



A Comprehensive Examination of Pediatric Behavioral Health Service Demand and Utilization in a Large, Academic Health System from 2019 to 2021

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Abstract

Studies of the effects of COVID-19 on youth suggest a worsening in mental health globally. We performed a retrospective analysis of data from January 2019–November 2021 for all outpatient referrals, as well as outpatient, inpatient, and emergency department (ED) encounters for behavioral health (BH) reasons in children aged <18 in a large academic health system in the United States. Mean weekly rates of outpatient psychiatry referrals, outpatient psychiatry visits, ED visits, and inpatient admissions for BH reasons were compared between pre-pandemic and pandemic periods. The average weekly rate of ambulatory referrals (8.0 ± 0.33 to 9.4 ± 0.31) and completed appointments (194.2 ± 0.72 to 213.1 ± 0.71) significantly increased during the pandemic, driven largely by teenagers. The weekly average of ED pediatric encounters for BH did not increase during the pandemic, although the percentage of all pediatric ED encounters that were for BH did increase from 2.6 to 4.1% ($p < 0.001$). Length of stay for pediatric BH ED patients increased from 1.59 ± 0.09 days pre-pandemic to 1.91 ± 0.11 days post-pandemic ($p < 0.0001$). Inpatient admissions for BH reasons overall decreased during the pandemic, due to a decrease in inpatient psychiatric bed capacity. However, the weekly percentage of inpatient hospitalizations for BH reasons that occurred on medical units increased during the pandemic ($15.2\% \pm 2.8$ – $24.6\% \pm 4.1\%$ ($p = 0.0006$)). Taken together, our data suggest the COVID-19 pandemic had varying degrees of impact, depending on the setting of care.

Keywords Pediatric · Behavioral health · COVID-19 · Utilization · Emergency department · Outpatient · Inpatient

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Background

Rates of mental health symptoms in youth have been rising for many years now. Prior to the onset of the COVID-19 pandemic, national surveys in the United States have shown a growing percentage of high school students reporting sadness, thoughts of suicide and/or creating a suicide plan [1]. In addition, rates of youth emergency department visits for depression, anxiety, and behavioral issues increased by 28% between 2011 and 2015 [2]. Suicide rates in youths increased by 57% from 2007 to 2018 [3]. Unfortunately, there are reports that the onset of the COVID-19 pandemic has led to worsening mental health in children and adolescents. Several studies have highlighted a global increase in depression and anxiety symptoms in youth [4] [5]. Impulsivity and irritability appear to also be increased [6]. In addition, there are reports of an increase in emergency room visits for youth with behavioral health complaints, especially among adolescent females [7–9]. The recognition of the effects of the COVID-19 pandemic on youth mental health has led the U.S. Surgeon General to issue an Advisory, calling attention to this urgent public health crisis [10]. One need highlighted in the Surgeon General's report is the need for improved mental health data collection in order to understand needs, trends, services, and interventions. Such studies in other countries suggest there may in fact not be a comprehensive increase in the need for all aspects of behavioral health care [11]. While there has been much written in public discourse about the increase in need for behavioral health services for youth, there are very few comprehensive examinations of the current state of such need and service utilization within the United States. Here, we present an attempt to understand demand for and utilization of outpatient, inpatient, and emergency behavioral health (BH) services for youth at a large, academic health system.

Methods

Settings

The UNC Health System is a large, integrated healthcare system that provides a wide range of medical services to patients in North Carolina and surrounding areas. It includes multiple hospitals, clinics, and healthcare facilities with the headquarters in Chapel Hill, NC. It provides outpatient primary care and psychiatry, inpatient pediatric psychiatry (ages 3–17), and emergency department (ED) services for children and adolescents at multiple sites.

Data Source

The study utilized data from the Carolina Data Warehouse for Healthcare (CDW-H), a comprehensive longitudinal repository that houses electronic health record data from all visits to the UNC Health Care System. The study covered the time period from January 2019 to November 2021 with detailed data on child and adolescent psychiatry service utilization in the UNC Health Care System before and during the COVID-19 pandemic. The UNC Institutional Review Board approved the study.

Data Extraction

This study focused on four key streams of data related to child and adolescent psychiatric visits: referrals to child psychiatry clinic visits, appointments at UNC Child and Adolescent psychiatry clinics, psychiatric ED visits, and psychiatric inpatient admissions. The study population was restricted to patients under 18 years of age at the time of their encounters. Variables extracted for encounters included age at time of the encounter, sex, primary encounter diagnosis (CPT code), encounter start date, and encounter discharge date. The overall number of visits to UNC Health EDs and inpatient services were extracted from the data for comparison. Inpatient psychiatric unit capacity over time was determined through direct communication with the inpatient psychiatry director. Length of stay (LOS) was defined as the number of days between encounter discharge date and encounter start date.

