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# Self-Harm in Children and Adolescents Who Presented at Emergency Units During the COVID-19 Pandemic: An International Retrospective Cohort Study

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Dr. Bakolis and Prof. Ougrin are joint senior authors for this work.

**Objective:** To compare psychiatric emergencies and self-harm at emergency departments (EDs) 1 year into the pandemic, to early pandemic and pre-pandemic, and to examine the changes in the characteristics of self-harm presentations.

**Method:** This retrospective cohort study expanded on the Pandemic-Related Emergency Psychiatric Presentations (PREP-kids) study. Routine record data in March to April of 2019, 2020, and 2021 from 62 EDs in 25 countries were included. ED presentations made by children and adolescents for any mental health reasons were analyzed.

**Results:** Altogether, 8,174 psychiatric presentations were recorded (63.5% female; mean [SD] age, 14.3 [2.6] years), 3,742 of which were self-harm presentations. Rate of psychiatric ED presentations in March to April 2021 was twice as high as in March to April 2020 (incidence rate ratio [IRR], 1.93; 95% CI, 1.60-2.33), and 50% higher than in March to April 2019 (IRR, 1.51; 95% CI, 1.25-1.81). Rate of self-harm presentations doubled between March to April 2020 and March to April 2021 (IRR, 1.98; 95% CI, 1.68-2.34), and was overall 1.7 times higher than in March to April 2019 (IRR, 1.70; 95% CI, 1.44-2.00). Comparing self-harm characteristics in March to April 2021 with March to April 2019, self-harm contributed to a higher proportion of all psychiatric presentations (odds ratio [OR], 1.30; 95% CI, 1.05-1.62), whereas female representation in self-harm presentations doubled (OR, 1.98; 95% CI, 1.45-2.72) and follow-up appointments were offered 4 times as often (OR, 4.46; 95% CI, 2.32-8.58).

**Conclusion:** Increased pediatric ED visits for both self-harm and psychiatric reasons were observed, suggesting potential deterioration in child mental health. Self-harm in girls possibly increased and needs to be prioritized. Clinical services should continue using follow-up appointments to support discharge from EDs.

**Diversity & Inclusion Statement:** One or more of the authors of this paper self-identifies as a member of one or more historically underrepresented racial and/or ethnic groups in science. We actively worked to promote inclusion of historically underrepresented racial and/or ethnic groups in science in our author group. While citing references scientifically relevant for this work, we also actively worked to promote inclusion of historically underrepresented racial and/or ethnic groups in science in our reference list. The author list of this paper includes contributors from the location and/or community where the research was conducted who participated in the data collection, design, analysis, and/or interpretation of the work.

**Key words:** self-injurious behavior; emergency psychiatric services; COVID-19 pandemic; youth mental health; epidemiology

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**S**elf-harm, including any self-directed harmful behavior irrespective of suicidal intent,<sup>1</sup> is a leading cause of death for youths globally.<sup>2</sup> Besides its growing prevalence and associated mortality,<sup>3</sup> the COVID-19 pandemic likely imposed further stressors such as school closure, social isolation, familial stress, and child abuse.<sup>4</sup> Despite recent advances in the understanding of self-harm treatment,<sup>5</sup> pathophysiology,<sup>6</sup> and service development,<sup>7</sup> children and adolescents remain severely underrepresented in self-harm research regarding the pandemic impacts.<sup>8</sup> The Pandemic-Related Emergency Psychiatric Presentations (PREP-kids) study found reductions in psychiatric and self-harm presentations to emergency departments (EDs) globally in the first 2 months of the pandemic, compared with corresponding months in 2019.<sup>9</sup> Help seeking was likely hindered by increased lockdown stringency.<sup>10</sup> Despite subsequent waves of COVID-19 infection and changing policies, little high-quality quantitative research has provided updates on the longer-term impacts of self-harm presentations. A Manchester-based time-series analysis found increased self-harm incidence in adolescents in August 2020 through May 2021 compared with 2019, raising concerns of increased clinical need regarding self-harm.<sup>11</sup> The proportion of psychiatric visits and suspected suicide attempts by adolescents also increased in EDs in the United States after early reductions.<sup>12</sup> However, the inclusion of non-suicidal self-harm was unclear and subject to varying routine coding practices. Reduced hazard ratios of self-harm or overdose ED presentations in adolescents and young adults were observed in Canada during the entire pandemic period until June 2021,<sup>13</sup> although fluctuations throughout might have altered results. Overall, there is a dearth of research from low- and middle-income countries (LMICs), which experienced the pandemic very differently. There were longer stringent lockdowns, poorer access to vaccines, and more profound socioeconomic consequences.<sup>14</sup> Mental health care in many LMICs relied on inpatient treatment, disruptions to which likely led to a greater treatment gap in the community.<sup>15,16</sup>

To understand the changes in psychiatric emergencies and self-harm in children and adolescents during the pandemic, we extended the first PREP-kids study,<sup>9</sup> including additional EDs and a surveillance period 1 year later. This study compared presentations a year into the pandemic with the corresponding early pandemic and pre-pandemic months. Our primary hypotheses were that both psychiatric and self-harm ED presentations have increased in 2021 compared with both periods due to elevated risks.

