Analysis of Intentional and Unintentional Injuries Caused by Firearms and Cutting/Piercing Instruments Among Providence Youth, Nov 2004–Dec 2007

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Despite declining rates of violent deaths over the last decade, homicide remains among the top 4 causes of death for Americans younger than 34 years old.[1] Morbidity from youth violence is also significant. In 2004, injuries from youth violence resulted in over 750,000 visits to **emergency departments (EDs)** nationwide.[2] In Rhode Island, 28% of RI high-school students reported at least one physical fight in the last year,[3] and according to hospital discharge data over 100 RI adolescents are hospitalized each year due to injury from assault.[4]

Risk factors for commission of youth violence are well-established; e.g., male gender, low socioeconomic status, availability of weapons, use of alcohol or drugs, and age between 12 and 20.[2, 5-7]

Demographic and behavioral correlates of injury from youth violence are not as clearly determined. Studies establish only that the best predictor of youth injury from violence is a previous violent injury.[8-12] Alcohol use and other known adult risk factors for violent injury[13-15] do not necessarily apply to youth.[9, 16] Moreover, studies of youth injury predictors rely on inpatient samples, and may be subject to bias from selection of a more severely injured population. Studies which rely on hospital discharge data may be subject to coding inaccuracies; some research suggests that erroneous external cause of injury codes are often given to youth injuries.[17, 18] EDs, in contrast, represent a wider spectrum of injury severity and type.[19-21]

This study was designed to address the lack of published data on trends of youth violent injury in Providence, as well as the need for additional data about risk factors and correlates of violent injury. We examined the distribution of intentional and unintentional injury from weapons (cutting/piercing and firearm) among Providence youth, the correlates and predictors of these violent injuries, and the accuracy of our ED coding of violent injury.

Methods

In this retrospective cross-sectional chart review of cutting/piercing and firearm injuries among Providence youth (younger than 21 years old), we examined all appropriate youth injuries presenting to Hasbro and Rhode Island Hospital EDs between November 1, 2004, and December 31, 2007. These hospitals provide the only adult and pediatric Level I trauma services in the state; they also have the highest ED volumes in the City of Providence. The Rhode Island Hospital/Lifespan Institutional Review Board approved the protocol.

Within the study time period, cases were selected from the ED billing databases using ICD-9-CM external cause of injury codes (E-codes): all cases corresponding to injuries from sharp (cutting/piercing) objects (E920.0-.9, E956, E966, E986, E974) or from firearms (E922.0-.9, E922.8. E922.9, E955.0-.4, E965.0-.5, E968.3, E979.4, E985.0-.6, E970) were retained. E-codes corresponding to assault with unknown object (E968.9) were also included, in case these assaults had occurred with a weapon but were miscoded. These codes encompass both unintentional and intentional injury. The first valid, relevant E-code was selected as per national guidelines for injury surveillance.[22] Records were further selected by age (< 21) and zip-code (02903, 02904, 02905, 02906, 02907, 02908, 02909, 02912, and 02940). Through this process, 446 charts were identified.

Two researchers, using a standardized chart review form and protocol, reviewed each chart.[23] In the case of discrepancies or questions, the reviewers consulted with each other and, when necessary, with a third member of the research team to reach a consensus about coding. All data were entered into a password-protected Excel database.

TABLE 1: Demographic Characteristics and Injury Type for Providence Youth treated in Hasbro/RIH ED, Nov 2004-Dec 2007 (n=446)

Age, yrs	mean 12.6 (SD 5.9) range 0-20
Sex	
M	295 (66%)
F	151 (34%)
Race/Ethnicity	
White	85 (19%)
Black	81 (18%)
Hispanic	117 (26%)
Asian	11 (2.5%)
Other	31 (7%)
Refused/not recorded	121 (27%)
Health Insurance	
Private	72 (16%)
Public	248 (56%)
Workers Comp	12 (3%)
Self-Pay	52 (12%)
Other	1 (0.25%)
Not recorded	61 (14%)
Type of injury (based on E-codes)	
Firearm	41 (9.2%)
Intentional-self *(Ecodes 955.0-.4, 955.6)*	0 (0%)
Intentional-other *(Ecodes 965.0-.4, 968.6, 970)*	29 (6.5%)
Unintentional *(Ecodes 922.0-922.9)*	11 (2.5%)
Not specified *(Ecodes 985.0-.4, 985.6)*	1 (0.22%)
Cutting/Piercing	284 (64%)
Intentional-self *(Ecode 956)*	6 (1.4%)
Intentional-other *(Ecodes 966, 968.7, 974)*	14 (3%)
Unintentional *(Ecodes 920.0-.9, 928.3)*	264 (59%)
Not specified *(Ecode 986)*	0 (0%)

During review, information regarding cases' age, sex, zip-code, type of insurance, and time and date of presentation was confirmed. Race/ethnicity was coded in patients' demographic information attached to the charts. Hispanic ethnicity was not specifically designated in demographic information; patients were identified as "Hispanic ethnicity" for the purpose of chart review if they Spanish as their primary language.

