appear especially vulnerable to COVID-19 pandemic stressors, with reports of worsening illness behaviors and cognitions (Graell et al., 2020; Termorshuizen et al., 2020). Emergency stay-at-home orders, designed to reduce the spread of COVID-19, prompted many unique challenges, including disrupted routines (e.g., shift from in-person to virtual schooling, altered living arrangements for college students), reduced opportunities for physical activity secondary to organized sports cancellations and gym closings, altered food accessibility (e.g., restaurant closures, modified dining options on college campuses, limited access to preferred foods, food insecurity), and disconnection from support systems due to social distancing (Branley-Bell & Talbot, 2020; Fernández-Aranda et al., 2020; Termorshuizen et al., 2020). Whereas various technological platforms have fostered social connection during the pandemic, individuals with EDs may be uniquely triggered by seeing their image during virtual interactions, prompting increased bodily awareness, negative appearance-related comparisons, and self-criticism (Fernández-Aranda et al., 2020) that drive illness symptoms. Social media use has also increased (Cellini et al., 2020; Drouin et al., 2020) which is associated with worsening symptoms in individuals with EDs (Benowitz-Fredericks et al., 2012; Wilksch et al., 2020).

Compounding these challenges are pandemic-related healthcare barriers, including reduced access to in-person treatment, restricted entry into intensive psychiatric treatment programs and ancillary services like group therapies, and prolonged wait times for those seeking to establish care (Clark Bryan et al., 2020; Schlegl et al., 2020). For some patients and caregivers, fears of contracting COVID-19 prompted an unwillingness to attend in-person visits when recommended, potentially

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resulting in the exacerbation of illness symptoms, including physiological sequelae (Datta et al., 2020; Davis et al., 2020). Telemedicine services offer a viable alternative to in-person care during the pandemic, yet also present challenges, such as inadequate medical assessment for patients with acute physical complications of EDs and limited technology access among underrepresented groups (Datta et al., 2020).

A growing body of research highlights the negative impact of COVID-19 on adults with EDs, yet less is known about youth. This study aimed to examine the impact of the COVID-19 pandemic on illness development and exacerbation among youth with AN or AAN. We were particularly interested in those with acute medical complications of AN/AAN who were hospitalized during COVID-19, as studies show an increased prevalence of admissions for this demographic during the pandemic (Datta et al., 2020; Haripersad et al., 2020). This is a high-risk subset of patients, often characterized by more severe psychological symptoms and physical morbidities, and increased mortality risks as compared to outpatient counterparts (Kapphahn et al., 2017; Webb et al., 2011). In this study, we aimed to examine inpatient census, admission, and readmission rates for youth with medical complications of AN/AAN throughout the pandemic, as well as the frequency by which COVID-19 was a self-identified correlate of AN/AAN symptomatology. Findings from our study could facilitate prevention and intervention efforts in the context of AN/AAN risk in youth during the COVID-19 pandemic and in future global health crises.

2. Methods

2.1. Participants and procedure

This study was a retrospective chart review of youth (aged 8–18) with acute medical complications of AN/AAN (e.g., bradycardia with daytime heart rate below 50, acute food refusal, electrolyte imbalance) who were hospitalized between July 15, 2017 and October 1, 2020. Admissions occurred on a specialized ED unit at a large pediatric medical center in the Midwestern United States. All inpatients receive a standard refeeding protocol for medical stabilization. The unit also integrates a mental health protocol in the framework of Family-Based Treatment (FBT; Lock & Le Grange, 2015; Matthews et al., 2019) but at COVID-19 onset, the protocol was altered to meet mandated social distancing requirements, including the suspension of therapy groups and supervised meals, restricted visitation policies, and shifting all medically unnecessary in-person encounters (i.e., psychology, nutrition) to telemedicine.

Patients in our sample (n = 163) were classified by the COVID-19 period coinciding with their first admission in the study period, including pre-COVID-19 (July 15, 2017 - March 14, 2020), COVID-19 lockdown (March 15, 2020 – May 12, 2020; characterized by the initiation of statewide stay-at-home orders, including school closures, retail and service business closures, and postponement of elective surgeries and medical procedures), and post COVID-19 lockdown (May 13, 2020 – October 1, 2020; characterized by phased re-openings of health-care services, retailers, and businesses). Most patients in our sample (n = 136, 83.4%) were hospitalized during pre-COVID-19. Three patients (1.8%) were admitted during COVID-19 lockdown and 24 patients (14.7%) were admitted during post COVID-19 lockdown. This study was approved by the Institutional Review Board. Informed consent was waived due to the retrospective nature of this study.