## METHOD

### Study Design and Population

This is a retrospective cohort study using data from electronic or paper-based ED records. Individual-level clinical outcomes were collected for all eligible presentations as follows: (1) to participating EDs; (2) between March 1 and April 30 of 2019, 2020, or 2021; (3) by children and adolescents less than 18 years of age; or (4) for any mental health reasons. The PREP-kids studies were approved by the King's College London/South London and Maudsley NHS Foundation Trust Service Evaluation and Clinical Audit Committee. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline for cohort studies was followed.

### Setting and Data Sources

This study updated and expanded on the first PREP-kids study,<sup>9</sup> which compared the early pandemic (March-April 2020) with corresponding pre-pandemic period (March-April 2019). The current study included an additional corresponding surveillance period a year later (March-April 2021). The 2021 surveillance period aligns roughly with the third wave of pandemic worldwide in terms of lockdown severity and COVID-19 incidence (Supplement 1; Figure S1, available online).

Additional EDs worldwide with eligible data joined through professional connections. Data collection was

conducted by the respective local principal investigators from June 2021 to January 2022. Previous PREP-kids data were included in the current analyses. In total, 62 EDs in 25 countries provided data on ED presentations in March to April of 2019, 2020, and/or 2021 (Supplement 2; Table S1, available online). Routine clinical records capture details of each presentation (eg, presenting difficulties, demographics, dates of arrival at EDs, clinical management, and clinical diagnoses according to the *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10)*).<sup>17</sup> Coders were blinded to the hypotheses.

Participating countries represented socioeconomically diverse populations and health care systems, including developing lower-middle income (India, Indonesia, Iran, Nigeria, Sri Lanka), developing upper-middle income (China, Mexico, Russia, Serbia, Turkey), developing high-income (Chile, Oman, United Arab Emirates), developed upper-middle income (Romania), and developed high income countries (Austria, Germany, Hungary, Ireland, Italy, Japan, Lithuania, Slovenia, Switzerland, United Kingdom, United States).<sup>18</sup>

## Outcomes

The total number of psychiatric ED presentations and the number of self-harm presentations each year were the primary outcomes. Self-harm was defined as “any act of self-poisoning or self-injury, irrespective of the motivation,”<sup>19</sup> thus including non-suicidal self-injury, suicide attempts, and any self-injurious behavior or self-poisoning with unclear or mixed intent.

For self-harm presentations, relevant characteristics were selected based on their risk relevance established in previous studies.<sup>9,20,21</sup> The following were recorded: whether the self-harm act was associated with suicidal intent, methods of self-harm (self-poisoning, self-injury with skin damage, firearm, hanging, drowning, jumping from heights, other methods), whether self-harm was shared on social media, and whether illicit drug use and/or alcohol consumption were associated with self-harm.

In addition, sociodemographic variables were recorded: age, sex (male, female, other), ethnicity relative to the local population (dominant, minoritized, other), placement in foster care (yes, no), education/employment status (mainstream, special school, apprenticeship, working, not attending any). For clinical characteristics, we collected data on primary and secondary psychiatric diagnoses (emotional disorders, behavioral disorders, psychotic disorders, eating disorders, neurodevelopmental disorders, substance misuse disorders, somatoform disorders, personality disorders, other disorders, no diagnosis), current psychiatric medication (antidepressant,

antipsychotic, antiepileptic/mood stabilizer, sedative, stimulant, melatonin, other, no medication), whether suicidal thinking was present in the current presentation, and whether there was previous contact with mental health services. Clinical management for each presentation included whether the following took place: admission to acute medical wards, admission to intensive treatment units, admission to psychiatric inpatient wards, assessed/treated/detained involuntarily under local mental health laws, follow-up appointment offered, follow-up appointment attended.

## Bias and Sample Size

This study used a convenience sample from routine clinical records. Therefore, the number of recorded eligible emergency presentations determined the sample size. A Web-based survey was designed on Qualtrics to provide a standardized framework for data extraction and data processing, which are 2 key sources of bias in clinical record research.<sup>22</sup> Sampling bias might be introduced at site level, as institutional ED participation was subject to professional connections and research interests of local principal investigators. Availability of routine data varied across sites, as they are designed to facilitate local clinical care instead of having a research agenda. To minimize potential information bias, variables were designated *a priori*. All researchers participated in data collection training to ensure accurate understanding of all variables. Missing data were checked to evaluate whether the missingness was independent of the outcomes.

## Statistical Methods

Descriptive statistics were reported for sociodemographic characteristics for presentations by year. EDs with fewer than 30 recorded presentations were grouped into culturally and geographically homogeneous areas. A total of 40 areas were clustered to provide sufficient samples for statistical analyses.

Data analyses were conducted using Stata/MP 17 (StataCorp). Our main analysis included areas that contributed data for all 3 periods (March–April of 2019, 2020, and 2021) with complete cases. We compared counts of psychiatric emergency presentations and self-harm presentations per area and among the 3 surveillance periods. Negative binomial models were fitted with counts of presentations from each area each March to April period as the outcome variable. Year and site were entered as independent variables. Incidence rate ratios (IRR) and corresponding 95% CIs were reported.

