Pediatric Fractures Associated with Riding Bicycles: A National Twenty-Year Analysis

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INTRODUCTION: Biking is a popular childhood activity that has an intrinsic risk of injury. While multiple advocacy groups have pushed for protective equipment to help mitigate these risks, to date, trends in the national health burden of fractures associated with biking in the pediatric population have not been explored in depth.

METHODS: The National Electronic Injury Surveillance System database was queried between 2001 and 2020 to identify patients aged ≤ 18 years with fractures presenting to U.S. Emergency Departments associated with bicycles. The narrative section was analyzed to exclude patients not actively riding a bicycle, as well as to note helmet use and motor vehicle involvement. Annual incidence over time was evaluated with linear regression. National estimates and analysis of demographic and injury characteristics were performed with 95% confidence intervals.

RESULTS: A total of 34,722 fractures were identified in the database, representing an estimated 1,019,509 fractures from 2001-2020, or 50,975 fractures annually in the United States. Linear regression analysis noted an overall significant decreasing trend in fractures over the time period (R^2=0.8997; P<0.001), although visual inspection of the data suggests that there may be a recent reversal in this trend. Most fractures occurred in patients who were male (71.8%, 95% Confidence Interval [C.I.] 70.3 – 73.2%), White (53.0%, C.I. 45.9 – 60.0%), and in patients aged 10-12 (30.6%, C.I. 29.6 – 31.7%) or 13-15 years (24.8%, C.I. 23.4 – 26.2%). Fractures occurred most commonly in the Spring (34.2%, C.I. 32.4 – 36.2%) or Summer (37.8%, 34.4 – 41.4%) and at the lower arm (25.2%, C.I. 22.8 – 27.8%), wrist (21.2%, C.I. 19.5 – 22.9%), or shoulder (10.5%, C.I. 9.7 – 11.3%). Patients who sustained fractures with the involvement of a motor vehicle were 4 times more likely to be admitted to the hospital (27.1%, C.I. 21.3 – 33.9%) compared to patients without the involvement of a motor vehicle (6.7%, C.I. 5.2 – 8.5%). Where helmet use was recorded in patients with skull fractures, only a small minority were wearing helmets (14.2%, C.I. 7.5 – 25.4%) with most patients not wearing helmets at the time of injury (85.7%, C.I. 28.7-40.8%).

DISCUSSION AND CONCLUSION: The national burden of fractures associated with riding bicycles in pediatric populations has shown a steady decrease for many years. However, the recent apparent increase in fractures noted since 2019 is consistent with literature noting a significant increase in other injuries during the COVID-19 pandemic, potentially due to an increased use of bicycles from stay-at-home orders and cancellation of school and summer camps. The significant number of fractures requiring hospitalization resulting from involvement with a motor vehicle warrants further research in prevention of these injuries in children. The alarming number of skull fractures noted in children not wearing helmets also supports continued efforts to promote consistent helmet use in children.

Figure 1. Fractures Presenting to U.S. Emergency Departments Associated with Riding Bicycles in Patients Aged ≤ 18 Years from 2001-2020

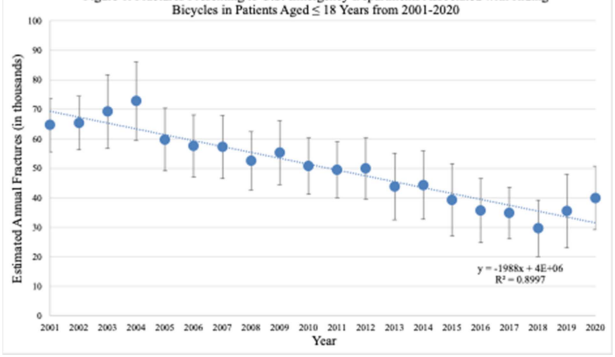

Table 1. Demographic and Injury Characteristics of Patients ≤18 Years of Age Presenting to U.S. Emergency Departments Between 2001 and 2020 with Fractures Associated with Riding Bicycles

Variable	%	95% CI
Season		
Winter	12.2	(9.2 - 16.0)
Spring	34.2	(32.4 - 36.2)
Summer	37.8	(34.4 - 41.4)
Fall	15.8	(14.2 - 17.5)
Age (years)		
0-3	2.6	(2.3 - 3.0)
4-6	17.0	(15.6 - 18.4)
7-9	15.9	(15.0 - 16.8)
10-12	30.6	(29.6 - 31.7)
13-15	24.8	(23.4 - 26.2)
16-18	9.2	(8.0 - 10.4)
Sex		
Male	71.8	(70.3 - 73.2)
Female	28.2	(26.8 - 29.7)
Race		
White	53.0	(45.9 - 60.0)
Black/African American	8.8	(6.2 - 12.4)
Hispanic	6.4	(4.5 - 8.9)
Asian	1.0	(0.6 - 1.9)
Other*	1.3	(0.7 - 3.0)
Not Specified	0.3	(0.2 - 0.4)
Body Part		
Lower Arm	25.2	(22.8 - 27.8)
Wrist	21.2	(19.5 - 22.9)
Shoulder	10.5	(9.7 - 11.3)
Elbow	8.2	(7.5 - 8.9)
Finger	6.8	(6.1 - 7.5)
Lower Leg	5.8	(5.2 - 6.4)
Hand	4.3	(3.9 - 4.9)
Ankle	3.5	(3.0 - 4.1)
Upper Arm	3.2	(2.7 - 3.9)
Face	3.1	(2.7 - 3.6)
Other†	8.3	(6.9 - 10.0)
Motor Vehicle Involvement		
Yes	6.5	(5.4 - 7.7)
No	93.5	(92.3 - 94.6)
Disposition with Vehicle Involved		
Treated/Examined and Released	66.4	(60.7 - 71.6)
Treated and Transferred	5.3	(3.5 - 7.8)
Treated and Admitted/Hospitalized	27.1	(21.3 - 33.9)
Disposition without Vehicle Involved		
Treated/Examined and Released	91.9	(90.8 - 92.8)
Treated and Transferred	2.5	(1.9 - 3.1)
Treated and Admitted/Hospitalized	5.5	(4.2 - 6.7)
Region Fractured with Vehicle Involved		
Axial Skeleton	19.0	(16.5 - 21.7)
Upper Extremity	43.9	(39.6 - 48.3)
Lower Extremity	37.1	(32.7 - 41.8)
Region Fractured without Vehicle Involved		
Axial Skeleton	5.0	(4.4 - 5.6)
Upper Extremity	81.8	(80.9 - 82.6)
Lower Extremity	13.2	(12.6 - 13.9)
Stated Helmet Use with Skull Fractures		
Yes	14.2	(7.5 - 25.4)
No	85.7	(74.6 - 92.5)

*Includes American Indian/Alaska Native and Native Hawaiian/Pacific Islander
†Includes Foot, Toe, Skull, Upper Leg, Neck, Mouth, 25-50% of Body, Pubic Region, Lower Trunk, Knee, Upper Trunk