

# COVID-19 and Pediatric Mental Health Hospitalizations

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abstract

**OBJECTIVES:** To analyze Australian national data to examine the impact of the coronavirus disease 2019 (COVID-19) pandemic on mental health-related hospital presentations among children and adolescents during the pandemic period with restrictions, and the period after the restrictions eased.

**METHODS:** We analyzed the monthly mental health-related inpatient admissions and emergency department (ED) attendances data from 6 large pediatric hospitals across Australia, using the Bayesian structural time series models. The COVID-19 restriction period was from March 2020 to December 2021 and the COVID-19 restriction-eased period from January to June 2022.

**RESULTS:** A total of 130 801 mental health-related hospital admissions (54 907) and ED attendances (75 894) were analyzed. During the COVID-19 restriction period, there was a significant increase in inpatient admissions related to deliberate self-harm behaviors (82%, 95% credible interval [CrI], 7%–160%) and ED attendances related to overall mental health disorders (15%, 95% CrI, 1.1%–30%) and eating disorders (76%, 95% CrI, 36%–115%). The increase was higher among females and those living in the least socioeconomically disadvantaged areas, suggesting a widening gap between mental health-related presentations by sex and socioeconomic status. After the restrictions eased, there were slight declines in mental health-related hospital presentations; however, the numbers remained higher than the pre-COVID-19 levels.

**CONCLUSIONS:** The increase in mental health-related hospital presentations during the COVID-19 period calls for additional support for pediatric mental health care, particularly for eating disorders and deliberate self-harm among female adolescents. It is important to monitor pediatric mental health service use as we enter “COVID-19 normal” period.



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**WHAT'S KNOWN ON THIS SUBJECT:** Previous research has shown an increase in grouped pediatric mental health presentations in the first year of the coronavirus disease 2019 pandemic. There is limited research assessing different pediatric mental health conditions over 2 years after the pandemic outbreak.

**WHAT THIS STUDY ADDS:** We found a significant increase in pediatric hospital presentations for eating disorders and deliberate self-harm, with widening gender and socioeconomic disparities, 2 years from pandemic onset.

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The coronavirus disease 2019 (COVID-19) pandemic has already taken >6.5 million lives, with >61 3 million confirmed cases globally.<sup>1</sup> Although it has been over 2 years since the first case of COVID-19 was detected, the pandemic has continued to challenge health care systems worldwide, including Australia.<sup>2,3</sup> In particular, the social and economic sequelae of COVID-19 have compounded the impact on mental health and well-being, leaving a significant proportion of the young population vulnerable to psychological distress and financial difficulty.<sup>4</sup> Children have been particularly affected by these wider health implications of the COVID-19 pandemic.<sup>5–8</sup> Children are reported to have suffered from the consequences of social isolation and home confinement,<sup>5</sup> school closure,<sup>6</sup> abrupt familial financial stress, and potentially increased numbers of domestic violence and abuse incidents.<sup>7,8</sup>

Our previous work based on a single site showed an up to 60% increase in hospital admissions and emergency department (ED) attendances related to mental health disorders during the first year of the pandemic in New South Wales (NSW), Australia.<sup>9</sup> Research has also shown a twofold increased growth rate in deliberate self-harm (DSH) and suicidal ideation among 10- to 17-year-olds across NSW (from 8.4% to 19.2%) during the pandemic.<sup>10</sup> Evidence across countries has shown heightened levels of mental health symptoms among children and adolescents during the pandemic for various conditions including depression, anxiety, posttraumatic stress disorder, eating disorders, and attention-deficit/hyperactivity disorder.<sup>11–15</sup>

There have, however, been few studies to show the impact of the COVID-19 pandemic on mental health-related hospital admissions and ED attendances among children

and adolescents in the 2 years since the pandemic first started.

Butterworth et al found no worsening mental health of adolescents aged 15 to 19 years in Victoria, where there was a prolonged period of lockdown, compared with the rest of Australia in 2020.<sup>16</sup> There is limited evidence showing how the impact on pediatric mental health-related hospital service use has changed as the restrictions started to ease over time.

In this study, we analyzed a national data set of electronic medical records routinely collected from the 6 largest pediatric hospitals across the 5 most populous states in Australia. Our primary aim was to examine mental health-related hospital presentations during the pandemic period when the restrictions were in place. Our secondary aim was to explore mental health-related hospital presentations after the easing of public health restrictions.