Two-step individual participant data (IPD) meta-analyses were conducted to calculate changes in the

proportion of self-harm presentations among all psychiatric presentations across the 3 periods, as well as the characteristics of self-harm presentations. First, logistic regression models were fitted for each area for each year's comparisons, with respective binary outcomes as dependent variables and year as exploratory variable. The *cluster* option in Stata was used to account for repeated observations by the same individuals, and odds ratios (ORs) and corresponding 95% CIs were reported. In the second step, overall pooled estimates and corresponding 95% CIs were estimated across areas with the use of random-effects meta-analysis and heterogeneity was summarized using the  $I^2$  statistic. The significance thresholds were reported following post hoc adjustment for multiple comparisons using the Simes procedure, as well as at  $\alpha = .05$  and  $\alpha = .01$ .

For sensitivity analyses, we repeated our analyses with all available data.

## RESULTS

### Demographic Characteristics

A total of 8,174 psychiatric ED presentations, including 3,742 self-harm presentations, in children and adolescents were recorded from 62 sites in 25 countries.

Sociodemographic characteristics of the whole sample are summarized in Table 1. The mean age at the time of presentation was 14.3 years. The majority of recorded presentations were made by female individuals (63.5%), children in mainstream education (78.7%), and individuals in the local dominant ethnic group (77.2%). Children in foster care constituted 12.3% of the sample. A total of 18 areas had available data for all 3 years ( $n = 3,865$ ). Presentations in these areas had similar characteristics to those of the entire sample.

Self-harm indicator was missing for 70 presentations (0.86%). Missingness analyses revealed a potential association with ethnicity (Supplement 3, available online). There

**TABLE 1** Summary of Sociodemographic Characteristics of Youths With Emergency Department Presentations

Characteristic	Percentage (n)			Total
	2019	2020	2021	
Entire sample (N = 8,174)				
Age, y, mean (SD)	14.5 (2.3)	14.4 (2.7)	14.2 (2.6)	14.3 (2.6)
Sex				
Male	33.7 (1,414)	39.2 (2,623)	33.2 (4,098)	35.2 (8,135)
Female	64.4 (1,414)	59.9 (2,623)	65.6 (4,098)	63.5 (8,135)
Other/not known	1.8 (1,414)	1.0 (2,623)	1.2 (4,098)	1.3 (8,135)
Education/employment status				
Mainstream	78.6 (979)	74.9 (2,298)	81.0 (3,716)	78.7 (6,993)
Special school	8.1 (979)	6.8 (2,298)	6.0 (3,716)	6.6 (6,993)
Not attending	10.3 (979)	11.3 (2,298)	7.4 (3,716)	9.1 (6,993)
Apprenticeship	1.7 (979)	6.1 (2,298)	5.3 (3,716)	5.0 (6,993)
Work	1.3 (979)	0.9 (2,298)	0.4 (3,716)	0.7 (6,993)
Dominant ethnic group	72.9 (1,100)	78.3 (2,242)	78.0 (3,331)	77.2 (6,673)
Foster care	13.0 (1,013)	15.0 (2,473)	10.5 (4,044)	12.3 (7,530)
Sites with available data for all 3 years (n = 3,865)				
Age, y, mean (SD)	14.6 (2.3)	14.8 (2.2)	14.6 (2.2)	14.6 (2.2)
Sex				
Male	33.2 (1,216)	31.4 (900)	26.0 (1,711)	29.6 (3,827)
Female	64.9 (1,216)	67.1 (900)	72.6 (1,711)	68.9 (3,827)
Other/not known	1.9 (1,216)	1.4 (900)	1.4 (1,711)	1.6 (3,827)
Education/employment status				
Mainstream	77.4 (808)	77.1 (713)	83.3 (1,711)	80.3 (3,086)
Special school	8.2 (808)	6.3 (713)	5.7 (1,711)	6.5 (3,086)
Not attending	11.4 (808)	11.9 (713)	8.0 (1,711)	9.8 (3,086)
Apprenticeship	2.1 (808)	3.2 (713)	2.6 (1,711)	2.6 (3,086)
Work	1.0 (808)	1.4 (713)	0.5 (1,711)	0.8 (3,086)
Dominant ethnic group	72.1 (925)	73.6 (651)	71.1 (1,177)	72.0 (2,753)
Foster care	14.9 (821)	19.2 (765)	13.4 (1,679)	15.1 (3,265)

**TABLE 2** Incidence Rate Ratios (IRRs) and 95% CIs for Psychiatric and Self-Harm Presentations at Emergency Departments (EDs)

Year comparison	Psychiatric presentations		Self-harm presentations	
	IRR	95% CI	IRR	95% CI
Sites with data for all 3 years				
2020/2019	0.78**	0.64-0.95	0.86	0.72-1.02
2021/2020	1.93**	1.60-2.33	1.98**	1.68-2.34
2021/2019	1.51**	1.25-1.81	1.70**	1.44-2.00
All available data (sensitivity analysis)				
2020/2019	0.80**	0.69-0.93	0.88	0.76-1.02
2021/2020	1.75**	1.57-1.96	1.81**	1.61-2.03
2021/2019	1.41**	1.21-1.64	1.59**	1.37-1.84

Note: \*\*p < .01.

was no evidence that the missingness of self-harm indicator was related to any other demographic variables.

