HHS Public Access

Author manuscript

Psychiatr Serv. Author manuscript; available in PMC 2022 November 04.

Published in final edited form as:

Psychiatr Serv. 2022 November 01; 73(11): 1202–1209. doi:10.1176/appi.ps.202100582.

Use of Acute Mental Health Care in U.S. Children's Hospitals Before and After Statewide COVID-19 School Closure Orders

Bonnie T. Zima, M.D., M.P.H.,
Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles (UCLA), Los Angeles

Juliet Beni Edgcomb, M.D., Ph.D.,
Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles (UCLA), Los Angeles

Jonathan Rodean, M.P.P.,
Children's Hospital Association, Lenexa, Kansas

Susan D. Cochran, Ph.D., M.S.,
Fielding School of Public Health, UCLA, Los Angeles

Christopher A. Harle, Ph.D.,
Department of Psychiatry, University of Florida, Gainesville

Jyotishman Pathak, Ph.D.,
Department of Healthcare Policy and Research, Weill Cornell Medicine, New York City

Chi-hong Tseng, Ph.D.,
Division of General Internal Medicine and Health Services Research, UCLA, Los Angeles

Regina Bussing, M.D., M.S.H.S.
Department of Psychiatry, University of Florida, Gainesville

Abstract

Objective: This study aimed to examine changes in child emergency department (ED) discharges and hospitalizations for primary general medical (GM) and primary psychiatric disorders; prevalence of psychiatric disorders among acute care encounters; and change in acute mental health (MH) care encounters by disorder type and, within these categories, by child sociodemographic characteristics before and after statewide COVID-19–related school closure orders.

Methods: This retrospective, cross-sectional cohort study used the Pediatric Health Information System database to assess percent changes in ED discharges and hospitalizations (N=2,658,474 total encounters) among children ages 3–17 years in 44 U.S. children's hospitals in 2020 compared with 2019, by using matched data for 36- and 12-calendar-week intervals.

Send correspondence to Dr. Zima (bzima@mednet.ucla.edu).

Preliminary findings of this study were presented as part of a research symposium at the Virtual Annual Meeting of American Academy of Child and Adolescent Psychiatry (prerecorded September 25, 2021; live session October 28, 2021).

Dr. Pathak is the founder of Iris OB Health. The other authors report no financial relationships with commercial interests.

Results: Decline in MH ED discharges accounted for about half of the decline in ED discharges and hospitalizations for primary GM disorders (−24.8% vs. −49.1%), and MH hospitalizations declined 3.4 times less (−8.0% vs. −26.8%) in 2020. Suicide attempt or self-injury and depressive disorders accounted for >50% of acute MH care encounters before and after the statewide school closures. The increase in both ED discharges and hospitalizations for suicide attempt or self-injury was 5.1 percentage points ($p<0.001$). By fall 2020, MH hospitalizations for suicide attempt or self-injury rose by 41.7%, with a 43.8% and 49.2% rise among adolescents and girls, respectively.

Conclusions: Suicide or self-injury and depressive disorders drove acute MH care encounters in 44 U.S. children's hospitals after COVID-19–related school closures. Research is needed to identify continuing risk indicators (e.g., sociodemographic characteristics, psychiatric disorder types, and social determinants of health) of acute child MH care.

Protecting the mental health (MH) of youths through improved access to high-quality MH care has been a national priority, especially during the COVID-19 pandemic (1, 2). The pandemic has created an unprecedented burden on the child MH care system in the United States by increasing the need for MH care (3-7), escalating existing institutional strain (8-14), and potentially worsening health care disparities (15-22). Risk factors related to the COVID-19 pandemic include social isolation, decreased physical activity, reduced access to school-based resources, child abuse and neglect, parental distress, familial COVID-19–related morbidity and mortality, and worsening social determinants of health (20, 23-38).

After statewide school closures were ordered, pediatric emergency department (ED) visits and hospitalizations sharply declined, but these reductions varied between general medical (GM) and psychiatric disorders (39-45). National public health surveillance data documented that the number of child MH ED visits abruptly decreased by 43%, but the overall proportion of MH ED visits increased (46), and ED visits for suspected suicide attempts among teens rose steadily through winter 2021, especially for girls (42, 43). During summer 2020, hospitalizations of U.S. children for suicide attempt or intentional injury increased by >10% (45).

