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## Mental Health Utilization and Expenditures for Children Pre–Post Firearm Injury

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### INTRODUCTION

Firearms are a leading cause of injury and death among children and adolescents.<sup>1</sup> For those who survive, firearm injuries are a source of significant toxic stress, often among already marginalized groups.<sup>2,3</sup> Although medical and public health professionals and the victims themselves recognize the need for a more comprehensive mental health approach before and after a firearm injury,<sup>4,5</sup> the health utilization and expenditures specifically dedicated to mental health services after a firearm injury for children remain unclear. Therefore, the authors set out to compare mental healthcare encounters and expenditures of youth preceding and proceeding a nonfatal firearm injury.

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## METHODS

Investigators analyzed data from the Medicaid MarketScan claims database, which includes data on healthcare expenditures across 10–12 de-identified states (year dependent). This study included mental health claims for children aged 0–18 years with an ICD-9/10 claim associated with firearm injuries (including non-powder) from 2010 to 2016. Included were those enrolled in Medicaid for at least 11 of 12 months before and after the firearm injury. Only individuals whose initial firearm-related claim was from an emergency department or inpatient encounter were included. Index injuries were identified by ensuring that each child did not have a firearm injury diagnosis in the year prior. The cohort was evaluated in 3 subgroups: (1) low prior healthcare expenditures (previously healthy), (2) high prior outpatient mental health expenditures (>90th percentile=\$1,866), and (3) high prior non-mental health expenditures (>90th percentile=\$6,730). The latter subgroup served as a default group if a subject had both high mental health expenditures and high general health service expenditures. Descriptive statistics were used to characterize patient demographics and healthcare service utilization and Wilcoxon signed rank tests were used to compare healthcare expenditures before and after firearm injury. A  $p$ -value <0.05 was considered statistically significant.

## RESULTS

A total of 3,296 children with firearm injuries from 2010–2016 were included. Demographic, intent, and health service characteristics are included in Table 1. There were 20,007 total mental healthcare encounters the year prior to the index firearm injury, and 18,448 after 1 year ( $p=0.057$ ). Those in the healthy subgroup had a 131% increase in mental healthcare encounters (pre=3,699, post=8,532,  $p<0.001$ ). For the high prior mental healthcare expenditures, there was a 44% decrease in mental healthcare encounters (pre=13,394, post=7,527,  $p<0.001$ ), which accounted for most of the overall decrease in mental healthcare encounters. Those with high non-mental health expenditures had a 18% decrease in mental healthcare encounters (pre=2,914, post=2,389,  $p=0.031$ ). There was a decrease of \$346,029 in mental health expenditures overall, an increase of \$804,024 in the healthy subgroup, a >\$1 million decrease among the high prior mental health expenditure subgroup, and a \$75,000 decrease in the high non-mental health expenditure group. All of these expenditure changes were statistically significant ( $p<0.001$ ) (Table 2).

## DISCUSSION

In this study of mental healthcare utilization before and after firearm injury, surprisingly, there was no change in utilization of mental healthcare services. However, when different subpopulations were evaluated, youth with low prior healthcare expenditures had a substantial increase in mental healthcare encounters and expenditures, whereas youth with previously high mental healthcare expenditures had a significant drop in mental healthcare service utilization and expenditures. This suggests that healthy children received needed services, but it remains unclear why those with high baseline need of mental health care had a decrease in utilization following a firearm injury. It is possible that increased medical utilization due to severity of injury superseded the mental healthcare needs, or children are

connected into an interdisciplinary treatment group that addresses mental health, without it being reflected in utilization and expenditure data.

### Limitations

Important limitations include: (1) potential high utilizer outlier influence for these services (although included mean, median, 90th percentile, and maximum in Table 2 suggest this is not the case), (2) exclusion of severe injuries as children may have died in the year following the firearm injury after the initial event, (3) other diagnoses outside of firearm injuries during the year prior and year after the injury were not taken into account, and (4) inability to analyze more longitudinal data with adequate sample size given database limitations.

## CONCLUSIONS

This investigation suggests that some childhood victims of firearm injury, notably those at highest risk, may not be receiving needed mental health services. Although previously healthy children had an increase in mental health services after firearm injury, it is unclear from this study if this level of increased mental health services is adequately serving the needs of this vulnerable population. Further investigation should better characterize the potential gaps in mental health needs of children after firearm injury.<sup>6</sup>

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**Table 1.**

Demographic and Intent Data 1-Year Before and 1-Year After a Non-Fatal Firearm Injury Among Children, 0–18 Years