2.2. Medical chart review

The following variables were extracted from electronic medical records (EMRs) for patients' first hospitalizations during the study period: date of birth, gender, race, ethnicity, ED diagnosis (AN or AAN, as defined in the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (APA, 2013)), illness duration (months), admission and discharge dates, and discharge disposition (outpatient or inpatient psychiatric hospitalization). For patients with multiple hospitalizations, admission and discharge dates from each admission were extracted. For youth hospitalized during COVID-19 lockdown or post COVID-19 lockdown, self-reported environmental correlates of AN/AAN onset and/or exacerbation were identified. For patients with rapid readmissions, self- and provider-reported environmental correlates of readmission were reviewed.

2.3. Statistical analyses

Analyses were run using SPSS version 27 and were summarized into three categories, including 1) demographic and illness severity, 2) association between inpatient census and admission rates related to COVID-19 lockdown and post COVID-19 lockdown, and 3) evaluating impact of COVID-19 on self-reported environmental correlates of AN/AAN onset and/or exacerbation. For the first category, overall demographic and admission details using descriptive statistics (mean, standard deviation, frequency) were completed. To compare groups on categorical variables (gender, race, ethnicity, diagnosis, multiple admissions), Chi Square and Fisher Exact Tests (when cell counts were less than five) were conducted. Binomial Logistic Regression analyses were computed to assess whether COVID-19 period was associated with likelihood for readmission to the inpatient unit within 30-days of discharge. Further, Chi Square analyses evaluated the association between COVID-19 period and discharge disposition for patients' first admissions. To examine differences between COVID-19 period on continuous demographic variables (age, hospital length of stay, illness duration), independent samples t-tests were conducted. Patients hospitalized during the COVID-19 lockdown period were excluded from analyses due to a very small sample size (n = 3). For the second category, a negative binomial regression was run to assess the association between COVID-19 period and daily admission rate (given several counts of zeros in the distribution and data being negatively skewed). Poisson regression analyses (to also account for skew in data) were used to assess the association between COVID-19 period and inpatient daily census. The post COVID-19 lockdown period was used as the reference group. Lastly, monthly admission rates by COVID-19 period were examined using an independent sample t-test. Again, due to low sample size, COVID-19 lockdown data was excluded. For category three, self-reported environmental correlates of AN/AAN development and/or exacerbation and COVID-19 related correlates of rapid readmissions were assessed and qualitatively summarized.

3. Results

3.1. Sample characteristics

A total of 163 patients were admitted for acute stabilization of medical complications of AN/AAN. Participants identified mostly as cisgender female (n = 135, 82.80%), Caucasian (n = 151, 92.60%), and non-Hispanic (n = 152, 93.3%). Participants were between the ages of 8.5 to 17.9 years, with illness durations ranging from one to 48 months. Hospital length of stay ranged from one to 32 days. Most patients discharged home to outpatient care (n = 145, 89.0%) and 11.0% (n = 18) were directly transferred to inpatient psychiatric treatment due to psychiatric comorbidities including acute suicidality, prior failure of outpatient FBT, reliance on nasogastric feeds during medical admission, and severe symptomatology warranting a controlled environment to ensure ongoing medical stability (e.g., frequent purging behaviors, excessive exercise). Thirty-three patients in our sample (20.6%) were hospitalized more than once and 27.3% (n = 9) of all readmissions were rapid, within 30-days of discharge. See Table 1 for demographics. Of note, although patients hospitalized during COVID-19 lockdown were not included in statistical analyses, demographic information for this cohort is included for reference.

Table 1
Demographics by COVID-19 period.