Nevertheless, little is known about how changes in child MH ED discharges and hospitalizations after statewide school closure orders varied by psychiatric disorder type or race-ethnicity (40-45, 47, 48). Children with developmental disorders may be especially vulnerable to the loss of special education resources (1, 26, 29, 49). In spring 2020, 80% of caregivers of school-age children with autism reported disruptions in special education and MH services (50). In contrast, children with anxiety disorders may be less likely to use acute MH care while learning virtually at home (51). To address these knowledge gaps, we conducted a retrospective cross-sectional study using hospital discharge data from 44 U.S. children's hospitals. Using 2019 as the comparator, our aim was to examine the relative (i.e., percent) changes in child ED discharges and hospitalizations for primary GM and primary psychiatric disorders. We also investigated changes in prevalence of primary psychiatric disorders among acute care encounters as well as the percent changes in acute MH care encounters by type of primary disorder and, within these categories, by child sociodemographic characteristics. Together, these findings identified clinically relevant drivers of the disproportionate rise in child acute MH care encounters co-occurring with the

abrupt shift to remote learning, summer vacation, and the start of the new school year after statewide COVID-19–related school closure orders. This knowledge is critical to inform public health mitigation strategies and to prepare for the potentially enduring effects of the COVID-19 pandemic on children's MH-related morbidity.

METHODS

Study Design and Data Source

This retrospective cross-sectional cohort study compared percent changes in the number of ED discharges and hospitalizations between 2019 (as comparator) and 2020, by using matched data for the 36-week interval corresponding to the spring-fall period (March 16, 2020–November 22, 2020, vs. March 18, 2019–November 24, 2019) and for 12-week seasonal intervals (spring: March 16, 2020–June 7, 2020, vs. March 18, 2019–June 9, 2019; summer: June 8, 2020–August 30, 2020, vs. June 10, 2019–September 1, 2019; fall: August 31, 2020–November 22, 2020, vs. September 2, 2019–November 24, 2019) to reduce potential confounding by seasonal trends (44). With the exception of three hospitals in two states with school closure orders 1 week later, the index start date for the 2020 interval corresponded to the Monday of the week of statewide school closure orders (52). Hospital details (name, inpatient psychiatric unit status, and location) and corresponding start dates for statewide school closures and shelter-in-place or stay-at-home orders are summarized in an online supplement to this article.

Data were drawn from the Pediatric Health Information System database (Children's Hospital Association, Lenexa, KS), which includes hospital discharges from 49 tertiary care children's hospitals. Administrative records included demographic characteristics, billing information, and up to 52 procedures and 41 diagnoses classified by the *ICD-9* or *ICD-10-CM*. Each record represents a single discharge; patients, each with a unique identifier, may contribute more than one record. Consistent with the Uniform Hospital Discharge Data Set rules, diagnosis codes were abstracted directly from the electronic medical records and checked for clinical validity (53). This study was deemed exempt by the institutional review board of University of California, Los Angeles (IRB 21-000303).

Study Population

The study population included all ED discharges and hospitalizations (i.e., inpatient and short-term observation unit stays) for children ages 3–17 years in 44 U.S. children's hospitals with complete discharge data for the 2019 and 2020 spring–fall intervals. Discharges from the ED or hospital included transfers to other hospitals, including freestanding inpatient psychiatric facilities (only 1.3% of ED discharges and 1.1% of hospitalizations). Slightly more than half of the hospitals (N=24, 55%) had an inpatient psychiatric unit. Among all encounters (N=2,658,474), 39.3% (N=1,044,548) involved children who were White, 26.6% (N=707,862) Hispanic, 23.7% (N=629,670) Black, and 10.4% (N=276,394) from another racial-ethnic group.

Study Variables

The dependent variables were percent changes in any acute care; ED discharges; and hospitalizations for all causes, primary GM disorder, and primary psychiatric disorder. The independent variables were child sociodemographic characteristics (age, sex, and race-ethnicity), payer type, and clinical characteristics. Medical complexity was categorized as 0, 1, or ≥2 (with higher numbers indicating greater complexity), by using version 2 of Feudtner's complex chronic conditions (CCCs) classification system (54), consistent with previous studies (41, 55). A CCC was defined as a medical condition lasting at least 1 year and affecting several different organ systems or one organ system severely enough to require specialty pediatric care (e.g., malignancies) (56). Psychiatric disorder groups were categorized with the Child and Adolescent Mental Health Disorders Classification System (CAMHD-CS), yielding 23 psychiatric diagnostic groups and suicide or self-injury (57). Acute care encounters without a CAMHD-CS diagnosis in the primary diagnostic field were categorized as being for a primary GM disorder. Children were identified as being likely to be eligible for special education resources if their primary disorder was attention-deficit hyperactivity disorder, disruptive behavior, impulse control and conduct disorders, specific learning disorders, autism spectrum disorder, communication disorders, developmental delay or unspecified neurodevelopmental disorder, or intellectual disability consistent with eligibility criteria specified in the Individuals With Disabilities Education Act (58). Anxiety-related disorders included anxiety disorders, trauma-related disorders, obsessive-compulsive disorders, and dissociative disorders.

