Supplemental Online Content

Overhage L, Hailu R, Busch AB, Mehrotra A, Michelson KA, Huskamp HA. Trends in acute care use for mental health conditions among youth during the COVID-19 pandemic. *JAMA Psychiatry*. Published online July 12, 2023. doi:10.1001/jamapsychiatry.2023.2195

eMethods.

- **eFigure 1.** Flow chart of acute mental health care utilization over 2 years of COVID **eFigure 2.** Changes in the percentage of mental health ED visits that result in an inpatient psychiatric stay
- **eFigure 3.** Change in mean length of inpatient psychiatric stay following emergency department visit
- **eTable 1.** Characteristics of youth in analyzed commercial claims dataset compared to United States population of youth age 5-17 years
- **eTable 2.** Number of mental health ED visits per youth among youth with at least one mental health ED visit per year
- **eTable 3.** Enrollment and outpatient mental health diagnoses 30 days prior to mental health ED visits

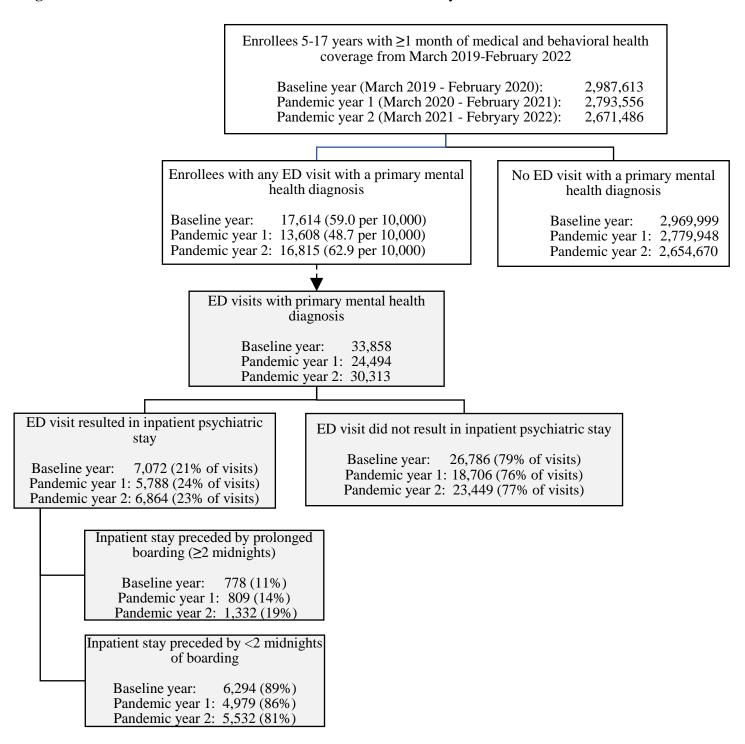
This supplemental material has been provided by the authors to give readers additional information about their work.

eMethods

ICD-10 codes for mental health diagnoses:

Dx category	ICD10
Suicide attempt	T14.91XA
Cartaidal ida adia n	D45 95 (: 1-4:)
Suicidal ideation	R45.85 (ideation)
Intentional self-harm	X71-X83 (intentional self harm)
	T36-T65, T71 when 6th character of code =2.
	Except for T36.9, T37.9, T39.9, T41.4, T42.7,
	T43.9, T45.9, T47.9, and T49.9, T51.9, T52.9,
	T53.9, T54.9, T56.9, T57.9, T58.0, T58.1, T58.9,
	T59.9, T60.9, T61.0, T61.1, T61.9, T62.9, T63.9,
	T64.0, T64.8, T65.9, which are included if the 5th
	character of the code=2).
Depressive disorder	F32.xx, F33.xx, F34.1x
Bipolar disorder	F30.xx-F31.xx, F34.0x
Schizophrenia/psychotic disorders	F20.xx, F22.xx-F29.xx
Anxiety disorders	F40.xx- F42.xx, F93.0x-F93.2x, F94.0x
Adjustment disorders	F43.2x
Trauma disorders	F43.0x, F43.1x, F43.8x, F43.9x, F94.1x, F94.2x
Conduct/impulse control disorders	F63.xx, F91.xx, F92.xx
ADHD	F90.xx
Autism spectrum disorder	F84.xx
Eating Disorders	F50.xx, F98.2x
Conversion/neurotic disorders	F44.xx, F45.xx, F48.xx, F68.xx
Other MH disorders:	
Personality disorders	F69.xx
Other/unspecified mood disorders	F34.8, F34.9x, F38.xx, F39.xx
Gender dysphoria	F64.xx-F66.xx
Sexual disorders	F52.xx-F54.xx
Tic and movement disorders	F95.xx, F98.4x
Other	F59.xx, F93.3x-F93.9x, F94.8x, F94.9x, F98.8x,
	F98.9x, F99.xx
Substance use disorder (as co-	F10-F16, F18-F19
occurring condition only)	

eFigure 1. Flow chart of acute mental health care utilization over 2 years of COVID-19