	Pre-COVID-19	COVID-19 lockdown	Post COVID-19 lockdown	Total sample
	n (%)	n (%)	n (%)	n (%)
	136 (83.44)	3 (1.84)	24 (14.72)	163 (100.0)
Gender				
Female	111 (81.6)	3 (100.0)	21 (87.5)	135 (82.8)
Male	22 (16.2)	0 (0.0)	3 (12.5)	25 (15.3)
Transgender male	2 (1.5)	0 (0.0)	0 (0.0)	2 (1.2)
Transgender female	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Non-binary	1 (0.7)	0 (0.0)	0 (0.0)	1 (0.6)
Diagnosis				
AN-R	64 (47.1)	2 (66.7)	10 (41.7)	80 (49.2)
AN-BP	6 (4.4)	0 (0.0)	1 (4.2)	7 (4.3)
AAN	66 (48.5)	1 (33.3)	13 (54.2)	76 (46.6)
Race				
Caucasian	132 (97.1)	3 (100.0)	23 (95.8)	158 (93.3)
Asian	2 (1.5)	0 (0.0)	1 (4.2)	3 (1.8)
Black	2 (1.5)	0 (0.0)	0 (0.0)	2 (1.2)
Ethnicity				
Non-Hispanic	127 (93.4)	3 (100.0)	22 (91.7)	152 (93.3)
Hispanic	9 (6.6)	0 (0.0)	2 (8.3)	11 (6.7)
Multiple admits				
Yes	26 (19.1)	0 (0.0)	7 (29.2)	33 (20.6)
Readmitted < 30-days*				
Yes	4 (2.9)	0 (0.0)	5 (20.8)	9 (5.5)
Disposition				
Home/outpatient	121 (89.0)	3 (0.0)	21 (87.5)	145 (89.0)
Psychiatric hospitalization	15 (11.0)	0 (0.0)	3 (12.5)	18 (11.0)
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Age (years)	15.17 (1.80)	15.72 (1.03)	15.00 (1.60)	15.15 (1.76)
Illness duration (months)	9.97 (8.81)	6.33 (4.93)	6.17 (3.03)	9.34 (8.26)
Length of stay (days)	9.96 (6.24)	9.00 (1.00)	9.38 (3.20)	9.85 (4.94)

* Percentage assessed by dividing readmissions within 30-days over number of patients with multiple admissions.

3.2. Demographics by COVID-19 period

There were no statistically significant differences between pre-COVID-19 and post COVID-19 lockdown on patient age ($t(158) = -0.42$, $p = .666$, 95% CI [−0.95, 0.61], Cohen's $d = 0.10$) or hospital length of stay ($t(158) = -0.53$, $p = .600$, 95% CI [−2.77, 1.60], Cohen's $d = 0.12$). Patients admitted during post COVID-19 lockdown had significantly shorter illness durations compared to patients admitted during pre-COVID-19, ($t(158) = -3.89$, $p < .001$, 95% CI [−5.74, −1.86] with different variances not assumed, Cohen's $d = 0.46$). There were no significant differences between pre-COVID-19 and post COVID-19 lockdown on gender,[1] (Fisher's Exact, $p = .768$), diagnosis[2], ($\chi^2(1)$, 0.24, $p = .663$), race[3], (Fisher's Exact, $p = .392$), or ethnicity, (Fisher's Exact, $p = .671$). There was not a significant association between COVID-19 period and disposition to outpatient versus inpatient psychiatric treatment (Fisher's Exact, $p = .736$). Further, there was not a significant association between COVID-19 period and hospital readmissions, $\chi^2(1) = 1.26$, $p = .262$. However, a significant binomial regression model ($\chi^2(1) = 8.63$, $p = .003$, $R^2 = 0.15$) suggested there was a significant association between COVID-19 period and rapid readmissions (within 30-days of discharge; $b = 2.16$, *S.E.* $= 0.71$, Wald $= 9.16$, $p = .002$) with an 8.68 times greater likelihood that post COVID-19 lockdown patients would be readmitted within 30-days. Among patients with multiple admissions, those admitted during post COVID-19 lockdown were significantly more likely to be readmitted within 30-days of discharge compared to patients admitted during the pre-COVID-19 period ($b = 2.95$, *S.E.* $= 1.038$, Wald $= 8.10$, $p = .004$) with a 19.23 times greater likelihood ($\chi^2(1) = 9.58$, $p = .002$, $R^2 = 0.38$). Chart review of patients requiring rapid readmissions during post COVID-19 lockdown were inconclusive, with no objective indication that readmissions were associated with COVID-19 stressors. Four of five patients requiring rapid readmissions (80%) during post COVID-19 lockdown required nasogastric feeds during at least one of their hospitalizations and for two patients (40%), inpatient psychiatric treatment was recommended but declined.

[1] Only cisgender Female and Male patients included given low n of transgender/gender-non-binary and lack of power to compare groups; [2]AN-R and AN-BP were combined to enhance Chi-Square analyses, [3]Due to low sample size of Black, Asian, and Hispanic patients, they were combined into one group to ensure statistical power sufficient to compare with Caucasian patients.