Data Analysis

To investigate changes in service utilization during the pandemic, the study period was divided into two-time frames: pre-pandemic (January 1, 2019, to March 15, 2020) and pandemic (March 15, 2020, to November 30, 2021). March 15, 2020 was used as the cutoff date as it was when the UNC system started to pivot to virtual care in response to COVID-19. Note that there are differences in the total number of weeks included between the time periods – roughly 62 weeks for pre-pandemic period vs. 84 weeks during the pandemic. We corrected for this by using either weekly means or 7-week moving averages when comparing the periods. The mean weekly number of referrals or visits were calculated for each time frame, and a t-test was conducted to determine if there was a significant difference between the means at an alpha level of 0.05. To explore potential differences in the impact of the COVID-19 pandemic on child psychiatry service utilization across age groups, additional t-test analyses were conducted stratified by age (children=age \leq 12; teenagers=age $>$ 12) for each type of visit (i.e., child psychiatry clinic visits, psychiatric ED visits, and inpatient admissions) to compare mean weekly visit counts before and after the pandemic. To visualize patterns over time, 7-week moving averages were calculated for referrals and all visit types. No-show rates were calculated by dividing documented no-show appointments by scheduled appointments. Changes in BH diagnoses in emergency department encounters and inpatient admissions were calculated by first converting rates to diagnosis per 1000 (emergency department) or per 100 (inpatient) encounters and then calculating the percent change for diagnoses with a pre-pandemic rate of \geq 10% of the total diagnoses. All analyses were conducted within Microsoft Excel[®].

Results

Outpatient

The average weekly ambulatory referral rate significantly increased from 8.0 ± 0.33 pre-pandemic to 9.4 ± 0.31 during the pandemic period (Table 1; $p=0.03$). Review of 7-week moving averages of ambulatory referrals show a relatively stable pattern pre-pandemic, with slight increases at the beginning and end of 2019 and relatively stable 7-week moving

Table 1 Ambulatory Pediatric Psychiatry Referrals, Completed Appointments, and No-Shows

	Referrals	Weekly Mean	Completed	Weekly Mean	No-Show	%	Weekly Mean
<i>All Ages</i>							
Pre-Pandemic	499	8.0±0.33*	12,237	194.2±0.72*	703	5.4	11.1±0.46**
Pandemic	792	9.4±0.31*	18,112	213.1±0.71*	1,416	7.3	16.7±0.30**
<i>Age≤12</i>							
Pre-Pandemic	275	4.4±0.24	5,874	93.2±0.58	273	4.4	4.3±0.43*
Pandemic	374	4.6±0.28	7,681	90.4±0.53	474	5.8	5.6±0.26*
<i>Age>12</i>							
Pre-Pandemic	226	3.7±0.29*	7,355	116.7±0.54**	493	6.3	7.8±0.41**
Pandemic	410	5.0±0.26*	11,929	140.3±0.57**	1049	8.1	12.3±0.29**

*p<0.05

**p<0.0001

average of referrals between March and September (Fig. 1A). Ambulatory referrals showed a decrease around the onset of pandemic precautions in March 2020. However, from April–July 2020, referrals stabilized and were relatively similar to pre-pandemic levels. There was a steady increase in weekly average referrals from July through October 2020, with a peak of 14.1 on November 8, which was higher than any weekly average pre-pandemic. Referral rates returned to pre-pandemic levels in early 2021, with an additional increase starting

