

AGE 14 STARTS A CHILD'S INCREASED RISK OF MAJOR KNIFE OR GUN INJURY IN WASHINGTON, DC

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This retrospective review of eight years of trauma registry data at an inner-city level-1 trauma center was undertaken to discover at what age urban children start to become at high risk of being victims of either a major gunshot wound or stabbing. We reviewed data from 2,191 patients who were the victim of either a gunshot wound or stabbing, were 18 years of age or under, and met pre-established criteria to qualify as a major trauma victim. There was a rise and subsequent fall in both overall crime and intentional injury rates during the eight-year period. Nevertheless, in each of the eight years studied, the risk of being a victim of a major gunshot wound or stabbing rose abruptly at age 14 ($p < 0.01$) and the incidence continued to rise sharply through age 18. (*J Natl Med Assoc.* 2004;96:169–174.)

Key words: penetrating injury ♦ wounds ♦ penetrating ♦ epidemiology ♦ adolescents ♦ firearms ♦ injury surveillance

INTRODUCTION

Intentional, inner-city violence is a recognized public health problem that has been studied extensively in recent years.¹⁻¹⁰ Among the factors known to increase a child's risk of becoming a victim of intentional violence are: male gender, low-income household, access to firearms, and residence in certain neighborhoods.^{1,2,7,11,12}

To look closely at the age of onset of increased

risk to children in Washington, DC, trauma registry data from an inner-city level-1 trauma center in Washington, DC were analyzed for a period of eight years.

MATERIALS AND METHODS

Study Design

This was a retrospective review of eight years of previously compiled data from the trauma registry of a large, urban level-1 trauma center. The study period was January 1, 1992 through December 31, 1999. The study was approved by the hospital's Institutional Review Board (IRB).

Study Setting and Population

The data compiled were from the District of Columbia General Hospital (DC General), which was the busiest level-1 trauma center in Washington, DC during the study period, seeing an average of 2,075 major trauma cases annually.

The hospital was located one mile southeast of the U.S. Capitol and its catchment area was primarily the southeast quadrant of the city, an historical-

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Table 1. Criteria for Designation as Major Trauma

Acute trauma patient with one or more of the following:

1. Penetrating wounds to the head, neck, chest, abdomen, pelvis, or groin ;
2. Age 5 or less;
3. Fractures of two or more long bones;
4. Any partially or completely severed limb
5. Trauma Score less than 13 (Champion, 1989)⁴⁶; or
6. Neurological presentation, including prolonged loss of consciousness, GCS less than 14, or focal neurological sign.

ly inner city, low-income, high-crime area. Occasional major trauma cases were drawn from adjacent Maryland and other parts of the District of Columbia. There were six level-1 trauma centers in Washington, DC during the study period, including one at Children's Hospital. Pediatric trauma cases were initially treated and evaluated at the closest level-1 trauma center. Children who were initially treated at a general (all ages) level-1 trauma center were then transferred to the pediatric trauma center on an as-needed basis.

All 519,218 patients presenting to the emergency department (ED) at DC General Hospital during the study period were potential participants in this study (see Case Selection below).

Data Source

Data reviewed were from the American College of Surgeons Committee on Trauma (ACSCOT) standardized trauma registry. An eight-year period, from January 1, 1992 through December 31, 1999, was reviewed. ED census data were drawn from the trauma registry and the hospital census database.

Definition and Case Selection

Cases were designated as "major trauma" by meeting pre-established criteria (see Table 1). The mechanism of injury of each major trauma case was recorded after ED discharge. The categories used to track mechanism of injury were: gunshot wounds (GSW), stab wounds (SW), motor vehicle collisions (MVC), assaults (intentional injury, non-penetrating), falls, pedestrian injuries, and "other."

Data Analysis

We reviewed data from all trauma victims who suffered a penetrating injury, were the victim of either a gunshot wound or stabbing, met criteria to qualify as a major trauma victim, and were 18 years of age or under on arrival at the hospital. Analysis of Variance (ANOVA) and the Kruskal-Wallis tests were performed in order to determine the age at which the incidence of major gunshot wounds and stab wounds first exhibit a statistically significant increase.