Statistical Analyses

To calculate percent changes between 2019 (comparator) and 2020, the number of clinical encounters in a given 2019 interval was subtracted from the number of encounters during the corresponding 2020 interval and then divided by the number of encounters in the 2019 interval. Statistical significance of differences in percent changes were evaluated with Wilcoxon rank sum or Kruskal-Wallis tests applied to hospital-level data. We estimated differences in proportions and their 95% confidence intervals (CIs) for each disorder group. We considered $p<0.05$ to be statistically significant. All analyses were performed with SAS, version 9.4.

RESULTS

Of all children (N=1,876,715) with discharge data, 1,277,560 had an acute care encounter in the 2019 study period, and 754,871 had an acute care encounter in the matching 2020 period. Of the children with an encounter in 2019, 78.4% (N=1,001,650) had one encounter, 15.4% (N=196,445) two encounters, and 6.2% (N=79,465) three or more. Of children with an encounter in 2020, 82.8% (N=624,852) had one encounter, 12.8% (N=96,418) two encounters, and 4.5% (N=33,601) three or more.

Percentage Changes in Child Acute Care Encounters by Primary Disorder Type

Before the statewide COVID-19–related school closure orders, 1,704,932 ED discharges and hospitalizations for all causes occurred during the spring–fall period in 2019. Among these, 95.8% (N=1,632,806) were for a primary GM disorder, and 4.2% (N=72,126) were

for a primary psychiatric disorder. After the statewide school closure orders, 953,542 acute care encounters occurred for all causes, of which 93.9% (N=894,915) were for a primary GM disorder, and 6.1% (N=58,627) were for a primary psychiatric disorder. The absolute numbers of and percent changes for all-cause primary GM and primary MH acute care encounters before and after the school closures, with matched 36-week (spring–fall) and 12-week (seasonal) periods, are summarized in the online supplement.

All percent changes in acute care encounters varied by whether the primary disorder was GM or psychiatric (all $p<0.001$). Compared with spring–fall 2019, all-cause acute care encounters declined by 44.1% (from 1,704,932 to 953,542) during the spring–fall 2020 period, with an almost twofold greater reduction in ED discharges than in hospitalizations (−48.3% vs. −25.2%, respectively). Compared with percent changes in primary GM care, the percent decrease in any acute MH care was 2.4 times less (−45.2% vs. −18.7%), reduction in MH ED discharges was almost two times less (−49.1% vs. −24.8%), and decline in MH hospitalizations was 3.4 times less (−26.8% vs. −8.0%). After the abrupt statewide school closures in spring 2020, acute care encounters substantially declined for GM (−59.2%) and psychiatric (−44.2%) disorders. In summer and fall 2020, declines in ED discharges and hospitalizations for primary GM disorders persisted but were less prominent (summer: ED=−36.7%, hospitalizations=−17.5%; fall: ED=−45.7%, hospitalizations=−19.3%). In contrast, MH ED discharges minimally (<3%) declined in summer 2020 and declined by only 13.3% in fall 2020, while MH hospitalizations increased by 4.8% and 4.4% in summer and fall 2020, respectively. Figure 1 depicts weekly percent changes in acute care encounters by type of primary disorder from January 1 to December 15, 2020, relative to 2019.