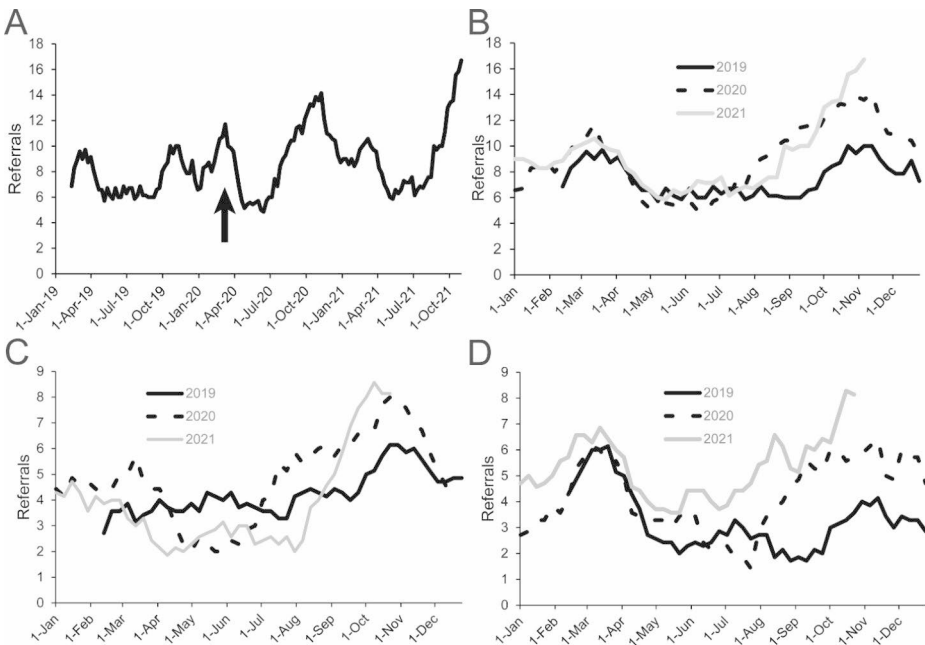


Fig. 1 Seven-week moving averages of ambulatory referrals to psychiatry for children ages < 18 years old. (A) Continuous 7-week moving average for all children during the entire study period. Arrow indicates declaration of COVID-19 pandemic by the World Health Organization. (B) 7-week moving averages for all children displayed by year. (C) 7-week moving averages for children ≤ 12 years old displayed by year. (D) 7-week moving averages for children ages 13–17 years old displayed by year

Table 2 Pediatric Emergency Department Encounters for Behavioral Health

	Encounters	Weekly Mean
<i>All Ages</i>		
Pre-Pandemic	3223	51.7±0.49
Pandemic	4099	48.2±0.49
<i>Age≤12</i>		
Pre-Pandemic	980	15.6±0.35**
Pandemic	1002	11.8±0.33**
<i>Age>12</i>		
Pre-Pandemic	2243	36.0±0.25
Pandemic	3097	36.4±0.22

**p<0.0001

in July 2021 and peaking at 16.7 on the last week of our data collection in October 2021. Review of the 7-week moving referral average over the course of individual years shows clear elevation in referrals from August through January in the years after the pandemic when compared to pre-pandemic rates (Fig. 1B). When broken down by age group, weekly referrals for children≤12 remained relatively similar to pre-pandemic rates, while weekly referrals for teenagers were significantly higher (Table 1; p=0.002) during the pandemic. This difference was largely driven by increases in later months of the year compared to pre-pandemic values (Fig. 1C, D).

Weekly average completed ambulatory visits significantly increased during the pandemic period (Table 1; p=0.01). This difference was due to a significant increase in completed visits for teenagers (p<0.001), while average completed weekly visits for children≤12 remained unchanged. The ambulatory no-show rate for all ages significantly increased from 5.4% pre-pandemic to 7.3% during the pandemic (Table 1; p<0.001), with significant increases seen in both children and teenagers.

Emergency Department

Overall, weekly pediatric ED encounters for BH reasons were similar between pre-pandemic (51.7±0.49) and pandemic (48.2±0.49) periods (Table 2). However, there were significantly fewer weekly pediatric BH ED encounters during the pandemic period for

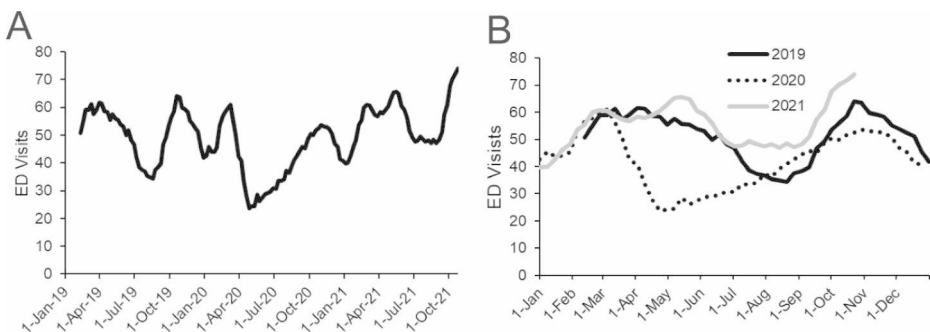


Fig. 2 Seven-week moving averages of pediatric patients presenting to emergency departments for behavioral health reasons. (A) Continuous 7-week moving average for the entire study time period. (B) 7-week moving averages displayed by year