#### Had Psychiatric Presentations to EDs Increased During the Pandemic?

We observed a rebound in rate of psychiatric ED presentations following an initial reduction (Table 2). The rate was reduced by 22% comparing early pandemic (March-April 2020) with pre-pandemic (March-April 2019; IRR, 0.78; 95% CI, 0.64-0.95). A year later, the rate in March-April 2021 was found to have doubled (IRR, 1.93; 95% CI, 1.60-2.33) and was overall 50% higher than pre-pandemic (IRR, 1.51; 95% CI, 1.25-1.81). Sensitivity analyses conducted with all available data suggested robustness of findings, estimating a 41% increase in rate comparing March to April 2021 with March to April 2019 (IRR, 1.41; 95% CI, 1.21-1.64), with an increase after the pandemic (IRR, 1.75; 95% CI, 1.57-1.96) after initial reduction (IRR, 0.80; 95% CI, 0.69-0.93).

#### Had Self-Harm Presentations at EDs Increased During the Pandemic?

There was no evidence for initial change in self-harm presentations at EDs between March to April 2020 and March to April 2019 (IRR, 0.86; 95% CI, 0.72-1.02). However, we observed a 2-fold increased rate (IRR, 1.98; 95% CI, 1.68-2.34) in March to April 2021 compared with March to April 2020 and a 1.7-fold increased rate compared with the March to April 2019 (IRR, 1.70; 95% CI, 1.44-2.00). Sensitivity analyses agreed there was no significant initial change in March to April 2020 compared with March to April 2019 (IRR, 0.88; 95% CI, 0.76-1.02), followed by an increase in rate in the first year of pandemic (IRR, 1.81;

95% CI, 1.61-2.03). The overall rate in March to April 2021 was higher than that pre-pandemic (IRR, 1.59; 95% CI, 1.37-1.84).

Proportion of self-harm presentations among all recorded psychiatric presentations at EDs was higher in March to April 2020 compared with March to April 2019 (OR, 1.36; 95% CI, 1.12-1.69). In March to April 2021, the proportion did not differ significantly compared with that in March to April 2020 (OR, 1.03; 95% CI, 0.83-1.28) and remained higher compared with that pre-pandemic (OR, 1.30; 95% CI, 1.05-1.62). Post hoc stratified analyses did not reveal any significant interaction by geographical region, country income level, or stringency index (Supplement 4, available online).

#### How Did the Characteristics of Self-Harm Presentations at EDs Change?

Table 3 summarizes the results of IPD meta-analyses on the subsample of self-harm presentations (n = 3,742). Further details and forest plots are presented in Supplements 5 through 7 (available online).

There were increased odds by 63% in female children and adolescents presenting at EDs for self-harm in March to April 2021 compared with March to April 2020 (OR, 1.62; 95% CI, 1.18-2.23), and almost 2-fold increase in odds compared with pre-pandemic (OR, 1.98; 95% CI, 1.45-2.72). Conversely, male children were about half as likely to present in 2021 compared with 2019 (OR, 0.55; 95% CI, 0.40-0.76). Low estimated  $I^2$  percentages suggested highly consistent effects across areas.

We observed no significant change in odds of self-harm with suicidal intent or in odds of any particular self-harm method. Across the pandemic, there was no change in the use of social media or consumption of alcohol/illicit drugs associated with self-harm.

For clinical diagnosis, the odds for psychotic disorders in self-harm presentations doubled initially in March to April 2020 compared with March to April 2019 (OR, 2.11; 95% CI, 1.34-3.31). It was found to have regressed after the first year of pandemic (OR, 0.36; 95% CI, 0.18-0.76). However, this reduction might not be robust, as sensitivity analyses did not reveal significant estimates (OR, 0.56; 95% CI, 0.30-1.02). Overall, no difference was found in March to April 2021 compared with March to April 2019. Substance misuse disorders (OR, 0.42; 95% CI, 0.22-0.80) and somatoform disorders (OR, 0.07; 95% CI, 0.02-0.26) both significantly reduced in self-harm presentations in the COVID-19 pandemic in the same period. However, only the latter diagnosis remained significant after adjusting for multiple comparisons. No significant change was found for