For MH ED discharges and hospitalizations, percent declines did not significantly vary by race-ethnicity or CCC count but did differ by age group, sex, and insurance status (see the online supplement). The decline in MH ED discharges among youths ages 12–17 years (−17.9%) was roughly half that of younger children (ages 3–5 years, −35.3%, and 6–11 years, −41.4%), and the reduction among girls was 2.2 times less than that for boys (−15.8% vs. −34.8%). The decline in MH ED discharges ranged from −27.1% for publicly insured children to −21.8% among those commercially insured. For MH hospitalizations, the decline among youths ages 12–17 was minimal (−3.5%) and two to eight times smaller than the decline among younger children (ages 3–5, −7.5%, and 6–11, −27.5%). There was also little change in MH hospitalizations for girls (−0.5%) compared with boys (−20.2%), White (−5.9%) compared with Black (−12.1%) and Hispanic (−10.0%) children, and commercially insured children (−4.2%) compared with those with public insurance (−11.1%) and self-pay (−8.6%). In contrast, primary GM acute care encounters were driven by CCC counts, such that the percent decline among children with two or more CCCs was 2.1 times less than the percent decline among children with no CCCs (−22.3% vs. −47.3%). Details of percent changes in primary MH acute care encounters for the spring–fall and seasonal periods by sociodemographic characteristics, payer type, CCC count, and acute MH care in the past 6 months are summarized in the online supplement.

Most Prevalent Child Psychiatric Disorders

The five most prevalent psychiatric disorders for acute MH care encounters after the statewide school closures in 2020 were identical to those in the same period in 2019, with only slight differences in ranking (see the online supplement). After the statewide school closures, 54.9% (N=31,726) of all acute MH care encounters (N=57,788) were for suicide attempt or self-injury (28.7%, N=16,604) and depressive disorders (26.2%, N=15,122), compared with 50.4% (N=36,027) in 2019 (total N=71,460) (suicide or self-injury: 23.8%, N= 17,029; depressive disorders: 26.6%, N=18,998). Following the statewide school closures, percentages for both MH ED discharges and hospitalizations for suicide or self-injury significantly rose by 5.1 percentage points (ED: 30.2% [N=10,399] vs. 25.1% [N=11,530], 5.1 percentage points, 95% CI=4.4–5.7, p<0.001; hospitalization: 26.6% [N=6,205] vs. 21.5% [N=5,499], 5.1 percentage points, 95% CI=4.3–5.8, p<0.001). In contrast, the percentage of these encounters for depressive disorders slightly decreased (ED: 20.2% [N=6,944] vs. 20.8% [N=9,546], −0.6 percentage points, 95% CI=−1.2 to −0.1, p=0.027; hospitalization: 35.0% [N=8,178] vs. 37.0% [N=9,452], −2.0 percentage points, 95% CI=−2.8 to −1.1, p<0.001). For ED discharges, the changes in the percentages of the remaining three most prevalent disorders were small (anxiety: 12.7% [N=4,377] vs. 12.0% [N=5,488], 0.7 percentage points, 95% CI=0.3–1.2, p=0.001); disruptive behavior (7.6% [N=2,629] vs. 10.6% [N=4,861], −3.0 percentage points, 95% CI=−3.4 to −2.6, p<0.001); and presentation for an MH symptom (6.6% [N=2,270] vs. 7.2% [N=3,310], −0.6 percentage points, 95% CI=−1.0 to −0.3, p=0.001). Likewise, for MH hospitalizations, the percentages for the other prevalent psychiatric disorders showed little changes (disruptive behavior: 6.4% [N=1,496] vs. 7.5% [N=1,921], −1.1 percentage points, 95% CI=−1.6 to −0.7, p<0.001; trauma-related disorders: 5.6% [N=1,303] vs. 5.8% [N=1,491], −0.3 percentage points, 95% CI=−0.7 to 0.2, p=0.230; and feeding and eating disorders: 6.7% [N=1,555] vs. 5.4% [N=1,388], 1.3 percentage points, 95% CI=−0.8 to 1.7, p<0.001).

Percent Change in Child Acute MH Care Encounters by Disorder Type

Percent changes in MH ED discharges and hospitalizations during the spring–fall period in 2020 versus 2019 differed by type of disorder (Figure 2). Declines in ED discharges in 2020 were <10% for suicide attempt or self-injury (−9.8%) and psychotic disorders (−6.1%), whereas increases in hospitalizations were >10% for both suicide or self-injury (12.8%) and psychotic disorders (10.8%). Feeding and eating disorders was the only diagnostic group for which both ED discharges (18.6%) and hospitalizations (12.0%) increased in 2020. Declines in MH ED discharges and hospitalizations for anxiety and trauma-related disorders in 2020 were 23.2% and 17.4%, respectively. For disorders likely eligible for special education, the 2020 decline in MH ED discharges was 42.2% and in hospitalizations 22.2%.