## METHODS

### Design and Data

We analyzed monthly aggregated data on mental health-related hospital inpatient admissions and ED attendances among children and adolescents aged 0 to 18 years. Aggregated data were provided by Children's Healthcare Australasia, a nonprofit organization that provides benchmarking, networking, and quality improvement services to children's hospitals and pediatric units across Australia and New Zealand.<sup>17</sup> The data were extracted from 6 large pediatric hospitals across 5 states in Australia (Supplemental Information). Inpatient admission records were available from July 2017 to June 2022, and ED attendances available from July 2014 to June 2022.

Ethics approval of this study was granted by the University of NSW

Human Research Ethics Committee (HC210894).

### Mental Health-Related Hospital Presentations

We identified hospital inpatient admissions related to 8 types of mental health conditions on the basis of the principal and up to 50 secondary diagnoses coded using the International Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification. The principal diagnosis is the primary reason for an admission, and secondary diagnosis may affect the admission and treatment. ED attendances related to mental health conditions were identified on the basis of the diagnosis at discharge coded in Systemized Nomenclature of Medicine–Clinical Terms, Australian Version, and International Classification of Diseases and Related Health Problems, 10th Revision, Australian Modification (Supplemental Table 4).

### Stratification Variables

We analyzed the data stratified by patient age group (0–4, 5–8, 9–11, 12–14, and 15–18 years), sex (male or female), residential area (ie, postcode-level) socioeconomic status (SES) quartiles defined by the Index of Relative Socioeconomic Disadvantage developed by the Australian Bureau of Statistics.<sup>9</sup>

### COVID-19 Versus Pre-COVID-19 Period

Because the COVID-19-related restrictions were enforced across Australia in March 2020, we defined the pre-COVID-19 period as being from July 2017 to February 2020 for inpatient admissions and July 2014 to February 2020 for ED attendances, because of the different availability of records in the 2 data sets. We defined the COVID-19 period as being from March 2020 to June 2022. Since the easing of restrictions (eg, border reopen) began in mid-December 2021

in Australia, we divided the COVID-19 period into 2 phases: the COVID-19 restriction period (March 2020–December 2021) and the COVID-19 restriction-eased period (January–June 2022).

### Statistical Analysis

Descriptive analyses were undertaken to illustrate the distribution of variables. Significance of the difference in monthly averages of hospital presentations among the pre-COVID-19, COVID-19 restriction, and COVID-19 restriction-eased periods was determined using the Kruskal-Wallis rank-sum or the Wilcoxon rank-sum test at the 5% significance level.

We used the Bayesian structural time series (BSTS) models to estimate the forecasted numbers of hospital presentations during the COVID-19 period, because they provided a more improved model fit than the Autoregressive Integrated Moving Average model. Two sets of models were developed for each mental health condition. First, we estimated the forecasted numbers of hospital presentations for the COVID-19 restriction period (ie, March 2020–December 2021) on the basis of the models trained using pre-COVID-19 data (ie, up to February 2020). These forecasted numbers represented the levels of mental health-related hospital presentations during the COVID-19 restriction period, had the pandemic not occurred. Second, we estimated the forecasted numbers of hospital presentations for the COVID-19 restriction-eased period (ie, January–June 2022) on the basis of the models trained using the data from both the pre-COVID-19 and the COVID-19 restriction periods (ie, up to December 2021). These forecasted numbers represented the levels of mental health-related hospital presentations, had the trend observed during the COVID-19 restriction

period persisted as the restrictions eased. The BSTS models produced the “relative effect” calculated on the basis of the difference between the forecasted and the observed numbers of hospital presentations, as a measure of the impact of the pandemic during the COVID-19 restriction and the restriction-eased periods, respectively. The forecasts and 95% credible intervals (CrIs) were generated using the Markov Chain Monte Carlo approach with 40 000 iterations and a burn-in period of 4000 iterations. We stratified all the analyses by sociodemographic characteristics and employed all the analyses using R version 4.1.2.