Use of alcohol or drugs was endorsed based on chart documentation of providers' clinical suspicion and/or actual measurement of alcohol/drug levels. The location at which the injury occurred and the patient's discharge status were recorded. In the case of intentional injuries, the patient's relationship to the perpetrator and the number of perpetrators were noted. The reviewers assessed each injury's intentionality (intentionally injured by self, unintentionally injured by self, intentionally injured by other, unintentionally injured by other) based on criteria in accordance with ICD-9 E-coding guidelines.[24] This chart review-based assessment of intentionality was compared with the E-code-determined intentionality recorded in the billing database.

Data were analyzed using Stata SE 10.0 (Stata Corp LP, College Park, TX). Simple descriptive statistics for demographics and assault characteristics were calculated. Demographics of injured youth were compared to statistics on Providence zip-codes' median incomes, percentage of children younger than 18 years old, and race/ethnicity as reported by The Providence Plan.[25] The relationship between intentionality and demographic/assault characteristics was assessed using Student's unpaired t, chi-square, and Fischer's exact tests of association.

TABLE 2: Comparison of Selected Demographic Characteristics of 446 Injured Providence Youth, by Intentionality of Injury (based on chart review)

		Intentional Injury	Unintentional Injury	p-value
Age		16 (15.5-16.5)	10 (9.7-11.2)	<.005
Sex	M	55 (76%)	155 (64%)	
	F	17 (24%)	87 (35%)	0.05
Incident Location				
	Home	15 (25%)	128 (61%)	
	Public Outdoors (e.g. Street)	32 (54%)	29 (14%)	
	Public Indoors (e.g., school)	4 (7%)	17 (8%)	
	Other's home (e.g., friend's house)	5 (8%)	8 (4%)	
	Commercial estab. (e.g., work)	2 (3%)	22 (11%)	
	Other	1 (2%)	5 (2%)	<.005
Zipcode				
	02903	10 (14%)	14 (6%)	
	02904	3 (4%)	20 (8%)	
	02905	14 (20%)	42 (17%)	
	02906	6 (8%)	10 (4%)	
	02907	22 (31%)	54 (22%)	
	02908	6 (8%)	40 (17%)	
	02909	11 (15%)	60 (25%)	
	02912	0 (0%)	1 (0.5%)	
	02940	0 (0%)	1 (0.5%)	0.06
Race/Ethnicity				
	Black	12 (17%)	54 (22%)	
	White	23 (32%)	35 (14%)	
	Hispanic	17 (24%)	61 (25%)	
	Asian	3 (4%)	6 (2%)	
	Other	5 (7%)	20 (8%)	
	Refused/not specified	12 (17%)	66 (27%)	0.02
Perpetrator				
	Self	14 (19%)	230 (95%)	
	Intimate partner	0 (0%)	0 (0%)	
	Other relative	2 (3%)	5 (2%)	
	Friend	3 (3%)	2 (0.8%)	
	Acquaintance	4 (6%)	2 (0.8%)	
	Stranger	6 (8%)	0 (0%)	
	Other/not specified*	44 (61%)	3 (1%)	<.005
Health Insurance				
	Private	9 (16%)	39 (18%)	
	Public	32 (59%)	149 (69%)	
	Workmans Compensation	5 (9%)	4 (2%)	
	Self-Pay	8 (15%)	22 (10%)	0.055

* There were 4 incidences of "other" perpetrator, 3 of which were for intentional injuries

Results

The results of the descriptive analysis are presented in Table 1. When comparing the characteristics of intentional and unintentional injuries using the categorization assigned during chart review, a number of significant differences between the two injury groups were found. (Table 2)

Injuries in general were more likely to occur in 02907 and 02909, the zip-codes with the lowest median incomes and the highest percentage of children under 18 in 2000.[25, 26] Forty-one percent (17/41) of firearm injuries occurred in the 02907 zip-code ($p < 0.005$). Intentional injuries were significantly more likely to occur between 8pm and 6am: 71% of intentional firearm injuries, 45% of intentional cutting/piercing injuries, and 36% of unintentional injuries occurring during this time ($p = 0.005$).