RESULTS

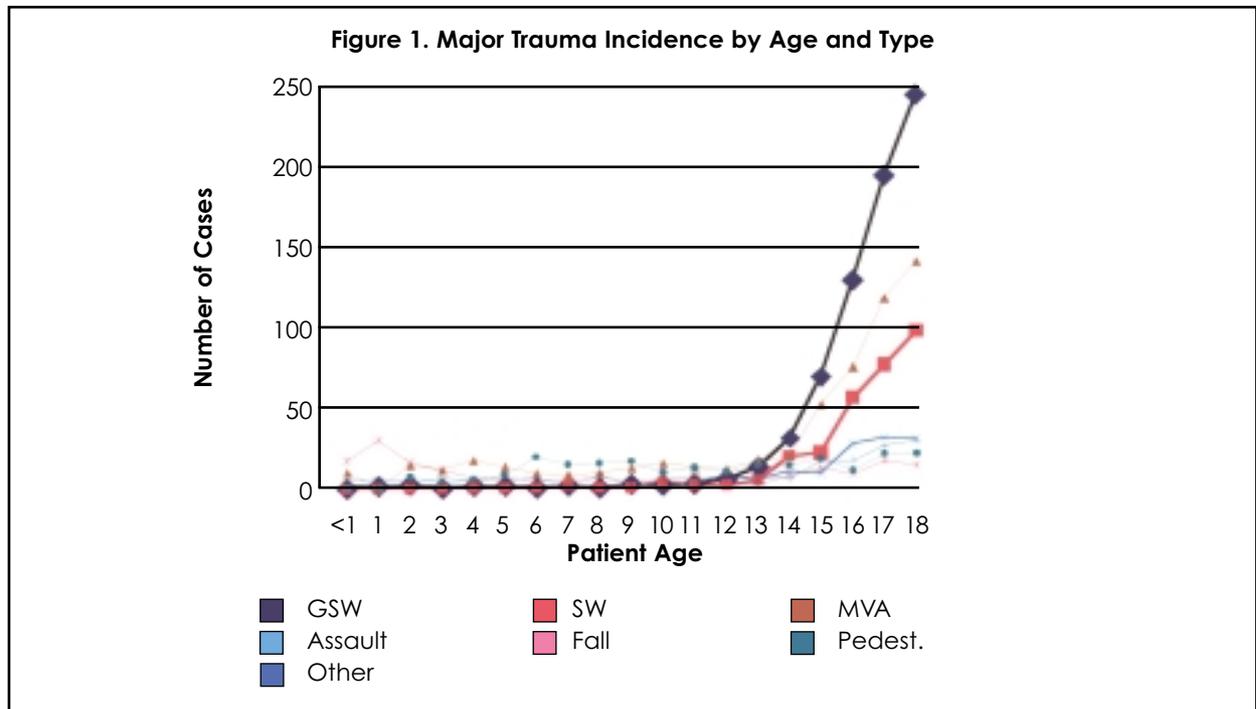
During the study period, the ED had 519,218 patient visits, including over 110,000 trauma victims (including major and minor trauma). During the study period, a total of 16,597 ED patients met major trauma criteria upon arrival, 2,191 (13%) of which were of age 0–18.

The mechanisms of injury in these 2,191 pediatric major trauma victims are shown in Table 2 and Figure 1. The expected rise in falls at age 1, children hit by cars at age 6, and MVCs in the teenage years were all seen.¹²

Of the 2,191 major trauma victims age birth–18, 688 (31%) had been shot and 276 (13%) had been stabbed, for a total of 964 (44% of pediatric major traumas) who had been the victim of a major shooting or stabbing.