## RESULTS

### Overall Descriptive Results

Among children and adolescents aged 0 to 18 years, a total of 130 801 mental health-related hospital

presentations were recorded in the 6 pediatric hospitals (54 907 hospital inpatient admissions and 75 894 ED attendances) (Table 1). Children aged 12 to 18 years accounted for 62.4% of pediatric mental health-related inpatient admissions and 76.4% of ED attendances. More females than males had hospital presentations (admissions 57.9% vs 42.0%; ED attendances 63.6% vs 35.4%). Children and adolescents from the least disadvantaged areas accounted for one-third of hospital presentations, whereas those from the most disadvantaged areas accounted for one-fifth.

There were, on average, 1088.4 and 1035.2 mental health admissions per month during the COVID-19 restriction and the restriction-eased period, respectively, which was significantly higher ( $P < .05$ ) than 773.5 admissions per month in the pre-COVID-19 period (Table 2).

**TABLE 1** Patient Sociodemographic Factors for All Mental Health-Related Inpatient Admissions or ED Attendances in 6 Australian Pediatric Hospitals

Total	Hospital Inpatient Admissions, N, %	ED Attendances, N, %
All mental health conditions	54 907, 100	75 894, 100
Age group, y		
0–4	7759, 14.1	1737, 2.3
5–8	6736, 12.3	3370, 4.4
9–11	6106, 11.1	7112, 9.4
12–14	14 787, 26.9	26 447, 34.8
15–18	19 478, 35.5	31 537, 41.6
Unknown	41, 0.1	5691, 7.5
Sex		
Male	23 086, 42.0	26 832, 35.4
Female	31 775, 57.9	48 240, 63.6
Others	20, 0.4	53, 0.1
Unknown	26, 0.05	759, 1.0
Residential area SES quartiles		
Q1 (most disadvantaged)	10 829, 19.7	14 841, 19.6
Q2 (second most disadvantaged)	11 260, 20.5	15 073, 19.9
Q3 (second least disadvantaged)	14 062, 25.6	19 563, 25.8
Q4 (least disadvantaged)	18 361, 33.4	25 907, 34.1
Unknown	395, 0.7	510, 0.7
Hospital		
Sydney Children's Hospital, Randwick	5828, 10.6	3978, 5.2
Children's Hospital at Westmead	10 059, 18.3	9350, 12.3
Perth Children's Hospital	8563, 15.6	12 162, 16.0
Royal Children's Hospital, Melbourne	9973, 18.2	13 616, 17.9
Women's and Children's Hospital, Adelaide	7434, 13.5	20 760, 27.4
Queensland Children's Hospital	13 050, 23.8	16 028, 21.1

Q1, first quartile; Q2, second quartile; Q3, third quartile; Q4, fourth quartile.

Regarding all mental health-related ED attendances, there were, on average, 1075.2 and 939.0 attendances by month during the COVID-19 restriction and the restriction-eased period, respectively, which was significantly higher ( $P < .05$ ) than 685.4 ED attendances per month in the pre-COVID-19 period. There was significant increase in the monthly averages of hospital presentations during the COVID-19 period than the pre-COVID-19 period for almost all different mental health conditions (Table 2).

During the COVID-19 period (including both restriction and restriction-eased periods), the monthly average of mental health-related hospital presentations increased across all groups by age, sex, and residential SES quartiles. The increase was higher among children aged 15 to 18 years and 12 to 14 years, females, and those who lived in the least disadvantaged areas (Supplemental Tables 5–7).

### Mental Health-Related Hospital Presentations During the COVID-19 Restriction Period

The BSTS model-based results show an overall 8.9% (95% CrI, –13% to 31%) clinically important, though not statistically significant, increase

in the number of mental health-related hospital inpatient admissions during the COVID-19 restriction period compared with those forecasted (ie, the numbers of hospital inpatient admissions that would have been, had the COVID-19 pandemic not occurred) (Table 3, Figs 1A and C). Among different mental health conditions, a statistically significant increase was found for inpatient admissions related to DSH behaviors (82%, 95% CrI, 7% to 160%) during the COVID-19 restriction period (Table 3, Supplemental Figs 3–14), with a significant increase among females (117%, 95% CrI, 27% to 210%) and children from the least disadvantaged areas (100%, 95% CrI, 13% to 195%) (Supplemental Table 8). There was also a 622% increase for same-day admissions for eating disorders during the COVID-19 restriction period (95% CrI, 448% to 767%) (Table 3).