In addition, seasonal trends in MH ED discharges and hospitalizations by type of disorder were observed. In spring 2020, ED discharges (suicide or self-injury: −44.7%; depressive disorders: −57.9%; anxiety and trauma-related disorders: −46.6%; and likely eligible for special education: −56.3%) substantially declined, followed by substantial increases in summer 2020 for suicide or self-injury (22.6%) and depressive disorders (9.7%) but continued relative declines for anxiety and trauma-related disorders (−13.3%) and disorders likely eligible for special education (−31.6%) (Figure 3). We also noted declines in

MH hospitalizations in spring 2020 (suicide or self-injury: −19.8%; depressive disorders: −38.6%; anxiety and trauma-related disorders: −23.3%; and likely eligible for special education: −34.2%), followed by a substantial rise in hospitalizations for suicide or self-injury in summer (20.0%) and fall (41.7%) (Figure 4). Details of percent changes in primary MH acute care, ED discharges, and hospitalizations, by disorder, after the statewide COVID-19–related school closures in 2020 compared with matched spring–fall and seasonal periods in 2019 are summarized in the online supplement.

Seasonal differences in percent changes in MH ED discharges and hospitalizations for suicide or self-injury in 2020 relative to 2019 were prominent for adolescents and girls (Figure 5). Among adolescents, ED discharges declined by 38.0% in the spring, followed by a 26.6% increase in the summer and an 11.5% rise in the fall. Hospitalizations declined by 16.4% in the spring, followed by a 22.1% rise in the summer and a 43.8% increase in the fall. Among girls, ED discharges decreased 40.7% in the spring, followed by a 30.9% increase in the summer and a 22.0% rise in the fall. Hospitalizations also declined 18.4% in the spring but rose 27.1% in the summer and 49.2% in the fall (Figure 5). Details of percent change in acute MH encounters during the spring–fall 2020 period versus 2019 and seasonal intervals, by disorder and child sociodemographic characteristics, are summarized in the online supplement.

DISCUSSION

Informed by data from a large sample of U.S. children's hospitals, these findings validate the notion that the declines related to COVID-19–related statewide school closure orders in acute MH care encounters among children and adolescents during the spring–fall 2020 period were disproportionately smaller than those for care encounters due to GM disorders (39, 41-46, 59, 60). They also suggest that seasonal trends by type of acute MH care encounter differed, as evidenced by small percent changes in all MH ED discharges in summer 2020 and a rise in all MH hospitalizations through fall 2020. This seasonal pattern is inconsistent with pre–COVID-19, 10-year trends in U.S. children's hospital MH admissions (44), raising the question whether the rise in summer 2020 was related to increased clinical need that overcame hospital avoidance. The rise in child MH hospitalizations exceeded 10% for suicide or self-injury, feeding and eating disorders, and psychotic disorders, suggesting that concerns related to imminent safety, severe weight loss, or worsening of psychotic symptoms selectively drove MH hospitalizations after COVID-19–related statewide school closure orders. Contrary to our expectations, acute care encounters for primary psychiatric disorders did not disproportionately rise for the disorders most likely to be eligible for special education resources, and declines in acute care use for anxiety and trauma-related disorders were relatively moderate after the school closure orders. Furthermore, the declines in MH ED and hospital discharges did not significantly vary by race-ethnicity. These findings should be interpreted cautiously because the time interval was restricted to the first 36 weeks after the statewide school closure orders and did not capture the extent of disparities that likely emerged over time (15, 16).

In addition, we observed little change in the relative prevalence of psychiatric disorders among acute care encounters before and after the statewide school closure orders, with

suicide attempt or self-injury and depressive disorders accounting for roughly half of MH ED discharges and 60% of MH hospitalizations, findings consistent with results of previous studies (52, 61-64). Acute care encounters for suicide or self-injury significantly increased by about 5 percentage points after the school closures, whereas those for depression were relatively stable. Although direct comparisons with previously published data were not feasible because of methodological differences, our findings were relatively consistent with those of studies that used the same data source. During summer 2020, Gill et al. (45) found that the median interquartile range of weekly U.S. hospital admissions of children for suicide or intentional injury increased by 11.8% and that the percent decline in hospital admissions for depressive disorders was roughly half that of spring 2020. Using a different diagnostic classification system, DeLaroche et al. (41) reported that ED visits for suicidal ideation or suicide attempt declined by 4% during the 6 months after statewide school closure orders, while ED visits for depressive disorders decreased by almost 40%.