**TABLE 3** Descriptive Statistics and Year Comparisons of Characteristics and Management of Self-Harm Presentations

Outcome	Sites with data for all 3 years						All available data (sensitivity analysis)					
	2020 vs 2019		2021 vs 2020		2021 vs 2019		2020 vs 2019		2021 vs 2020		2021 vs 2019	
	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>
Sociodemographic characteristics												
Female	1.08 (0.78-1.50)	3	1.62** (1.18-2.23)	0	1.98*** (1.45-2.72)	0	1.24 (0.90-1.71)	11	1.40*** (1.16-1.70)	3	1.98*** (1.45-2.72)	0
Male	0.98 (0.71-1.35)	0	0.63** (0.45-0.88)	0	0.55*** (0.40-0.76)	0	0.86 (0.64-1.15)	0	0.73*** (0.60-0.88)	0	0.55*** (0.40-0.76)	0
Minoritized ethnic group	1.20 (0.83-1.73)	0	0.70 (0.48-1.01)	0	0.91 (0.64-1.29)	0	1.08 (0.77-1.50)	0	1.07 (0.76-1.49)	26	1.23 (0.70-2.16)	53
In foster care	1.40 (0.54-3.63)	76	0.56 (0.23-1.33)	71	0.78 (0.44-1.39)	33	1.24 (0.59-2.60)	71	0.56* (0.35-0.90)	66	0.65 (0.33-1.29)	67
Self-harm characteristics												
Suicidal intent	1.30 (0.88-1.92)	32	0.91 (0.58-1.45)	58	1.05 (0.67-1.66)	60	1.30 (0.94-1.80)	23	1.06 (0.81-1.39)	42	1.05 (0.67-1.66)	60
Method – self-poisoning	1.07 (0.78-1.46)	13	0.98 (0.74-1.31)	9	0.90 (0.59-1.38)	54	1.21 (0.88-1.68)	29	1.14 (0.87-1.49)	38	0.90 (0.59-1.38)	54
Method – self-injury with skin damage	1.02 (0.75-1.39)	8	0.94 (0.72-1.23)	0	1.10 (0.80-1.52)	27	0.94 (0.71-1.26)	12	0.92 (0.70-1.22)	45	1.10 (0.80-1.52)	27
Method – firearm <sup>a</sup>	n/a		n/a		n/a		n/a		n/a		n/a	
Method – hanging	1.11 (0.61-2.00)	30	0.95 (0.55-1.66)	5	1.08 (0.44-2.63)	40	1.14 (0.67-1.94)	22	0.98 (0.68-1.41)	5	1.08 (0.44-2.63)	40
Method – drowning <sup>a</sup>	n/a		n/a		n/a		n/a		n/a		n/a	
Method – jumping from heights	1.22 (0.70-2.14)	0	1.22 (0.66-2.24)	0	1.41 (0.47-4.28)	62	1.22 (0.70-2.14)	0	1.10 (0.66-1.82)	0	1.41 (0.47-4.28)	62
Method – other method	0.88 (0.44-1.74)	49	0.65 (0.37-1.17)	28	0.45 (0.19-1.05)	66	0.82 (0.44-1.53)	45	0.54*** (0.38-0.78)	18	0.45 (0.19-1.05)	66
Use of social media	0.95 (0.45-1.97)	31	0.89 (0.26-2.98)	80	0.94 (0.55-1.60)	13	1.08 (0.47-2.48)	66	0.80 (0.44-1.46)	64	0.77 (0.44-1.36)	32
Illicit drug consumption	0.68 (0.35-1.31)	0	1.05 (0.42-2.61)	55	0.87 (0.34-2.23)	64	0.73 (0.37-1.44)	45	0.67 (0.32-1.40)	85	0.46 (0.12-1.75)	89
Alcohol consumption	1.38 (0.72-2.62)	38	0.81 (0.47-1.39)	17	0.90 (0.58-1.41)	0	1.21 (0.72-2.04)	28	0.59* (0.35-0.99)	69	0.56 (0.25-1.27)	76
Clinical characteristics												
Diagnosis – emotional disorders	1.24 (0.81-1.90)	29	0.97 (0.58-1.62)	53	1.17 (0.74-1.83)	47	1.31 (0.91-1.88)	23	1.30 (0.87-1.93)	69	0.99 (0.56-1.76)	74
Diagnosis – behavioral disorders	1.18 (0.67-2.10)	36	0.76 (0.36-1.57)	58	0.79 (0.37-1.70)	53	1.09 (0.66-1.79)	33	0.58 (0.30-1.11)	83	0.48 (0.12-1.93)	89
Diagnosis – psychotic disorders	2.11*** (1.34-3.31)	0	0.36** (0.18-0.76)	0	0.93 (0.09-9.88)	78	2.11*** (1.34-3.31)	0	0.56 (0.30-1.02)	51	0.93 (0.09-9.88)	78
Diagnosis – eating disorders	1.13 (0.55-2.29)	37	0.89 (0.46-1.73)	22	0.95 (0.42-2.13)	36	1.32 (0.71-2.43)	36	0.83 (0.26-2.70)	89	0.43 (0.06-2.99)	92
Diagnosis – neurodevelopmental disorders	1.17 (0.76-1.81)	0	1.08 (0.64-1.81)	29	1.14 (0.71-1.84)	0	1.24 (0.84-1.83)	0	0.70 (0.44-1.10)	60	0.90 (0.39-2.07)	73
Diagnosis – substance misuse disorders	1.00 (0.43-2.33)	49	0.56 (0.27-1.19)	36	0.42** (0.22-0.80)	0	0.84 (0.38-1.84)	51	0.72 (0.49-1.07)	22	0.42** (0.22-0.80)	0
Diagnosis – somatoform disorders	0.61 (0.23-1.63)	63	0.49 (0.21-1.13)	0	0.07*** (0.02-0.26)	0	0.61 (0.23-1.63)	63	0.75 (0.35-1.61)	39	0.07*** (0.02-0.26)	0
Diagnosis – personality disorders	1.17 (0.69-1.97)	20	0.56 (0.31-1.01)	38	0.74 (0.37-1.50)	59	1.09 (0.67-1.77)	16	0.75 (0.47-1.20)	55	0.74 (0.37-1.50)	59

(continued)