Study included youth 5-17 years who were enrolled in health insurance (medical and behavioral coverage) from a large national insurer between March 2019 and February 2022. Baseline year is March 2019 to February 2020; pandemic year 1 is March 2020 to February 2021; and pandemic year 2 is March 2021 to February 2022. ED visits with a primary diagnosis of substance use disorder were not counted as mental health emergency department visits.

eTable 1. Characteristics of youth in analyzed commercial claims dataset compared to United States population

of youth age 5-17 years

	Youth in sample, year averages	Youth in the United States
Total	2.8 million	53.7 million
Documented Sex		
Male	51%	51%
Female	49%	49%
Age		
5-12 years	59%	61%
13-17 years	41%	39%
Rurality		
Non-Rural	96%	94.6%
Rural	4%	5.4%
County quartile: Income		
Highest	34%	25%
Percentile 50-75	26%	25%
Percentile 25-50	25%	25%
Lowest	15%	25%
County quartile: Percent n	on-White	
Highest	20%	25%
Percentile 50-75	29%	25%
Percentile 25-50	27%	25%
Lowest	24%	25%

This table compares demographics of youth enrolled in the commercial insurer whose data we used for this analysis to the United States population of youth age 5-17 years. United States population estimates by age and sex were calculated from come from the United States American Community Survey 2021 estimates. Rurality prevalence based on 2018 estimates. Approximately 62% of youth have commercial insurance, so we estimate that our sample includes 8.4% of commercially insured youth in the United States (2.8 million / (62%*53.7million).

eTable 2. Number of mental health ED visits per youth among youth with at least one mental health ED visit

per year

	1 mental health ED visit in year		2 mental health ED visits in year		3+ mental health ED visits in year		
	Number	Percent	Number	Percent	Number	Percent	
Baseline Year (Mar 2019-Feb 2020)	13,731	78%	2,055	11.7%	1,828	10.4%	
Pandemic Year 1 (Mar 2020-Feb 2021)	10,738	79%	1,514	11.1%	1,356	10.0%	
Pandemic Year 2 (Mar 2021-Feb 2022)	13,174	78%	1,994	11.9%	1,647	9.8%	

Distribution of number of ED visits per youth per year, restricting to youth who have at least one mental health ED visit in the given year. We do not require continuous enrollment in this table.

eTable 3. Enrollment and outpatient mental health diagnoses 30 days prior to mental health ED visits

Total mental health ED visits (Number)		ED visits for which child had any outpatient visit with a primary mental health diagnosis in 30 days prior to visit (Percent)			
Baseline Year (Mar 2019-Feb 2020)	33,858	78.1%			
Pandemic Year 1 (Mar 2020-Feb 2021)	24,494	76.3%			
Pandemic Year 2 (Mar 2021-Feb 2022)	30,313	72.2%			

Episode-level analysis of enrollment and outpatient visits before a mental health ED visit, by year. The percentage of ED visits preceded by an outpatient visit with a mental health diagnosis excludes youth who were not enrolled 30 days prior to ED visit (0.7% of ED visits in the baseline year, 0.6% in pandemic year 1, and 0.8% in pandemic year 2).

eFigure 2. Changes in the percentage of mental health ED visits that result in an inpatient psychiatric stay