For ED attendances, there was a 15% statistically significant increase in the number of all mental health-related ED attendances than forecasted during the COVID-19 restriction period (15%, 95% CrI, 1.1%–30%) (Table 3, Figs 2A and C). For specific conditions, there was a 76% statistically significant

increase in ED attendances related to eating disorders (76%, 95% CrI, 36%–115%) (Table 3, Supplemental Figs 15–22), with a significant increase for females (88%, 95% CrI, 46%–132%) and children from the least disadvantaged areas (96%, 95% CrI, 25%–169%) (Supplemental Table 8).

During the COVID-19 restriction period, we also found an increasing difference in the monthly averages of mental health-related hospital presentations between females and males, compared with pre-COVID-19 period (2.64-fold and 2.35-fold increased difference for all mental health-related admissions and ED attendances, respectively). This difference was generally more noticeable for eating disorders, mental health symptoms, DSH, and substance use disorders (Supplemental Table 6). There was also a widening gap in the monthly averages of mental health-related hospital presentations between patients from the least versus the most disadvantaged areas during the COVID-19 restriction period (2.56-fold and 2.13-fold increased gap for all mental health-related admissions and ED attendances, respectively). Likewise, this widening gap was generally more noticeable for eating disorders, DSH,

**TABLE 2** Monthly Averages of Mental Health-Related Hospital Inpatient Admissions and ED Attendances During Pre-COVID-19 and COVID-19 Restriction and Restriction-Eased Periods

Total	Hospital Inpatient Admissions			ED Attendances		
	Pre-COVID-19	COVID-19 Restriction	COVID-19 Restriction-Eased	Pre-COVID-19	COVID-19 Restriction	COVID-19 Restriction-Eased
All mental health conditions	773.5*	1088.4*	1035.2*	685.4*	1075.2*	939.0*
Substance use-related disorders	69.3*	86.0*	67.0*	42.9*	53.2*	40.2*
Depressive disorders	81.1*	115.3*	84.5*	31.9	34.3	27.0
Anxiety, obsessive-compulsive disorders	207.7*	342.4*	343.5*	52.6*	83.2*	76.5*
Reaction and adjustment disorders	63.5*	70.4*	91.2*	84.0*	136.6*	65.2*
Eating disorders	69.3*	180.7*	182.8*	26.5*	76.9*	73.8*
Attention-deficit, disruptive, impulse-control disorders	53.5*	89.3*	81.7*	91.0*	75.4*	47.0*
Deliberate self-harm	145.5*	215.7*	205.7*	129.3*	302.4*	335.8*
Mental health symptoms	153.3*	188.8*	177.5*	141.8*	323.4*	382.8*

Pre-COVID-19 period was from July 2017 to February 2020 for inpatient admissions data and from July 2014 to February 2020 for ED attendances data; COVID-19 restriction period was from March 2020 to December 2021; and COVID-19 restriction-eased period was from January to June 2022.

\* The difference among the monthly averages of mental health-related hospital presentations during the pre-COVID-19, COVID-19 restriction, and COVID-19 restriction-eased periods was statistically significant at the level of  $P < .05$ , on the basis of the Kruskal-Wallis rank-sum test.

**TABLE 3** Estimated Effects of the COVID-19 Pandemic on Mental Health-Related Hospital Admissions and ED Attendances, During the COVID-19 Restriction and Restriction-Eased Periods