Adolescent girls were particularly vulnerable after the statewide school closures, as evidenced by a disproportionate rise in acute MH encounters for suicide or self-injury in summer and fall 2020. Hospitalizations for suicide or self-injury in fall 2020 increased by >40% for children ages 12–17 years and by almost 50% for girls, consistent with trends identified in public health surveillance data (42, 46). Possible explanations for this increase include elevated prevalence of suicide or self-injury among teen girls (65, 66) and imminent safety risk and higher likelihood of meeting criteria for an involuntary psychiatric hold (67). They may also include a higher risk for depression and anxiety during COVID-19–related confinement (68-70) and greater detection of MH problems by teachers and school counselors among children reengaging with schools (71).

This study had several limitations. Its findings were based on children's hospital discharge data. Therefore, inpatient stays on medical units may not have been captured if they were less likely to document a primary psychiatric diagnosis (e.g., substance ingestion or metabolic abnormalities related to anorexia nervosa). The percent changes in acute MH care encounters cannot be solely attributed to school closures because although the index start date for the 2020 interval aligned with statewide orders to close schools, the period examined also included variations in school reopenings, types of classroom instruction, special education resources, and other unmeasurable risk factors (e.g., structural racism, civil unrest, or social isolation) (15, 16). Furthermore, child-, parent-, and community-level variables were not available to assess clinical need, hospital avoidance, or worsening of social determinants of health related to COVID-19 (e.g., parental unemployment or loss of health insurance). Future research is needed that examines trends in acute MH encounters over a longer period and links to indicators of individual-level MH service need, family-household social determinants of health, and population-level COVID-19 pandemic severity and recovery.

CONCLUSIONS

After the issuance of statewide COVID-19–related school closure orders, acute MH encounters in 44 U.S. children's hospitals were driven by suicide attempt or self-injury and depressive disorders. The percent changes ranged widely by type of psychiatric

disorder. Adolescent girls were particularly vulnerable, indicated by a substantial rise in ED discharges and hospitalizations for suicide or self-injury among girls in summer and fall 2020. For the transition to pandemic recovery, future research is needed to identify continuing risk indicators (e.g., sociodemographic characteristics, psychiatric disorder types, or exposures to social determinants of health) of acute child MH care.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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HIGHLIGHTS

- Compared with primary general medical care, the percent decrease in any acute mental health (MH) care was 2.4 times less, reduction in MH emergency department discharges was almost two times less, and decline in MH hospitalizations was 3.4 times less after statewide COVID-19–related school closures in 2020, relative to the same period in 2019.
- In 2020, hospitalizations significantly increased for suicide attempt or self-injury (12.8%), feeding and eating disorders (12.0%), and psychotic disorders (10.8%).
- In the fall of 2020 after statewide COVID-19–related school closures, hospitalizations for suicide attempt or self-injury rose 41.7%, with a 43.8% and 49.2% increase among adolescents and girls, respectively.

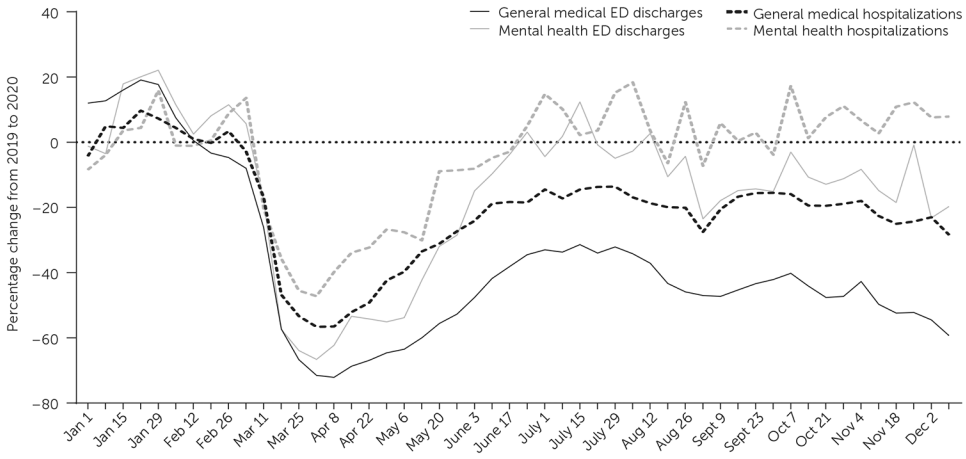

FIGURE 1.