3.3. Daily and monthly admission rates by COVID-19 period

Table 2 provides descriptive data on daily hospital admissions and daily inpatient census. The average daily admissions were 0.18 patients per day (*SD* = 0.43) with median and modal admissions being zero. Negative binomial regression was utilized to assess differences in daily admission rates related to COVID-19 period. The Likelihood Chi-Square Test indicated the full model was not a significant improvement in fit over the null model ($p = .100$). While the full model was not significant, trends suggest there was not a statistically significant association between pre-COVID-19 and post COVID-19 lockdown on daily admissions ($p = .089$). Monthly admission rates were not significantly different based on COVID-19 period ($t(4.29) = 0.605$, $p = .442$), with different variances not assumed, Cohen's $d = 0.373$.

3.4. Daily census by COVID-19 period

Overall, the daily census of inpatients with AN/AAN and aged 8–18 on average was two patients (*SD* = 1.54) and ranged from zero to seven patients with a modal and median census of two. A Poisson regression was conducted to assess the association between daily census and COVID-19 period; the Likelihood Chi-Square Test indicated the full model was a significantly better fit than the null model ($p < .001$). The daily census during post COVID-19 lockdown was significantly higher than the daily census during pre-COVID-19 ($b = 0.44$, *S.E.* $= 0.06$, $p < .001$) with a 1.54 times greater likelihood.

3.5. Impact of COVID-19 on AN/AAN development and exacerbation

Among patients ($n = 27$) first hospitalized during COVID-19 lockdown or post COVID-19 lockdown, 33.3% (n = 9) identified unique

Table 2
Daily admissions and census by COVID-19 period.

	Pre-COVID-19	COVID-19 lockdown	Post COVID-19 lockdown
Daily admissions			
Minimum-maximum	0–3	0–1	0–3
Mean (SD)	0.17 (0.42)	0.07 (0.24)	0.24 (0.61)
Median	0	0	0
Mode	0	0	0
Daily census			
Minimum-maximum	0–6	0–2	0–7
Mean (SD)	1.95 (1.35)	0.65 (0.76)	3.02 (2.37)
Median	2	0	2
Mode	2	0	0

environmental correlates of AN/AAN onset and/or exacerbation related to the pandemic. Four patients self-reported that AN/AAN symptoms were related to COVID-19 induced gym closures and/or the cancellation of organized sports. One patient reported that they began dieting in hopes that being healthier would decrease chances of contracting COVID-19. Three patients reported discomfort with reduced structural demands (e.g., school closures, activity cancellations), prompting motivation to use free time to get "healthy." Finally, one patient reported that they began dieting in hopes of preventing the "Quarantine 15" (i.e., weight gain from stress eating and sedentary behaviors during COVID-19 lockdown).

4. Discussion

Our study illustrates an association between the COVID-19 pandemic and hospitalization trends for youth with medical complications of AN/AAN, including a greater frequency of daily admissions and a higher inpatient census, as described at other institutions (Datta et al., 2020; Haripersad et al., 2020). We found a 1.54 times greater likelihood of a higher inpatient census and a 3.54 times greater likelihood of daily admissions after COVID-19 lockdown versus before the onset of the COVID-19 pandemic. Notably, throughout the 7-week COVID-19 lockdown period, only three youth with AN/AAN were hospitalized, illustrating a marked decrease in hospital utilization during this timeframe. Within our institutional ED program, most patients are directly admitted from outpatient medical visits with an adolescent medicine physician. Whereas many ambulatory services shifted to telemedicine at the start of the pandemic, in-person medical appointments for youth with EDs were maintained and encouraged. Thus, reduced hospitalization trends during COVID-19 lockdown appear unrelated to service delivery interruptions and could reflect patient-specific factors, such as foregoing in-person appointments or declining recommended admissions due to fears of contracting COVID-19 (e.g., Datta et al., 2020; Davis et al., 2020).