Types	COVID-19 Restriction Relative Effect (95% CrI)	COVID-19 Restriction-Eased Relative Effect (95% CrI)
<b>Inpatient admissions</b>		
All mental health conditions	8.9% (−13% to 31%)	−5.6% (−27% to 17%)
Substance use-related disorders	5% (−44% to 51%)	−7.3% (−39% to 29%)
Depressive disorders	26% (−14% to 66%)	−18% (−45% to 9.4%)
Anxiety and obsessive-compulsive disorders	9.9% (−14% to 34%)	−6% (−30% to 20%)
Reaction and adjustment disorders	−22% (−76% to 32%)	20% (−18% to 58%)
Eating disorders	58% (−0.27% to 111%)	−11% (−42% to 21%)
Eating disorders, overnight admissions	23% (−31% to 72%)	−6.8% (−37% to 24%)
Eating disorders, same-day admissions	622% (448% to 767%)*	−16% (−67% to 37%)
Attention-deficit, disruptive, impulse-control disorders	6.2% (−35% to 45%)	3.6% (−29% to 41%)
Deliberate self-harm	47% (−19% to 115%)	−0.35% (−30% to 34%)
Deliberate self-harm, behavior	82% (7% to 160%)*	10% (−21% to 45%)
Deliberate self-harm, ideation	22% (−57% to 98%)	−17% (−51% to 18%)
Mental health symptoms	20% (−43% to 87%)	−9.5% (−37% to 19%)
<b>ED attendances</b>		
All mental health conditions	15% (1.1% to 30%)*	−16% (−33% to 1.5%)
Substance use-related disorders	−15% (−70% to 40)	−14% (−54% to 30%)
Depressive disorders	29% (−97% to 153%)	−37% (−82% to 4.9%)
Anxiety and obsessive-compulsive disorders	8.6% (−37% to 52%)	−9.6% (−35% to 19%)
Reaction and adjustment disorders	21% (−29% to 72%)	−28% (−77% to 23%)
Eating disorders	76% (36% to 115%)*	−21% (−44% to 1.4%)
Attention-deficit, disruptive, impulse-control disorders	−14% (−86% to 56%)	−29% (−79% to 22%)
Deliberate self-harm	31% (−11% to 71%)	−6% (−29% to 18%)
Mental health symptoms	30% (−1.2% to 61)	−7.8% (−29% to 14%)

\* Refers to statistical significance at the level of  $P < .05$ .

and mental health symptoms (Supplemental Table 7).

### Mental Health-Related Hospital Presentations During the COVID-19 Restriction-Eased Period

The BSTS model showed a 5.6% (95% CrI, −27% to 17% for inpatient admissions) and a 16% (95% CrI, −33% to 1.5%, for ED attendances) nonstatistically significant decrease in the numbers of mental health-related hospital presentations during the COVID-19 restriction-eased period than forecasted on the basis of the data from the pre-COVID-19 and the COVID-19 restriction periods (Table 3, Figs 1 and 2 [B and D]). There was a significant decrease in eating disorders-related ED attendances among females (−22%, 95% CrI, −44% to −0.86%) and those from less disadvantaged areas (−26%, 95% CrI, −52% to −3.1%) (Supplemental Table 8). However, there was a nonstatistically significant increase for DSH behaviors-

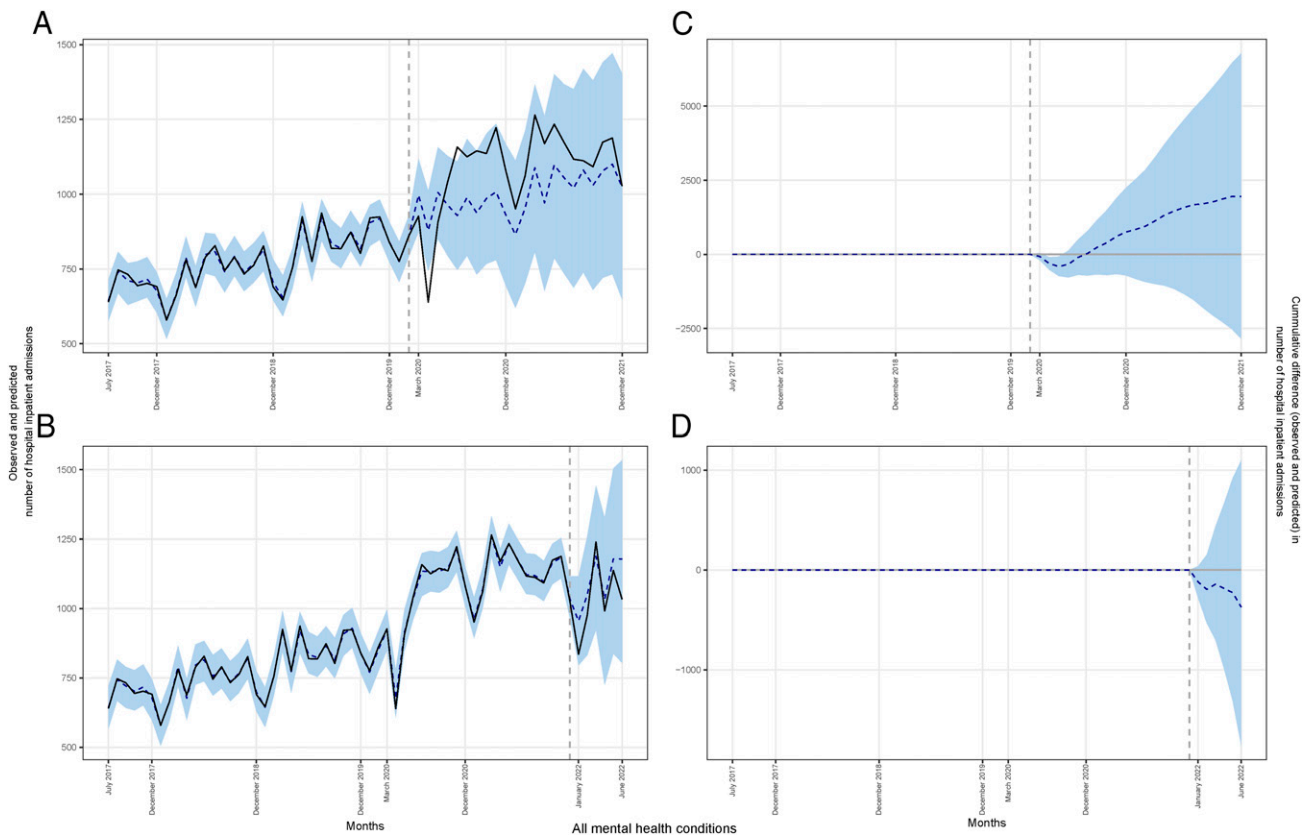
related admissions during the COVID-19 restriction-eased period (Table 3, Supplemental Figs 3–22).