Percentage change in emergency department (ED) discharges and hospitalizations in children's hospitals by primary diagnosis type, 2019–2020

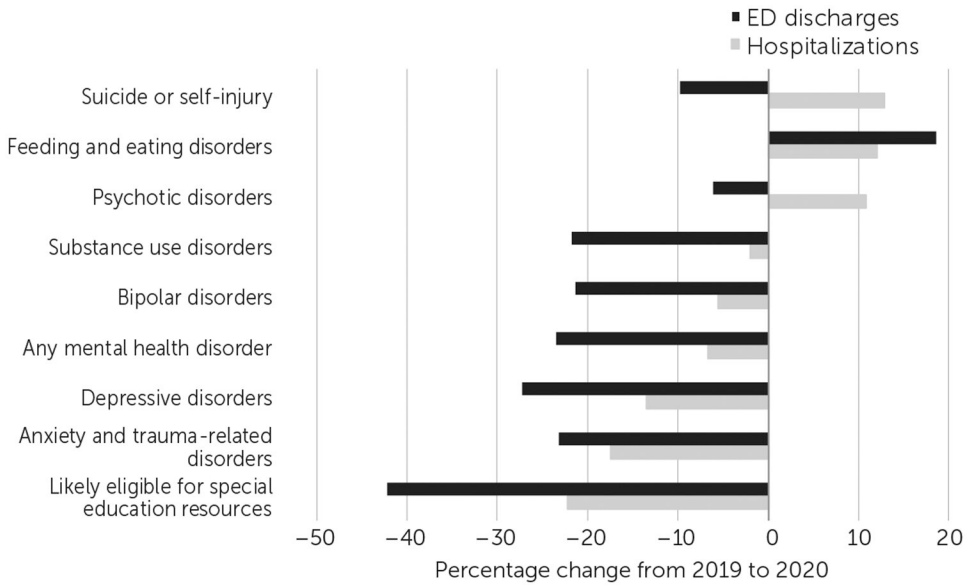

FIGURE 2. Percentage change in emergency department (ED) discharges and hospitalizations by psychiatric disorder group, 2019–2020[a]

[a]Data were matched for 36-week intervals corresponding to the spring–fall period: March 16, 2020–November 22, 2020, vs. March 18, 2019–November 24, 2019.

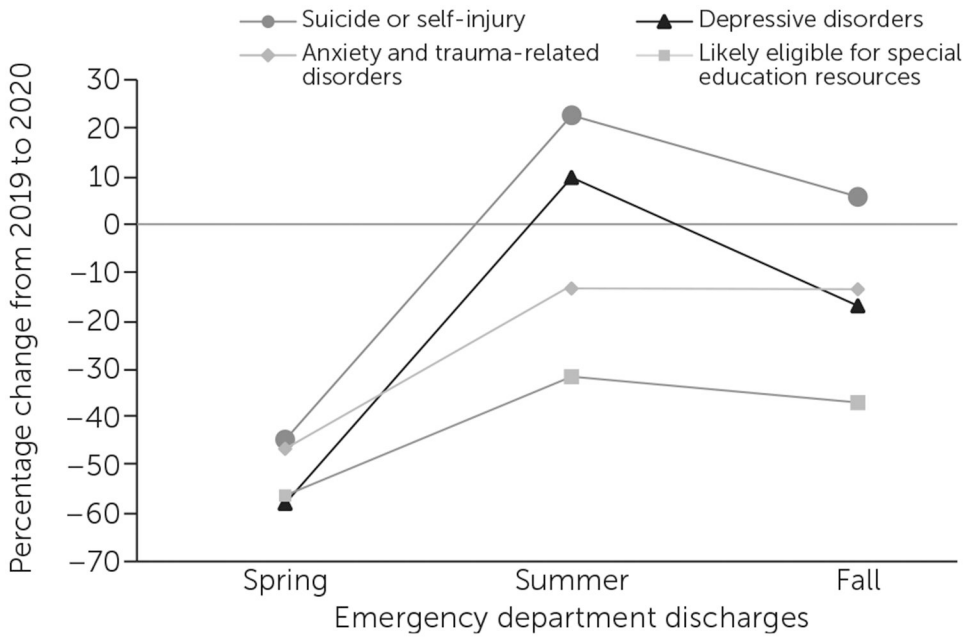

FIGURE 3. Percentage change in emergency department discharges for psychiatric disorders, 2019–2020[a]

[a]Data were matched for 12-week seasonal intervals; spring: March 16, 2020–June 7, 2020, vs. March 18, 2019–June 9, 2019; summer: June 8, 2020–August 30, 2020, vs. June 10, 2019–September 1, 2019; fall: August 31, 2020–November 22, 2020, vs. September 2, 2019–November 24, 2019.