TABLE 3 Continued

Outcome	Sites with data for all 3 years						All available data (sensitivity analysis)					
	2020 vs 2019		2021 vs 2020		2021 vs 2019		2020 vs 2019		2021 vs 2020		2021 vs 2019	
	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>	OR (95% CI)	I <sup>2</sup>
Diagnosis — other disorders	3.65* (1.10-12.17)	74	1.00 (0.53-1.87)	24	3.27 (0.85-12.65)	86	2.65 (0.95-7.39)	75	0.61 (0.28-1.32)	85	1.57 (0.19-13.09)	96
Current medication — antidepressant	0.77 (0.47-1.26)	25	0.91 (0.62-1.34)	5	0.81 (0.46-1.42)	47	0.79 (0.51-1.22)	29	0.85 (0.64-1.12)	35	0.74 (0.44-1.23)	54
Current medication — antipsychotic	1.51 (0.93-2.42)	0	0.63 (0.34-1.14)	47	1.11 (0.61-2.02)	32	1.26 (0.77-2.06)	26	0.75 (0.55-1.02)	47	0.79 (0.43-1.45)	56
Current medication — antiepileptic	0.88 (0.29-2.72)	54	0.68 (0.12-4.05)	80	0.60 (0.26-1.34)	25	0.64 (0.20-1.98)	61	0.64 (0.31-1.33)	68	0.45 (0.19-1.07)	46
Current medication — sedative	1.11 (0.65-1.91)	0	1.00 (0.54-1.83)	21	0.99 (0.34-2.92)	49	1.20 (0.72-2.00)	0	1.15 (0.75-1.77)	5	0.99 (0.34-2.92)	49
Current medication — stimulant	1.28 (0.40-4.08)	67	0.55 (0.14-2.10)	77	0.54 (0.21-1.42)	22	0.92 (0.40-2.09)	59	0.37* (0.14-0.99)	85	0.19** (0.05-0.64)	82
Current medication — melatonin	0.91 (0.47-1.76)	13	0.90 (0.48-1.69)	0	0.76 (0.36-1.61)	17	0.91 (0.47-1.76)	13	0.53 (0.21-1.32)	77	0.31 (0.09-1.10)	83
Current medication — other psychiatric drug	1.38 (0.43-4.46)	0	0.54 (0.16-1.81)	0	0.59 (0.20-1.70)	0	0.56 (0.09-3.40)	79	0.54 (0.14-2.05)	93	0.14 (0.02-1.05)	90
Presence of suicidal thinking <sup>b</sup>	n/a		1.24 (0.36-4.29)	58	n/a		n/a		1.46* (1.07-1.98)	67	n/a	
Previous MH service contact <sup>b</sup>	n/a		1.11 (0.58-2.13)	13	n/a		n/a		1.45* (1.09-1.92)	62	n/a	
Clinical management												
Admission to acute ward	1.19 (0.70-2.02)	33	1.06 (0.72-1.58)	11	1.16 (0.67-2.03)	53	1.04 (0.63-1.74)	39	0.96 (0.54-1.71)	79	0.71 (0.28-1.81)	86
Admission to intensive treatment unit	0.71 (0.21-2.47)	59	2.33 (0.97-5.57)	14	1.97 (0.64-6.06)	0	0.69 (0.28-1.68)	39	1.14 (0.45-2.91)	80	1.97 (0.64-6.06)	0
Admission to psychiatric ward	1.10 (0.75-1.62)	0	0.73 (0.44-1.22)	49	0.75 (0.44-1.29)	44	1.22 (0.85-1.75)	0	0.83 (0.55-1.24)	60	0.75 (0.44-1.29)	44
Detained involuntarily	0.81 (0.34-1.92)	30	1.38 (0.71-2.70)	0	0.73 (0.31-1.75)	33	0.76 (0.43-1.37)	22	0.56 (0.18-1.68)	88	0.47 (0.13-1.78)	89
Follow-up offered	1.36 (0.82-2.25)	37	2.32** (1.24-4.35)	52	4.46*** (2.32-8.58)	45	1.10 (0.70-1.74)	42	1.40 (0.78-2.53)	71	3.63*** (2.06-6.41)	46
Follow-up attended	1.25 (0.71-2.22)	2	1.15 (0.68-1.95)	0	1.48 (0.84-2.60)	18	1.93* (1.08-3.43)	38	1.47 (0.95-2.27)	48	1.43 (0.70-2.92)	60

Note: n/a = not available (due to insufficient number of presentations for formal year comparison); OR = odds ratio.

<sup>a</sup>Insufficient number for formal analysis

<sup>b</sup>Variable was not collected for 2019, as it was not included in the first Pandemic-Related Emergency Psychiatric Presentations (PREP-kids) study.

\*p < .05; \*\*p < .01; \*\*\*p < Simes-adjusted threshold ( $\alpha = .00208$  for sites with data for all 3 years,  $\alpha = .00375$  for sensitivity analyses).

other psychiatric disorders or current prescription of any psychiatric medication, although sensitivity analyses revealed potential reduction in stimulant prescription in 2021 (OR, 0.37; 95% CI, 0.14-0.99). Comparing March to April 2021 with March to April 2020, there was no evidence of change in odds of presentations with suicidal thinking (regardless of relevance to self-harm; OR, 1.24; 95% CI, 0.36-4.29) and odds of previous contact with mental health services (OR, 1.11; 95% CI, 0.58-2.13). This could, however, be limited by the small sample and insufficient power, as sensitivity analyses of all available data revealed a significant increase at  $\alpha = .05$  by almost 50% in odds for both variables.