### DISCUSSION

This study analyzed the impact of the COVID-19 pandemic on mental health-related hospital presentations in children and adolescents, utilizing data from 6 large pediatric hospitals across Australia. To our knowledge, this is the first study to investigate the impact of the COVID-19 pandemic on pediatric hospital service use for a range of mental health conditions over 2 years after the pandemic outbreak, and how the impact has changed as the restrictions have been eased. In this study, we only found statistically significant increases for pediatric hospital inpatient admissions related to DSH behaviors and ED attendances related to eating disorders over the 1.5-year-long COVID-19 period with restrictions. The increase was predominantly observed among adolescent girls aged

12 to 18 years and children and adolescents living in the least disadvantaged areas. Since the restrictions eased drastically (eg, border reopen), pediatric mental health-related hospital presentations started to decline.

Our study shows a significantly 15% and a nearly 9% increase in all mental health-related ED attendances and inpatient admissions during the COVID-19 restriction period. These results have important clinical implications, given the continual historical increase before the pandemic. These findings highlight the rapidly increased pressure additionally imposed upon pediatric hospital mental health services during the COVID-19 pandemic period. These results are corroborated by studies conducted in Sydney and Melbourne in Australia during the first wave of the pandemic.<sup>9,18</sup> The COVID-19 pandemic was found to have negatively impacted the mental health of 1 in every 3 Australian children



**FIGURE 1**

Monthly observed (solid line) and forecasted (dashed line) numbers of all mental health-related hospital admissions during the pre-COVID-19 and the COVID-19 periods in Australia (panels A and B); cumulative differences between forecasted and observed numbers of admissions in the COVID-19 period (panels C and D). Note the first row displays the forecasts in the COVID-19 restriction period on the basis of data in the pre-COVID-19 period (panels A and C), and the second row displays the forecasts in the COVID-19 restriction-eased period on the basis of data in the pre-COVID-19 and the restriction periods (panels B and D).