TABLE 3: Disparities between Intentionality, as determined by chart review, and Intentionality, as indicated by billing E-codes

Injury Type (as determined by billing E-code)	Intent of injury (as determined by chart review)		
	Intentional-self	Intentional-other	Unintentional
Firearms:			
Intentional – self	0	0	0
Intentional – other	0	26	**1***
Unintentional	0	**7***	2
Other/not specified	0	**1***	0
Cutting/Piercing:			
Intentional – self	6	0	0
Intentional – other	0	14	0
Unintentional	**8***	**10***	239
Other/not specified	0	0	0

* = charts where chart review-determined intentionality and E-code-determined intentionality differed

Very few of the characteristics that we hypothesized would be associated with intentional injury were regularly recorded in the charts. Documentation of alcohol and substance abuse was missing for 75% and 90% of charts, respectively. Of those with recorded alcohol levels (n=116), mean BAC was 122 (range 25-295); only 42 had recorded drug screens, of which 11 were positive, mainly marijuana (n=9). Similarly, 22% of all charts, and 74% of cases with intentional injuries, omitted the patient's relationship with the perpetrator. This lack of data limited our ability to examine associations between these characteristics and injury.

Finally, our comparison of intent according to hospital-provided E-codes versus chart-review found discrepancies for 27 charts (8.3% of all injuries). Nine disparities were firearm injuries (24% of firearm injuries). (Table 3)

Discussion

Several facts about injury from youth violence in Providence emerge.

First, unintentional cutting/piercing injuries were much more common than intentional injuries, occurred among a younger age group, and occurred primarily among children receiving public insurance. These findings suggest that efforts to prevent unintentional injuries in Providence should focus on prevention efforts with low-income families. (It is possible, however, that higher-income or privately insured children were seen elsewhere, therefore overestimating the burden of these injuries on low-income children.)

Second, demographic findings in this study differ from national data. Although males were more likely to suffer intentional violent injuries, the margin was smaller than nationally reported.[2] Moreover, unlike national data, in this study white/Caucasian patients were more likely to be intentionally injured than African-Americans or Hispanics.[2] More than three-quarters of Providence youth are Hispanic or non-white.[25] Some Hispanics may have been misclassified as "white/Caucasian."

Third, a significant percentage of charts lacked information regarding the characteristics of the injury and the patient's alcohol/substance abuse history. Other researchers have noted this absence– particularly intent, cause, and number of/relationship to perpetrators.[27] It may be because health care providers view the details of violent injury as too uncertain to document, outside of their purview, or not worth their time.[28] To draw accurate conclusions about predictors and correlates of youth violent injury, a much expanded research methodology is needed. One option would be to create a dedicated registry of violent injuries, possibly with standardized charting forms for ED physicians. For instance, because Rhode Island is already part of the National Violent Death Reporting System, this structure could be expanded to cover non-fatal violent injuries. Another option would be to have research assistants query violently injured youth during or soon after their ED stay.

Fourth, intentionality was misclassified by E-code (as compared to the chart review) for a number of injuries. The frequency of miscoding was higher for intentional than unintentional injuries. The difficulty in determining intentionality by E-code has been suggested previously;[17, 18, 29] our results substantiate this claim. Again, hospital billing records may be poor sources of data for injury prevention planning efforts.

Limitations

This study is subject to a few important limitations. First, data were obtained from only two of four 24-hour EDs in Providence. Although these EDs have almost three times the annual patient volume of the other Providence hospitals and comprise the state's only Level I trauma centers, it is possible that this study missed some youth injuries. Second, injured youth who sought care in private physicians' offices or from free-standing urgent care facilities are excluded from the study. As a result, the uninsured and those with public health insurance as well as youth with more serious injuries may be over-represented. Third, we depended on hospital-assigned E-codes for initial selection of charts. It is possible that we missed injuries miscoded as not due to injury. Fourth, the small number of intentional injuries limits our ability to analyze characteristics of these injuries in detail. Fifth, we probably undercounted or misclassified Hispanics.

Conclusion

Demographic characteristics of intentional and unintentional cutting, piercing, and firearm injuries among Providence youth differ from national statistics. The high percentage of injuries among youth with public health insurance suggests the need for prevention interventions targeting this population. Although billing data are frequently utilized to describe injury patterns, these data sometimes conflict with the chart-documented intentionality of the injury, especially for firearm-related injuries. A standardized violent-injury registry may be the most accurate way to collect accurate, comprehensive data on the characteristics of injured youth and the circumstances of these injuries.

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Disclosure of Financial Interests

The authors have no financial interests to disclose.

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