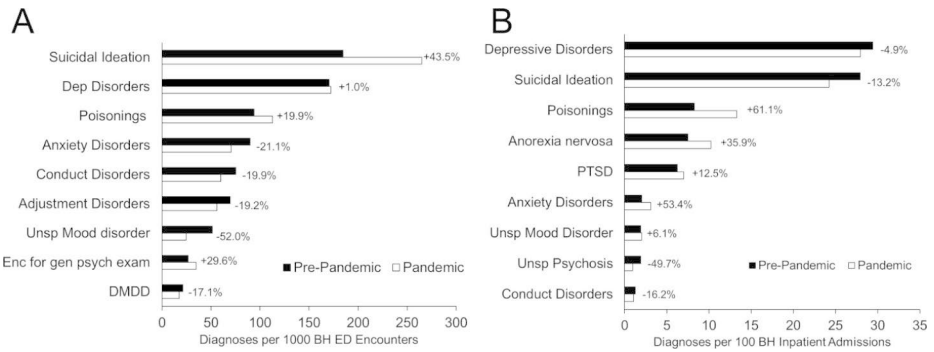


Fig. 3 Changes in Pediatric Behavioral Health Diagnoses for Emergency Department encounters and Inpatient Admissions. Data are represented as the percentage change in (A) diagnosis per 1000 BH ED encounters or (B) diagnosis per 100 BH inpatient admission

children ages ≤ 12 ($p < 0.001$). Weekly BH ED encounters for teenagers were not significantly different between the periods. The 7-week moving average of all pediatric BH ED visits shows a stark decrease in volume in the early stages of the pandemic period, with volumes not returning to near pre-pandemic rates until August 2020 (Fig. 2A, B). Overall all-cause pediatric ED encounters also decreased during the same period. The mean weekly percentage of all pediatric ED encounters that were for BH reasons increased from 2.6 to 4.1% ($p < 0.001$) and peaked at 7.4% in February 2021. Weekly BH ED visits for males decreased in 2020 (16.2) compared to 2019 (23.0; $p < 0.00001$), but they returned to baseline levels in 2021 (21.2). However, weekly BH ED visits by females remained the same in 2020 (26.0) compared to 2019 (27.7) and significantly increased in 2021 (36.8) compared to baseline ($p < 0.0001$). LOS for pediatric BH ED patients increased from 1.59 ± 0.09 days pre-pandemic to 1.91 ± 0.11 days post-pandemic ($p < 0.0001$). The overall top 10 diagnoses coded for pediatric BH ED encounters during the pre-pandemic period are shown in Fig. 3A. Diagnoses whose rates increased during the pandemic included suicidal ideation (+43.5%), encounter for general psychiatric evaluation (+29.1%), poisonings (+19.9%), and depressive disorders (+1.0%).

Inpatient Psychiatry

Weekly pediatric psychiatry inpatient hospitalizations significantly decreased during the pandemic period (Table 3; $p < 0.001$). This significant reduction was seen in both chil-

Table 3 Pediatric Inpatient Admissions for Behavioral Health

	All Admissions	Weekly Mean	Adjusted Admissions	Weekly Mean	Weekly IP Med/Surg Admissions	% BH Admissions to Med/Surg
<i>All Ages</i>						
Pre-Pandemic	945	14.9 ± 0.4**	945	14.9 ± 0.4	2.3 ± 0.5	15.2 ± 2.8*
Pandemic	940	11.1 ± 0.3**	1,257	14.8 ± 0.4	2.7 ± 0.5	24.6 ± 4.1*

* $p < 0.0006$

** $p < 0.0001$

dren ≤ 12 and teenagers (data not shown). However, when adjusted for inpatient psychiatry unit capacity, the difference in weekly psychiatry inpatient hospitalizations was not significant ($p=0.83$). The percentage of psychiatry inpatients who identified as female did increase in 2021 (79.7%) compared to 2019 (70.0%) and 2020 (67.1%). The average length of stay was unchanged between the pre-pandemic and pandemic periods (13.6 ± 0.7 days vs. 14.4 ± 0.8 days; $p=0.14$). While the average weekly admissions for BH reasons to inpatient medical or surgical units was unchanged between time periods, the weekly percentage of inpatient hospitalizations for BH reasons that occurred on medical or surgical inpatient units increased during the pandemic, from $15.2\% \pm 2.8$ to $24.6\% \pm 4.1\%$ (Table 3; $p=0.0006$). The overall top 10 diagnoses coded for pediatric inpatient BH admissions during the pre-pandemic period are shown in Fig. 3B. Diagnoses whose rates increased during the pandemic included poisonings (+61.1%), anxiety disorders (+53.4%), anorexia nervosa (+35.9%), trauma-stressor related disorders (+12.5%), and unspecified mood disorders (+6.1%).