There was no significant change in admissions to any psychiatric or medical ward, or in whether the young person was detained involuntarily under local mental health laws. Offer of follow-up appointments after self-harm presentations saw a more than 4-fold increase in odds in 2021 compared with pre-pandemic level (OR, 4.46; 95% CI, 2.32-8.58) after an initial increase over the start of the pandemic (OR, 2.32; 95% CI, 1.24-4.35). Meanwhile, the attendance rate of these appointments was maintained, as no significant change was found.

## DISCUSSION

Incorporating data from 8,174 ED presentations from 25 socioeconomically diverse countries, we found that both psychiatric emergencies and self-harm in children and adolescents resulting in ED visits increased significantly during the pandemic following initial reductions. Self-harm presentations in March to April 2021 were more likely to be made by girls rather than boys compared with corresponding periods in 2020 and 2019. Comparing March to April 2021 with March to April 2019, youths who presented at EDs for self-harm were 4 times more likely to be offered follow-up appointments, whereas they were also less likely to have somatoform disorders.

Reduced psychiatric ED presentations in 2020 were well documented in high-income countries.<sup>9,23</sup> Our findings suggest that the initial reduction in help seeking for mental health difficulties was potentially a worldwide phenomenon. After the first year of the pandemic, the rate of psychiatric ED presentations increased to twice that in the early pandemic and overall 50% higher than that pre-pandemic. The early warnings<sup>24</sup> of the pandemic's negative psychological impacts might explain the later increase in the use of emergency psychiatric care. An alternative explanation is that the initial lockdown measures and stay-at-home orders had been barriers to presentation early in the

pandemic. Help seeking might have improved when restrictions were eased in 2021.<sup>25</sup> Nevertheless, inpatient psychiatric admission and mental health service referrals for young people were previously found to have increased,<sup>26-28</sup> and worsened mental health in the community was reported in longitudinal studies and surveys.<sup>29,30</sup> The combined evidence may reflect potential widespread deterioration of children's mental health across all levels of severity since the pandemic.

A 2-fold increase in self-harm presentation rate suggests that the mental health deterioration came with increased safety risks, echoing limited existing research.<sup>11,12</sup> Moreover, the increase in the proportion of self-harm among all psychiatric ED presentations reflects the fact that it became a greater public health burden in the studied EDs since the pandemic, adding pressure to clinical caseload and spending. Underlying pandemic-related stressors have potentially accumulated since early lockdown.<sup>9,31</sup> Previous studies on adolescent self-harm emphasized the impacts of maladaptive emotional regulation.<sup>32</sup> Increased self-harm presentations possibly reflect that children and adolescents found it more difficult to regulate the accumulated, heightened distress, especially in the absence of protective support network as well as a lack of alternative coping strategies.<sup>33</sup> Any single self-harm episode elevates the risks of repeated self-harm and suicidal attempts.<sup>34</sup> It is therefore important that we prioritize these adolescents who are at risk and ensure their access to emergency care and clinical resources. A 4-fold increase in the rate of offered follow-up appointments suggests a promising direction. Follow-up after discharge helps to ensure that safety plans are followed in the community to minimize future risks.<sup>35</sup> Development in remote meeting platforms has assisted in scheduling appointments.<sup>36</sup> Meanwhile, the observed high heterogeneity reflects potential health care inequalities across sites. It is a concern whether digital poverty in some LMICs has any impact on the number of follow-up appointments offered to youths who have presented with self-harm.<sup>37</sup> As clinical landscapes continue to diversify worldwide, it is important that international researchers and funding bodies reflect on adaptations for clinical practice to ensure sufficient support for individuals with potentially higher self-harm risk.

Despite the increased presentations, self-harm severity did not differ in our studied regions across the pandemic. We did not observe a significant change in any high-risk self-harm method or rate of admission to intensive treatment units. In addition, we did not observe a change in suicidal ideation or suicide attempts (ie, self-harm with suicidal intent). This potentially reflected cross-cultural differences in suicidality, as previous evidence diverged.

Suspected suicide attempts observed by American EDs increased,<sup>12</sup> whereas suicide attempts in a French ED halved.<sup>32</sup> Community samples in Mexico and the Netherlands revealed no change in suicidality.<sup>38,39</sup> Mortality data again revealed mixed outcomes. International suicide rates overall did not change significantly during the early pandemic.<sup>40</sup> No significant change was detected in England,<sup>41</sup> whereas completed suicides were found to increase afterward in the United States<sup>42</sup> and Japan.<sup>43</sup> Localities need to remain vigilant about potential fluctuations that may be specific to respective populations, considering the link between self-harm and suicide.<sup>44</sup> Notably, the severity of self-harm was not diluted by increased presentations. There was likely a genuine increase in self-harm occurrence among youths in March to April 2021, compared with pre-pandemic and early pandemic, instead of merely a heightened public perception of the need for emergency treatment following self-harm.