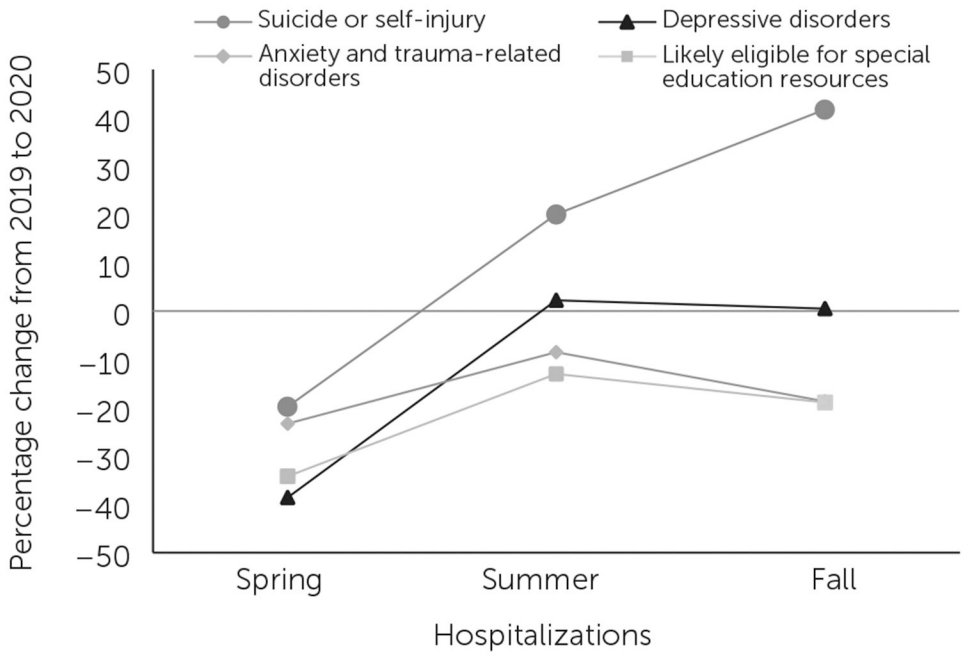

FIGURE 4. Percentage change in hospitalizations for psychiatric disorders, 2019–2020[a]

[a]Data were matched for 12-week seasonal intervals; spring: March 16, 2020–June 7, 2020, vs. March 18, 2019–June 9, 2019; summer: June 8, 2020–August 30, 2020, vs. June 10, 2019–September 1, 2019; fall: August 31, 2020–November 22, 2020, vs. September 2, 2019–November 24, 2019.

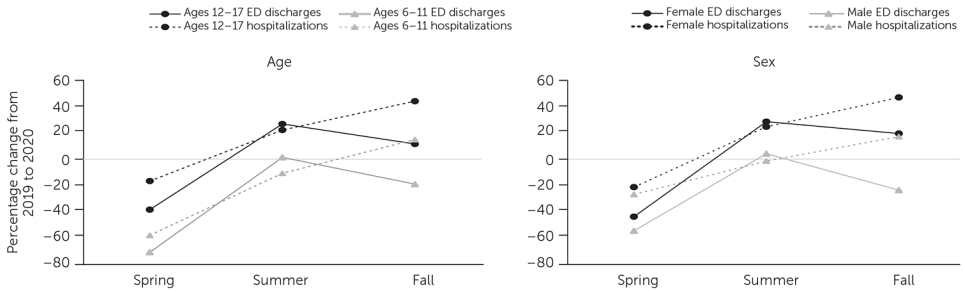

FIGURE 5. Percentage change in emergency department discharges and hospitalizations for suicide or self-injury by age and sex, 2019–2020[a]

[a]Data were matched for 12-week seasonal intervals; spring: March 16, 2020–June 7, 2020, vs. March 18, 2019–June 9, 2019; summer: June 8, 2020–August 30, 2020, vs. June 10, 2019–September 1, 2019; fall: August 31, 2020–November 22, 2020, vs. September 2, 2019–November 24, 2019.