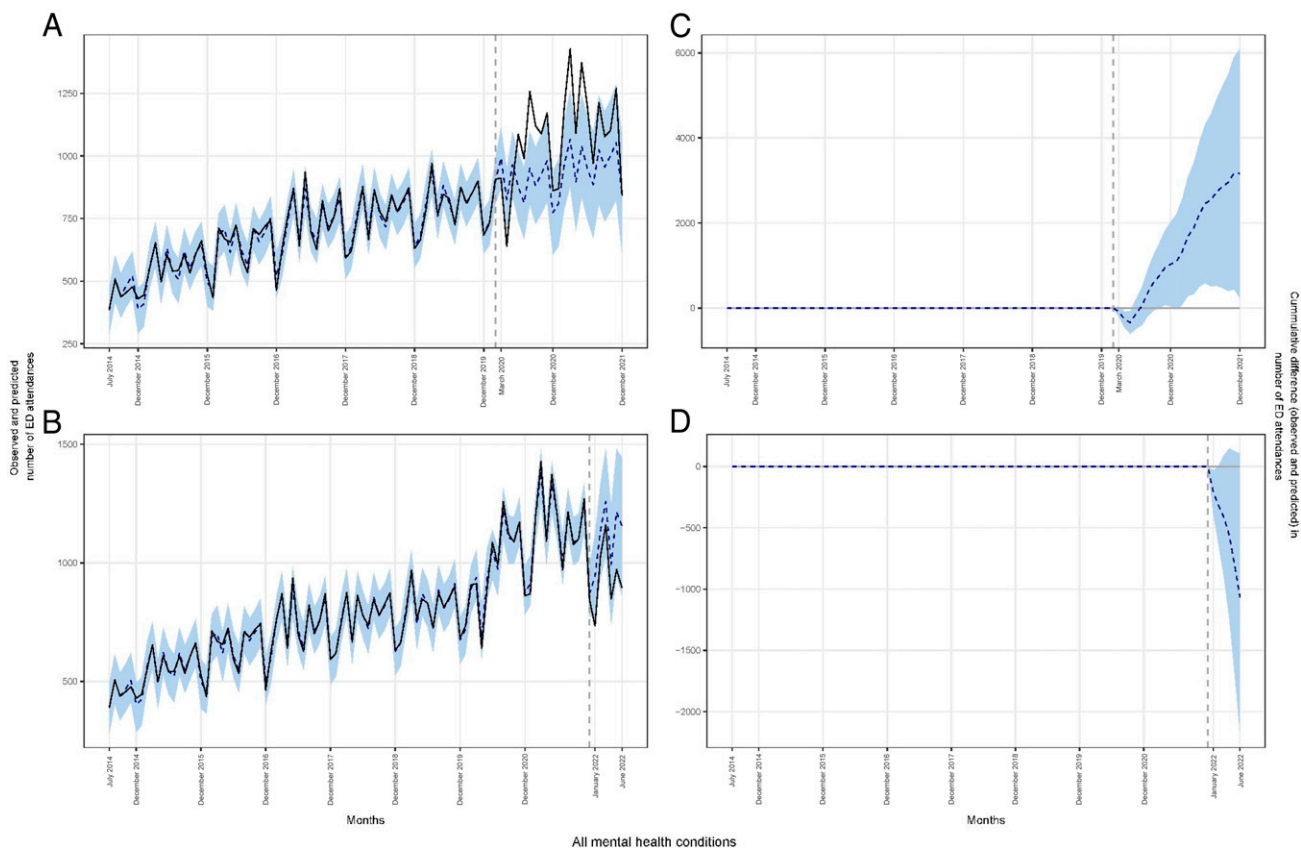
aged <18 years.<sup>19</sup> Many factors linked to the COVID-19 pandemic and restrictions have the potential to affect mental health, including psychological distress, social isolation, family and economic distress, loneliness, and disruptions to education and life routines.<sup>20</sup> In the meantime, the capacity of out-of-hospital (eg, community-based services) mental health services would have been significantly reduced during the pandemic and this, coupled with technological barriers to access telehealth, may have changed people's health-seeking behaviors, resulting in increased utilization of EDs for mental health concerns.<sup>21</sup>

We found ED attendances for eating disorders had one of the highest increases over the COVID-19

restriction period among girls and those from the least socioeconomically disadvantaged areas. The last 3 decades have seen an increasing prevalence of children affected by eating disorders.<sup>22</sup> Our finding suggested that eating disorder symptoms may be triggered by the rapid changes to the living environment associated with the COVID-19 pandemic response,<sup>15,23</sup> giving rise to increased needs for preventative public health measures around body image and health services for eating disorders, especially for female adolescents.<sup>15</sup>