Penetrating injury was the predominant etiology of major trauma in children after the 14th birthday (56%) but only accounted for 7% of the major injuries in younger children. Of the 964 major gunshot wound and stabbing cases aged birth–18 years, 926 (96%) were between the ages of 14 and 18. GSW victims 0–18 years old averaged 16.583 years of age; SW victims 0–18 years old averaged 16.534 years of age.

The number of major gunshot wounds of children aged 14 was greater than for all younger age groups combined, and the incidence of these injuries continued to rise sharply through age 18. This pattern was seen both in the summary data for the study period and in each of the eight years reviewed. Nearly twice the number of serious stabbings occurred in the one year after a child's 14th birthday than in all younger age groups combined. As with major gunshot wounds, the incidence of major stabbing then continued to rise sharply each year through age 18. This did not change over time during the eight-year study period. This pattern



was seen both in the overall data and in each of the eight years reviewed.

The ANOVA procedure was run for the gunshot wound and stabbing trauma data for ages 13 through 15. ANOVA determined that the age of the patient displayed a significant trend (F-value 11.5, $df=2$) such that as the child got older, his/her risk of being a victim of a major gunshot wound or stabbing increased. On the other hand, the year in which the incident occurred was judged random (F-value 1.36, $df=7$), meaning that the fluctuation in numbers between calendar years during the study period saw no significant pattern. That validated the use of the nonparametric Kruskal-Wallis tests performed on GSW and SW data separately. The Kruskal-Wallis tests found that the number of major gunshot and stabbing cases significantly increased in the year after the 14th birthday ($\alpha=0.0026$ for GSW; $\alpha=0.0099$ for SW). That was the first statistically significant increase ($p<0.05$) shown in the data. Although the number of GSW and SW start to rise before the 14th birthday, 14 is the age at which the increase in GSW and SW first exhibit a statistically significant increase.

DISCUSSION

The tools used to cause intentional injury to children age 0–18 are commonly found. According

to numerous surveys, over a third of American households own a firearm, making guns one of America's most common consumer products.¹³⁻¹⁶ This is in spite of the fact that there are 43 fatal shootings of family members or acquaintances—in suicides, homicides, or “accidents,” for each instance in which a gun at home is used to kill in self-defense.¹⁷ The number of handguns in America is currently projected at about 200 million,¹⁸ with approximately five million new firearms manufactured in the United States annually.¹⁹

Nationwide, guns rank a close second to motor vehicles as a cause of traumatic death.²⁰⁻²² Even though gun deaths reached a 30-year low in 1998, there were still 30,708 gun-related deaths in the United States that year. At that reduced incidence, every two years far more Americans are killed by guns than in all 11 years of the Vietnam War. The most recent CDC estimate is that 64,484 gun-related injuries are treated annually in the USA.¹⁸ In a 1995 study, Kizer et al. projected that the national cost of firearm-related injuries reached the \$4 billion mark. Projections from other sources have run even higher.²³

From the late 1980s until the early 1990s, the number of deaths due to intentional violence among school-aged children more than doubled, even as the death rates from other causes declined.^{20,24-26} In a 1991 national study, nearly 20%

Table 2. Age and Type of Injury 1992–1999

Age	GSW	SW	MVA	Assault	Fall	Pedest.	Other	Totals
0	0	0	10	2	17	1	5	35
1	1	0	0	1	30	0	6	38
2	2	0	14	2	16	7	3	44
3	0	0	11	1	11	3	6	32
4	1	0	17	0	6	5	5	34
5	1	0	13	1	6	8	5	34
6	0	0	9	1	5	19	6	40
7	1	1	8	0	4	14	1	29
8	0	0	9	0	7	15	7	38
9	2	0	12	1	3	16	1	35
10	1	3	15	1	5	9	5	39
11	2	1	12	2	5	12	7	41
12	5	1	11	7	4	9	5	42
13	12	4	16	4	1	13	7	57
14	30	19	19	9	7	13	5	102
15	68	21	51	8	11	17	16	192
16	128	55	74	26	8	10	16	317
17	192	75	117	30	16	20	25	475
18	242	96	139	29	13	20	28	567
Totals	688	276	557	125	175	211	159	2,191