Discussion

In this comprehensive review of utilization of psychiatry services in a large, academic medical system, the COVID-19 pandemic had varying degrees of impact, depending on the setting of care. In the outpatient setting, referrals increased during the pandemic, driven largely by an increase in demand from teenagers. Our outpatient clinicians increased then number of completed appointments in this population, likely in an attempt to meet the increased demand. Interestingly, despite the transition to largely virtual care during the pandemic, outpatient appointment no-shows increased in both young children and teenagers. This is in contrast to other published data that showed a decrease in no-show rates with the transition to virtual care [12–14]. It is unclear why our data differs, and further study is needed to understand the change in no-show rates seen in our population.

Overall emergency department visits for BH in the total pediatric population did not significantly change as a result of the pandemic. However, overall ED visits decreased substantially in the months immediately after announcement of the public health emergency, which may have confounded these results. The percentage of overall pediatric ED visits that were for BH reasons did increase during the pandemic, suggesting that even though the total number of children and adolescents seeking emergency care for BH reasons did not increase, the proportional need for BH care compared to physical health emergencies did increase. Our data suggest the pandemic may have had a greater effect on females over males, as rates of BH ED visits increased in females in 2021 compared to pre-pandemic rates, while there was no such increase seen in males. This fits with previously reported data that suggest higher rates of BH ED presentations in females [7–9]. ED LOS did increase during the pandemic, likely representing a combination of the relative increase in patients presenting for BH reasons with the overall decrease in child and adolescent psychiatry inpatient beds due to infection prevention measures. This decreased inpatient capacity appears to have led to a significant decrease in inpatient child and adolescent psychiatry admissions during the pandemic. Perhaps not surprisingly, the percentage of inpatient admissions for BH reasons that occurred on medical/surgical wards increased during the same time period, which could represent a diversion of BH patients to these wards due to the reduced inpatient psychiatry capacity, an increase in medical comorbidity (such as in patients with anorexia

nervosa), and/or a rise in medically-significant attempts at self-harm. Indeed, the percentage of inpatient BH admissions that were due to poisonings (intentional or unintentional) increased 61% during the pandemic, perhaps suggesting a higher relative amount of serious self-injury attempts. Taken together, data from ED presentations and inpatient admissions suggest that higher rates of children and adolescents were presenting to care for suicidal ideation or after suicide attempts during the pandemic period.

Our data has several limitations. First, given that we have aggregate data, we cannot determine if any of the changes seen in demand for services are due to a change in the number of patients seeking care or a change in frequency of service seeking from a similar number of patients between the periods examined. Patient-level data would help to answer this question. Second, for the outpatient appointment data, we do not have information on any change in provider capacity that could explain the increase in completed appointments during the pandemic. Informal discussions with outpatient leadership seem to support this hypothesis, but we do not have data to support this assertion. Finally, we should recognize that diagnosis data is entirely dependent on provider documentation practice. It is possible that there was a change in providers or how providers documented their ED and inpatient encounters that could explain our results. While this could explain minor changes in diagnoses between the time periods, it seems unlikely that it could explain large changes, such as those seen for certain diagnoses (i.e. poisonings, anorexia nervosa, suicidal ideation, etc.).

Taken together, our data represent a comprehensive assessment of pediatric BH utilization around the time of the onset of the COVID-19 pandemic in a very large academic hospital system. Our data support the idea that there was an increased need for outpatient BH treatment in the first 2 years of the pandemic. However, our data did not demonstrate a massive increase in demand for emergency or inpatient psychiatric services as suggested by others. This appears to be largely due to overall changes in patients seeking all forms of health care during the early stages of the pandemic. It is possible that examination of data that extend beyond the time period we examined could show further changes in the need for higher levels of pediatric BH care. Our results highlight the need for health systems to conduct comprehensive assessments of utilization of BH care in order to make informed decisions about how to approach distribution of limited resources to treat youth with BH needs.

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Declarations

Disclosures The authors have nothing to disclose related to this work.

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