Our findings show a significantly 82% increase in admissions related to DSH behaviors among adolescents during the COVID-19 restriction period, and this increasing trend persisted when

the restrictions were eased. To date, findings on the trends of DSH-related health service use have varied by country and period. A study undertaken in England showed a 40% decrease in DSH referrals to liaison psychiatry in the first 6 weeks after the COVID-19 lockdown, but thereafter, referrals surged.<sup>24</sup> A cohort study analyzing the data on ED attendances and hospitalizations found that the risk of DSH or drug overdose decreased among adolescents and young adults aged 14 to 24 years in Canada during the 15-month pandemic period.<sup>25</sup> The differences between our results and these previous findings may reflect the country-specific nature of COVID-19-related public health measures,<sup>16</sup> study period, and differences in the access to and availability of mental health services.



**FIGURE 2**

Monthly observed (solid line) and forecasted (dashed line) numbers of all mental health-related ED attendances during the pre-COVID-19 and the COVID-19 periods in Australia (panels A and B); cumulative differences between forecasted and observed numbers of ED attendances in the COVID-19 period (panels C and D). Note the first row displays the forecasts in the COVID-19 restriction period on the basis of data in the pre-COVID-19 period (panels A and C), and the second row displays the forecasts in the COVID-19 restriction-eased period on the basis of data in the pre-COVID-19 and the restriction periods (panels B and D).

Our findings demonstrate an increase in the disparity by gender and area-level SES in hospital presentations, in particular, those related to eating disorders, DSH, and mental health symptoms. These findings suggest that female adolescents and those from socioeconomically advantaged areas particularly contributed to the increase in mental health-related hospital service use during the pandemic. Although this finding is consistent with previous studies from Australia and other countries,<sup>9, 10,12,26</sup> there are reports of increase among both girls and boys, as well as from high and low SES areas.<sup>9</sup> Although it is unclear what factors explain this, we can hypothesize that this relative increase in hospital use

by those from more affluent backgrounds may reflect a specific increase in need by this population or may be the result of most private services being closed during the lockdown, necessitating them to seek public hospital services. It is also possible that the stigma and differential attitudes attached to mental health for boys and children from lower socioeconomic groups may mean that these populations are not accessing appropriate help.

Our results show decreased mental health-related hospital presentations as the restrictions were eased. Serrano-Alarcón et al also found that relaxing the lockdown improved mental health of the adult population in the community

settings of England and Scotland.<sup>27</sup> However, it is important to notice that the numbers of these presentations in the COVID-19 restriction-eased period remained significantly higher than those in the pre-COVID-19 period. These results call for monitoring of mental health-related health service use both within and outside hospital settings in the long term.

The major strength of the current study is the utilization of mental health services data from the 6 largest pediatric hospitals across Australia. The large sample size allowed us to evaluate the mental health service utilization rates for several different mental health diagnoses/conditions in different

demographic populations in response to the pandemic. The current study, however, only reported on trends in hospital service use and could not outline the causes of these increases. We did not have patient level data for confidentiality reasons; as such, we were not able to conduct more nuanced analysis. In addition, it is unclear whether and how children presenting to hospitals, especially those with less acute needs for medical attention, would use mental health services outside the hospitals, such as general practice and private mental health services, if the COVID-19 mitigation measures were not enforced. Last, although we analyzed data from the 6 largest pediatric hospitals in Australia, we did not have data from all hospitals. Thus, we could not explore the differential

impacts of different restriction measures implemented in different states on mental health-related hospital presentations.

## CONCLUSIONS

The current study shows that, during the COVID-19 pandemic period with restrictions, there was significant increase in pediatric hospital presentations related to eating disorders and DSH behaviors, with the highest increase among female adolescents and those living in the less disadvantaged areas. Additional support should be provided to these populations. There was a slight decrease in mental health-related hospital presentations as the restrictions started to ease, but the numbers remained at high levels. Thus, future

research needs to monitor the longer-term mental health service utilization as we enter a “COVID-19 normal phase,” and assess if government investment has been able to shift the increasing mental health tide for young people away from hospital services.

## ABBREVIATIONS

BSTS: Bayesian structural time series  
COVID-19: coronavirus disease 2019  
CrI: credible interval  
DSH: deliberate self-harm  
ED: emergency department  
NSW: New South Wales  
SES: socioeconomic status

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coordinated and supervised the study, and critically reviewed the manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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