Our findings also suggest an association between the COVID-19 pandemic and hospital readmission rates. We found a 19-times greater likelihood that patients with multiple admissions (20.6%) in our sample were first hospitalized after COVID-19 onset. Further, patients first hospitalized after pandemic onset were 8.68 times more likely to be readmitted within 30-days of discharge than those first hospitalized during pre-COVID-19 (20.8% versus 2.9%). Self-reported correlates of this trend were unclear upon retrospective chart review. Reduced care access due to COVID-19 appeared unrelated, as all patients with rapid readmissions received timely outpatient follow-up from multidisciplinary providers, including outpatient FBT within a mean of 7.2 days (SD = 5.02) of discharge. Outpatient FBT was provided via telemedicine versus in-person which could have reduced efficacy, yet this medium has demonstrated efficacy in prior studies (Anderson et al., 2017; Matheson et al., 2020). Although untested, increased readmission rates since COVID-19 may be associated with altered inpatient interventions secondary to pandemic consequences. Whereas the inpatient medical protocol remained consistent throughout all study periods, many components of the inpatient FBT-guided protocol were discontinued to accommodate social distancing mandates. Further, census growth prompted overwhelming patient-to-provider ratios among inpatient psychologists and dietitians, necessitating abridged interventions during hospitalizations. Although speculative, it is conceivable that caregivers of youth hospitalized after COVID-19 were less equipped to implement FBT post-discharge, as compared to those pre-COVID-19, which may have contributed to rapid readmissions.

An unexpected finding was that patients hospitalized after COVID-19 onset reported a shorter duration of AN/AAN symptoms than those hospitalized before the pandemic which may suggest faster illness progression among youth hospitalized after COVID-19. Alternatively, in light of stay-at-home orders, more family togetherness could have prompted faster detection of ED symptoms by caregivers. However, the retrospective nature of our study prevents a thorough analysis of associated factors and further research is warranted.

Regarding AN/AAN onset and/or exacerbation for youth hospitalized after COVID-19 onset, one-third identified pandemic-related consequences as a primary correlate of dietary restriction. Qualitative self-reported factors included concerns for weight gain or getting "out-of-shape" due to cancellations of organized sports, fears of gaining the "Quarantine 15," beliefs that weight loss would increase immunity to the COVID-19 virus, and allocating newfound, unstructured free time to pursue health goals. These findings suggest that youth with increased risk for AN/AAN development, such as genetic predisposition (Himmerich et al., 2019; Hinney & Volckmar, 2013) and/or struggles to tolerate uncertainty (Hempel et al., 2018; Serpell et al., 1999) could be more susceptible to AN/AAN development during COVID-19 and other widespread public health emergencies. However, these data are purely qualitative and prohibit causal conclusions. Further studies should examine quantitative increases in AN/AAN symptoms associated with the COVID-19 pandemic.

Our study is not without limitations. First, our institutional ED program provides treatment for patients with diverse EDs through age 25. Because our sample was limited to youth with AN/AAN to reduce treatment protocol discrepancies, our analyses only reflect a subgroup of hospitalized patients and should be interpreted as such. Second, insofar as pandemic consequences persist, the defined timespan of our study's post COVID-19 lockdown period is in no way inclusive of the many months and/or years in which individuals will likely be impacted by the pandemic. Study findings may not generalize beyond the study period. A third limitation is our study's retrospective design and the inability to make causal relationships between COVID-19 and AN/AAN onset and/or exacerbation.

Although causal claims cannot be made, our findings support an association between the COVID-19 pandemic, hospital utilization trends, and illness symptoms among youth with medical complications of AN/AAN. This study further contributes to growing evidence suggesting the negative impact of COVID-19 among individuals with EDs. Ongoing assessment of the long-term and potentially delayed effects of the COVID-19 pandemic on AN/AAN development/exacerbation and inpatient hospitalization trends in youth is warranted to delineate adequate support and interventions should repeated COVID-19 or other global crises induce widespread barriers to care.

5. Conclusions

On a medical stabilization unit, inpatient census, daily admission, and rapid readmission rates for youth with AN/AAN were significantly greater during the post COVID-19 lockdown period versus before COVID-19 onset. Approximately one-third of patients self-reported pandemic consequences as a primary correlate of AN/AAN onset and/or exacerbation, suggesting the pandemic may have played a role in the increase of symptomatology and hospital utilization rates among youth.

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CRediT authorship contribution statement

Abigail Matthews: Conceptualization, Investigation, Writing – Original Draft, Writing – Review & Editing. **Rachel Kramer**: Formal Analysis, Methodology, Writing – Original Draft, Writing – Review & Editing. **Claire Peterson**: Writing – Original Draft, Writing – Review & Editing. ***Laurie Mitan***: Writing – Original Draft, Writing – Review & Editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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