Characteristics	Total (n=3,296)	Intentional n=(197)	Self-inflicted (n=25)	Unintentional (n=2,270)	Undetermined (n=804)
Age, years (mean)	13.4 (0.1)	15.0 (0.3)	15.1 (0.7)	12.8 (0.1)	14.3 (0.1)
0 to 4	155 (4.7)	10 (5.1)	1 (4.0)	112 (4.9)	32 (4.0)
5 to 9	448 (13.6)	10 (5.1)	1 (4.0)	360 (15.9)	77 (9.6)
10 to 14	1,047 (31.8)	31 (15.7)	2 (8.0)	846 (37.3)	168 (20.9)
15 to 18	1,646 (49.9)	146 (74.1)	21 (84.0)	952 (41.9)	527 (65.5)
Sex (% male)	2,750 (83.4)	155 (78.7)	22 (88.0)	1,893 (83.4)	680 (84.6)
Race/Ethnicity					
Black, non-Hispanic	1,699 (51.5)	150 (76.1)	9 (36.0)	993 (43.7)	547 (68.0)
White	1,242 (37.7)	26 (13.2)	13 (52.0)	1,009 (44.4)	194 (24.1)
Hispanic	103 (3.1)	6 (3.0)	0 (0.0)	79 (3.5)	18 (2.2)
Other	252 (7.6)	15 (7.6)	3 (12.0)	189 (8.3)	45 (5.6)
Hospitalization					
% Inpatient <sup>a</sup>	597 (18.1)	58 (29.4)	12 (48.0)	312 (13.7)	215 (26.7)
% ED	2,699 (81.9)	139 (70.6)	13 (52.0)	1,958 (86.3)	589 (73.3)
Disposition					
Admit/Transfer	49 (8.2)	5 (8.6)	2 (16.7)	22 (7.1)	20 (9.3)
Discharged/AMA	424 (71.0)	36 (62.1)	7 (58.3)	225 (72.1)	156 (72.6)
Other	124 (20.8)	17 (29.3)	3 (25.0)	65 (20.8)	39 (18.1)
Inpatient LOS (mean)	3.8 (0.2)	4.2 (0.5)	4.6 (1.2)	3.8 (0.3)	3.7 (0.3)
Pre-utilization category					
Low utilization	2,823 (85.6)	163 (82.7)	14 (56.0)	1,962 (86.4)	684 (85.1)
High mental health utilization	282 (8.6)	20 (10.2)	3 (12.0)	182 (8.0)	77 (9.6)
High non-mental health utilization	145 (4.4)	14 (7.1)	8 (32.0)	126 (5.6)	43 (5.3)

<sup>a</sup>Includes intensive care unit admission.

ED, emergency department; AMA, against medical advice; LOS, length of stay.

**Table 2.**

Mental Health Utilization and Expenditures 1-Year Before and 1-Year After a Non-Fatal Firearm Injury  
Among Children 0–18 Years

Prespending category	Pre Total	Post Total	Total	Difference (post-pre)				p-value
				Mean	Median	90th Pctl	Max	
Utilization, encounters								
Total (3,296)	20,007	18,448	-1,559	-1.1	0	20	205	0.057
Low prior expenditures (2,823 [85.6%])	<b>3,699</b>	<b>8,532</b>	<b>4,833</b>	<b>4.9</b>	<b>1</b>	<b>20</b>	<b>205</b>	<b>&lt;0.001</b>
High prior mental health expenditures (282 [8.6%])	<b>13,394</b>	<b>7,527</b>	<b>-5,867</b>	<b>-20.8</b>	<b>-17</b>	<b>16</b>	<b>123</b>	<b>&lt;0.001</b>
High non-mental health prior expenditures (145 [4.4%])	<b>2,914</b>	<b>2,389</b>	<b>-525</b>	<b>-4</b>	<b>-1</b>	<b>24</b>	<b>184</b>	<b>0.031</b>
Expenditures, standard payment, \$								
Total (3,296)	<b>2,901,442</b>	<b>2,555,413</b>	<b>-346,029</b>	<b>-248</b>	<b>-38.2</b>	<b>2,410.40</b>	<b>61,610</b>	<b>0.029</b>
Low prior expenditures (2,823 [85.6%])	<b>351,260</b>	<b>1,155,284</b>	<b>804,024</b>	<b>819.6</b>	<b>63.1</b>	<b>2,390.90</b>	<b>61,610</b>	<b>&lt;0.001</b>
High prior mental health expenditures (282 [8.6%])	<b>2,080,798</b>	<b>1,005,893</b>	<b>-1,074,905</b>	<b>-3,811.70</b>	<b>-2,485</b>	<b>1,982.30</b>	<b>17,632</b>	<b>&lt;0.001</b>
High non-mental health prior expenditures (145 [4.4%])	<b>469,384</b>	<b>394,235</b>	<b>-75,149</b>	<b>-569.3</b>	<b>-215.5</b>	<b>2782</b>	<b>44,051</b>	<b>0.006</b>

Note: Boldface indicates statistical significance ( $p < 0.05$ ).