	•				•		
	Total MH	Baseline	Baseline vs. pandemic		vs. pandemic yr 1		vs. pandemic yr 2
	ED visits	admission rate	$yr 1 (\triangle) and yr 2 (\bullet)$	% Change		% Change	
Total	88,665	20.9%	, •	13.1%	[10.1%, 16.1%]	8.4%	[5.5%, 11.2%]
Documented Sex							
Male	41,291	15.9%	Take	7.9%	[2.4%, 13.0%]	-0.3%	[-5.8%, 4.7%]
Female	47,374	26.1%	●	10.0%	[6.3%, 13.5%]	6.8%	[3.3%, 10.2%]
Age			1				
5-12 years	30,178	8.8%	*	20.7%	[12.0%, 28.5%]	5.7%	[-3.1%, 13.5%]
13-17 years	58,487	28.2%	<u> </u>	5.4%	[2.2%, 8.5%]	2.6%	[-0.5%, 5.6%]
Rurality			į.				
Non-Rural	85,133	20.9%	¦ °	12.2%	[9.0%, 15.2%]	8.6%	[5.6%, 11.5%]
Rural	3,712	21.3%	-	34.9%	[21.0%, 46.2%]	3.2%	[-12.7%, 16.3%]
County Quartile: Income			i				
Q1 (Lowest)	11,147	25.7%	<u>i</u> • •	5.8%	[-2.1%, 13.0%]	14.3%	[7.0%, 20.9%]
Q2	21,852	22.5%	<u>_</u>	6.1%	[-0.1%, 11.8%]	-3.7%	[-9.9%, 2.0%]
Q3	23,003	19.7%	.	23.7%	[17.7%, 29.2%]	26.9%	[21.5%, 32.0%]
Q4 (Highest)	32,663	19.1%	±	13.8%	[8.3%, 18.8%]	3.0%	[-2.4%, 8.0%]
County quartile: percent no	on-White		-				
Highest	14,194	17.9%	±	16.6%	[7.9%, 24.2%]	19.2%	[11.3%, 26.2%]
Percentile 50-75	25,002	19.9%	.	11.2%	[5.1%, 16.9%]	8.2%	[2.3%, 13.6%]
Percentile 25-50	25,640	20.8%	.	21.0%	[15.4%, 26.1%]	4.2%	[-1.5%, 9.5%]
Lowest	23,829	23.7%	±	6.4%	[0.8%, 11.7%]	8.7%	[3.4%, 13.7%]
Diagnosis			1				
Depressive disorder	18707	34.1%	*	10.8%	[6.1%, 15.2%]	14.0%	[9.4%, 18.2%]
Suicidal Ideation/							
Attempt and Self Harm	14983	57.8%	*	7.4%	[3.9%, 10.6%]	-2.3%	[-5.6%, 0.9%]
Bipolar and Psychotic	11,505	27.070	į	7.170	[3.570, 10.070]	2.570	[5.670, 6.570]
Disorders	1604	44.4%	*	3.1%	[-11.0%, 15.1%]	7.3%	[-6.6%, 19.0%]
Anxiety Disorder	10952	5.6%	 -	-5.2%	[-27.4%, 12.2%]	-23.1%	[-45.5%, -5.4%]
Adjustment and Trauma					_		
Disorders	5956	8.0%	-	1.7%	[-23.4%, 20.5%]	-16.3%	[-41.6%, 2.9%]
Impulse control disorders	3152	22.7%		4.9%	[-12.2%, 19.0%]	-3.0%	[-20.3%, 11.2%]
ADHD	5563	3.7%		15.4%	[-25.3%, 41.5%]	-33.9%	[-77.5%, -4.7%]
Autism	17954	0.7%	<u> </u>	29.6%	[-21.0%, 58.5%]	-23.8%	[-81.4%, 11.1%]
Eating Disorders	4537	4.9%		-28.9%	[-80.9%, 2.3%]	-23.0%	[-72.9%, 6.6%]
Other	5187	21.9%	——————————————————————————————————————	10.0%	[-3.2%, 21.1%]	-4.7%	[-18.3%, 6.9%]
		Admission to inposychiatry less li		s to inpatient more likely			
		-100%	-50% 0% 50% 10	00%			

Change in the percentage of ED visits with a mental health diagnosis that resulted in admission to inpatient psychiatry between baseline year (March 2019 to February 2020), pandemic year 1 (March 2020 to February 2021), and pandemic year 2 (March 2021-February 2022) among youth 5-17 years enrolled in a large national commercial insurer. Confidence intervals were calculated using clustered standard errors at the individual level. Mental health ED visits were identified by a primary mental health diagnosis on the first ED claim. ICD-10 codes are available in the eMethods.

eFigure 3: Change in mean length of inpatient psychiatric stay following emergency department visit