of students in grades 9–12 reported that they had carried a firearm, knife, or a club as a weapon at least once during the 30 days preceding the survey.⁷ The phenomenon seemed to peak during the study period around 1995, when 5,277 American children age 19 and under were killed by guns (aver age 14.46/day)²⁷ Since then, the Federal Bureau of Investigation has reported that national crime rates have declined, and overall gun deaths have dropped more than 25%. Eight-thousand fewer murders were recorded in 1999 than in 1992, and recently reported murder rates are the lowest they have been for about 30 years.²⁸ Consistent with the national trend, there was first a rise and then a decline in intentional injury rates during the study period in Washington, DC.²⁹ During that time, we found that the onset of risk of major GSW and SW at age 14 remained constant.

Over the past decades, the social problem of serious violence, particularly among the youth of America, has gained increased recognition in medical literature.^{1,7,8,30-36} Often described as an epidemic,^{22,33,35} most of these cases are not really “accidents”:

“The murder I’m in for... the guy I shot started to threaten me. He put the gun up to my jaw and said that he would shoot me if I messed around with another guy.” (female, age 16)²⁰

“I use guns for the right use. I wouldn’t just shoot someone for nothing. You use it if you can’t handle the situation.” (male, age 16)²⁰

In our study, the risk of being a victim of a major gunshot wound rose abruptly at age 14 during each year of the 1992–1999 study period. Similarly, an abrupt rise in the incidence of major stabblings occurred at the same age. The risk of being a victim of a major gunshot wound or stabbing continued to rise sharply through the 18th birthday in each of the eight years studied. This pattern of increased risk of gunshot wounds and stabbing starting at age 14 stayed unchanged throughout the rise and subsequent fall of murder rates, overall intentional injury rates, and crime rates.

Although some violent antisocial behavior is fixed and not amenable to remediation, most is limited to adolescence and does not present a life-long pattern of behavior.³⁷⁻³⁹ The data presented here demonstrate that a child’s risk of being the victim of a major gunshot wound or stabbing started to rise significantly in the year after a child’s 14th birthday. This is consistent with reports of other aspects of youth violence.^{29,38} The impact of this finding, including its cost in terms of human life and survivor suffering, challenges health professionals, community leaders, elected officials,

and parents to respond. This challenge is particularly important, since recent work has demonstrated that violence prevention programs directed at children have proven to be effective.⁴⁰⁻⁴⁵

This study has a number of limitations. As with any retrospective review, it relies on the accuracy of previously inputted data. Additionally, fatalities that never arrived in the trauma center (patients dead at the scene and not resuscitated) were not included in our study, which introduces a possible source of selection bias. The vast majority of GSW and SW patients met our pre-established criteria for major trauma (See Table 1). Nevertheless, we did not study those who did not, and there exists the possibility that the increased risk of the most minor injuries from firearms and knives starts at a different age.

One of the notable findings of this study was that 44% of the pediatric major trauma patients were victims of penetrating injury—a marked distinction from the 4.8% penetrating injury seen in an average rural population and the 20% penetrating injury previously reported for pediatric trauma overall nationwide.¹⁵ Further research is necessary before our results can be generalized for other urban populations.

The degree to which violent, antisocial behavior is amenable to prevention is unknown. Although recent youth violence prevention programs have been shown to be partially effective, the cost-effectiveness, appropriate age, and optimal content of such programs remain largely unknown and open for future investigation.

CONCLUSION

In this urban environment, there is a marked increase in the incidence of serious injuries caused by guns and knives starting in the year after a child's 14th birthday. Even with fluctuating numbers of cases each year and a rise and subsequent fall in overall crime rates, the trend remains constant—the point at which the first statistically significant jump in the incidence of these injuries occurred at age 14 in each of the eight years studied. The data reported are potentially valuable for education and the targeting of injury prevention efforts.

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