The increased rate of self-harm presentation by girls in 2021 at the participating EDs corresponds with the long-established dominance of female representation.<sup>20</sup> Depressive and anxiety symptoms are more prevalent in adolescent girls and likely further increased during the pandemic.<sup>9,31</sup> All psychiatric disorders rather than just emotional disorders became more prevalent in adolescent girls at American EDs throughout the pandemic.<sup>45</sup> There are also reports of increased need for outpatient psychiatric services<sup>26</sup> and suicidal attempts in girls.<sup>46</sup> Increased lockdown stringency was previously found to mediate reduction in female self-harm presentations at EDs.<sup>10</sup> Girls might be disproportionately affected by the COVID-19 pandemic compared with boys. As lockdown measures eased in 2021, the likelihood for girls who self-harm to present at EDs might have increased accordingly to a higher level even compared with that pre-pandemic. Although our findings only observations only at the participating EDs instead of epidemiology in the community, they flag potential sex differences in emergency care use in young people who self-harm in the pandemic. Lasting impacts could result in potential long-term clinical burden on adult EDs, as self-harm in adolescent girls is more likely to continue in adulthood compared with boys.<sup>47</sup> Future studies with formal analyses are needed for better understanding of this topic.

Somatoform disorders were substantially reduced among self-harm presentations. Despite their association with elevated self-harm risk,<sup>48</sup> there is a paucity of studies on relevant changes following the pandemic. Early increase in psychotic disorders in self-harm presentations replicated similar findings in Canada,<sup>49</sup> potentially because youths with psychotic symptoms were least deterred from visiting EDs early pandemic. Interestingly, there was no increase in

rates of self-poisoning and eating disorder diagnosis, both typically found in adolescent girls who self-harm.<sup>21,45</sup> Similarly, we did not observe any significant change in presentation odds for children in foster care and those from local minoritized ethnic groups, despite suspected higher risk of self-harm for both groups.<sup>10,35</sup> Further research updates are needed regarding the potentially changing clinical profiles and care pathways for these self-harm correlates.

This is the first international research on impacts beyond the first wave of the COVID-19 pandemic on pediatric self-harm presentations at EDs. Using 3 surveillance periods in reference to the pandemic, we were able to distinguish the short-term and longer-term changes. Our sample spanned various cultures and health care models. The findings were thus more globally generalizable to LMICs that are not commonly represented in clinical research. The classification and interpretation of a wide range of self-harm correlates were standardized across sites and various clinical coding practices, overcoming a common challenge in international psychiatry research.<sup>50</sup>

Our findings are subject to at least 5 limitations. First, this study focused on pediatric self-harm resulting in ED visits and could not describe self-harm rates in the community. Roughly only 1 in 8 self-harm episodes leads to hospital presentations,<sup>21</sup> which are likely skewed toward self-poisoning and suicide attempts.<sup>20</sup> Second, we did not have access to data across the entire pandemic period or prior to 2019. Annual fluctuations might have contributed to observed effects, although comparing seasonal patterns could aid interpretation. Continuous temporal data are needed to ascertain the associations between the pandemic and any observed finding. Third, participating sites might not be representative of their respective countries. Adopting convenience sampling at the institutional ED level for practicality potentially introduced selection bias. In the current study, this helped to engage countries that are not often represented in high-quality research. Fourth, variability in the availability of outpatient or specialist mental health services was not considered in our model, but might explain cross-site differences. Finally, the pandemic entailed changes in COVID-19 infection, government policies, and general lifestyle, which were inseparable in the current methodology.

Our findings highlight an increase in ED self-harm presentations among youths 1 year after the pandemic onset, raising an urgent need to evaluate current clinical resources and help-seeking pathways for youth who self-harm. Clinicians need to address the potentially unmet psychiatric needs in girls leading to self-harm. Future studies are needed to further update our understanding of risk

factors and to support targeted intervention for identification and treatment. Continual surveillance is needed to explore how youth self-harm responds or acclimates to the new norm of sustained stressors created by the pandemic.

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BHW had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. SC (King's College London) and IB (King's College London) conducted and are responsible for the data analysis. Electronic health records are, by definition, considered "sensitive" data in the UK by the GDPR and cannot be shared via public deposition because of information governance restriction in place to protect patient confidentiality. Access to data is available only once approval has been obtained through the individual constituent entities controlling access to the data. Data of March-April 2019 and March-April 2020 from the following sites were reported in the two previous PREP-kids papers: Children's Health Ireland at Temple Street, Royal Manchester Children's Hospital, AKH Wien, Clinic for Neurology and Psychiatry for Children and Youth, Children Hospital "Regina Margherita" University of Turin, Children's Health Ireland at Crumlin, Vadaskert Child and Adolescent Psychiatric Hospital, ARNAS Brotzu Hospital and University of Cagliari, Chelsea & Westminster Hospital, St. Mary's Hospital, Northwick Park Hospital Emergency Department, Hillingdon Hospital, University Hospital Lewisham, Sultan Qaboos University Hospital, Royal Edinburgh Hospital, Royal Infirmary of Edinburgh, Royal Hospital for Children and Young People, St. John's Hospital, Watford General Hospital, King's College Hospital, Wexham Park Hospital, Royal Berkshire Hospital, St. Thomas' Hospital, and Croydon University Hospital.

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