	Total	Baseline mean	Baseline vs. pandemic		. Pandemic Yr 1		. Pandemic Yr 2
	Episodes	LOS (midnights)	• • • • • • • • • • • • • • • • • • • •	% Change	95% CI	% Change	95% CI
Total	19,724	9.2	•±	10.6%	[6.6%, 14.3%]	3.8%	[1.8%, 5.7%]
Documented Sex							
Male	6,680	8.8		11.6%	[4.9%, 17.8%]	4.7%	[1.0%, 7.9%]
Female	13,044	9.4	<u> </u>	9.5%	[4.5%, 14.1%]	3.1%	[0.7%, 5.3%]
Age							
5-12 years	2,840	9.5	 -	7.8%	[-2.8%, 17.1%]	-1.9%	[-6.7%, 2.4%]
13-17 years	16,884	9.1	i ◆	11.1%	[6.8%, 15.2%]	4.8%	[2.6%, 6.8%]
Rurality			1				
Non-Rural	18,848	9.2	• ±	11.0%	[6.9%, 14.8%]	3.8%	[1.8%, 5.7%]
Rural	876	8.2	<u> </u>	3.3%	[-14.4%, 17.5%]	3.2%	[-4.9%, 9.9%]
County Quartile: Income							
Q1 (Lowest)	3,044	7.9	<u>+</u>	1.6%	[-8.9%, 10.9%]	0.9%	[-4.1%, 5.2%]
Q2	4,932	8.3	<u> </u>	10.0%	[1.1%, 17.9%]	5.0%	[0.9%, 8.8%]
Q3	5,218	9.6		5.6%	[-2.5%, 12.9%]	0.9%	[-3.2%, 4.5%]
Q4 (Highest)	6,530	10.1	 •	17.6%	[11.3%, 23.4%]	6.2%	[2.9%, 9.2%]
County quartile: percent no	on-white						
Highest	2,827	8.7	<u> </u>	17.4%	[5.9%, 27.1%]	9.5%	[3.8%, 14.3%]
Percentile 50-75	5,276	9.7	 • .	13.6%	[5.8%, 20.6%]	3.1%	[-0.7%, 6.6%]
Percentile 25-50	5,714	9.1	-	14.6%	[7.1%, 21.2%]	5.9%	[1.9%, 9.4%]
Lowest	5,907	9.0		0.2%	[-7.1%, 6.8%]	-0.3%	[-3.7%, 2.8%]
Diagnosis			Ī				
Depressive Disorder	6,863	8.7	• .	11.9%	[5.2%, 18.1%]	2.7%	[-0.5%, 5.6%]
Suicidal Ideation /	0.551	0.6		11.00/	F5 00/ 17 40/3	5.40/	
Attempt / Self Harm	8,751	8.6		11.9%	[5.9%, 17.4%]	5.4%	[2.6%, 8.1%]
Bipolar / Psychotic	72.4	10.0	į	10.10/	F 77 20/ 04 10/1	0.40/	
Disorders	734	10.9		10.1%	[-7.3%, 24.1%]	0.4%	[-10.3%, 8.8%]
Anxiety Disorder	561	10.1		9.6%	[-16.0%, 28.7%]	4.2%	[-9.7%, 14.3%]
Adjustment / Trauma			_				[,
Disorders	449	9.3		19.8%	[-6.2%, 38.4%]	-1.7%	[-14.1%, 7.7%]
			į				[-14.170, 7.770]
Impulse Control	717	11.8		-5.9%	[-29.8%, 12.7%]	0.3%	F 12 00/ 10 10/
Disorders			<u> </u>				[-12.8%, 10.1%
ADHD	190			25.4%	[-23.0%, 53.0%]	27.9%	[-3.2%, 42.3%]
Autism	132			8.3%	[-38.0%, 36.5%]	9.0%	[-18.0%, 24.6%
Eating Disorders	178		<u></u>	17.0%	[-26.6%, 42.2%]	12.0%	[-10.6%, 24.1%]
Other	1,149		orter stays Longer stay	-1.5%	[-20.2%, 13.5%]	-0.3%	[-11.3%, 8.3%]
		Sh	orter stays Longer stay	o			
			-40% 10%				

Mean length of inpatient psychiatric stay in number of midnights for youth 5-17 years admitted to inpatient psychiatry after an emergency department visit with a primary mental health diagnosis. Mean length of stay is shown for baseline year (March 2019-February 2021), and then percent change in mean length of stay is shown from baseline to pandemic year 1(March 2020 to February 2021) and baseline to pandemic year 2 (March 2021 to February 2022).

LOS – length of stay.