Firearm Violence Among High-Risk Emergency Department Youth After an Assault Injury

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BACKGROUND: The risk for firearm violence among high-risk youth after treatment for an assault is unknown.

abstract

METHODS: In this 2-year prospective cohort study, data were analyzed from a consecutive sample of 14- to 24-year-olds with drug use in the past 6 months seeking assault-injury care (AIG) at an urban level 1 emergency department (ED) compared with a proportionally sampled comparison group (CG) of drug-using nonassaulted youth. Validated measures were administered at baseline and follow-up (6, 12, 18, 24 months).

RESULTS: A total of 349 AIG and 250 CG youth were followed for 24 months. During the follow-up period, 59% of the AIG reported firearm violence, a 40% higher risk than was observed among the CG (59.0% vs. 42.5%; relative risk [RR] = 1.39). Among those reporting firearm violence, 31.7% reported aggression, and 96.4% reported victimization, including 19 firearm injuries requiring medical care and 2 homicides. The majority with firearm violence (63.5%) reported at least 1 event within the first 6 months. Poisson regression identified baseline predictors of firearm violence, including male gender (RR = 1.51), African American race (RR = 1.26), assault-injury (RR = 1.35), firearm possession (RR = 1.23), attitudes favoring retaliation (RR = 1.03), posttraumatic stress disorder (RR = 1.39), and a drug use disorder (RR = 1.22).

CONCLUSIONS: High-risk youth presenting to urban EDs for assault have elevated rates of subsequent firearm violence. Interventions at an index visit addressing substance use, mental health needs, retaliatory attitudes, and firearm possession may help decrease firearm violence among urban youth.

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WHAT'S KNOWN ON THIS SUBJECT: Firearm violence is a leading cause of death among US youth aged 14 to 24. The emergency department is a key setting for interacting with high-risk assault-injured youth and remains an underused but important setting for violence prevention programs.

WHAT THIS STUDY ADDS: High-risk youth seeking emergency department care for assault have high rates of firearm violence over the subsequent 2 years. Higher severity substance use, combined with negative retaliatory attitudes and access to firearms, increases this risk for involvement with firearm violence.

Firearm homicide is the leading cause of death among African American youth and the second leading cause of death among youth overall regardless of race and ethnicity,¹ with rates twice those among adults¹ and 42.7 times higher than rates among youth in 22 similarly developed nations.² Firearms are also responsible for 31% of the 900 000 nonfatal adolescent assault injuries treated annually in emergency departments (EDs).¹ The cost of acute firearm-related injury care is substantial, approaching \$630 million annually in the United States before including costs for lost wages/productivity, long-term medical care, and legal/criminal justice proceedings.³ Adolescent firearm injuries account for the greatest share of these costs, almost 42%, with public insurance programs and the uninsured assuming 80% of the cost burden.³ This problem has led national medical organizations,^{4–6} including the Institute of Medicine,⁷ to recognize an urgent need to develop prevention programs that decrease firearm violence among high-risk populations.

Recently, violence researchers have focused national attention on the lack of data necessary to inform such prevention efforts.^{8–12} Although the risk for future firearm violence among youth undergoing violent injury care is recognized as high, no researchers have conducted longitudinal studies examining the incidence of firearm violence after an assault injury or its relation to modifiable or treatable risk factors. Urban EDs represent an underutilized resource for conducting such surveillance.⁴ Among assault-injured youth seeking urban ED care, almost 25% report having a firearm, with recent violence, attitudes favoring retaliation, and illicit drug use cited as key risk factors for illicit firearm possession.¹³ Substance use, which is as high as 55% among assault-injured ED youth,¹⁴ has also been shown to be a key risk factor for a range of

high-risk firearm behaviors, including weapon carriage,^{15,16} unsafe weapon storage,¹⁶ and firearm-related threats against others.¹⁷ Furthermore, although almost 50% of assault-injured ED youth have a recent mental health diagnosis (eg, major depressive episode, posttraumatic stress disorder [PTSD]), <20% have received treatment for that illness,¹⁸ and previous studies have not characterized how a preexisting mental health diagnosis may contribute to future firearm violence risk in this population. Such data are critical to informing evidence-based violence interventions that can be applied among assault-injured youth.

The Flint Youth Injury Study^{14,18} is a 2-year longitudinal study examining violent injury and substance use among drug-using youth seeking ED care for an assault or as part of a comparison cohort of drug-using youth seeking care for unintentional injury or medical reasons. This study has demonstrated that assault-injured drug-using youth have substantial rates of violent injury recidivism, with 36% returning to the ED within 2 years for another violent injury.¹⁹ The objectives of this analysis are (1) to describe rates of firearm aggression, victimization, and fatal/nonfatal firearm injury during the 2 years after an ED visit for assault and (2) to examine modifiable predictors of this firearm violence, including substance use, mental health disorders, attitudes favoring retaliation, and firearm possession.

METHODS

Study Design and Setting

This 2-year prospective cohort study examined firearm violence outcomes among a consecutively obtained ED sample of assault-injured youth (aged 14–24 years) with past 6-month drug use (AIG) compared with a proportionally sampled (by age and gender) comparison group (CG) of nonassaulted, drug-using youth. The

study was conducted in the Hurley Medical Center (HMC) ED in Flint, Michigan, which serves as the region's only level 1 trauma center and provides care for ~75 000 adult and ~25 000 pediatric (<20 years old) patients annually. The study population reflects Flint, which is 50% to 60% African American²⁰ and is similar to previous HMC studies.^{21–23} Flint violent crime and poverty rates are comparable to other urban settings.²⁴ The University of Michigan and HMC institutional review boards approved all study procedures; a National Institutes of Health Certificate of Confidentiality was obtained.

Study Population and Recruitment

Recruitment proceeded 7 days per week, excluding holidays, between December 2009 and September 2011, with trained research assistants (RAs) recruiting 21 hours (5 AM–2 AM) on Tuesday and Wednesday and 24 hours a day Thursday through Monday. Youth seeking ED care for assault and reporting past 6-month drug use, as well as a proportionally sampled CG of nonassaulted drug-using ED youth were eligible for the longitudinal study. Assaults were defined as any intentional injury caused by another person. Participants presenting for acute sexual assault, child maltreatment (ie, injury by an adult caregiver), suicidal ideation or attempt, or a medical condition preventing consent (eg, altered mental status, acute alcohol impairment) were excluded. Youth <18 years old without a parent/guardian present were excluded. Unstable trauma patients were recruited after admission if they stabilized within 72 hours.

Study Protocol

RAs approached participants in ED waiting or treatment areas. Written assent/consent (parental consent if <18 years old) was obtained. Participants self-administered a computerized screening survey¹⁴

to assess study eligibility, specifically past 6-month drug use (the National Institute on Drug Abuse Alcohol Smoking and Substance Involvement Screening Test [NIDA ASSIST]^{25,26}). The CG was recruited in parallel to limit seasonal/temporal variation, and was systematically enrolled to balance the cohorts by age (ie, 14–17, 18–20, 21–24) and gender. For example, after screening and enrolling a male 18-year-old with an assault and past 6-month drug use history, the RA would recruit sequentially, by triage time, the next male 18- to 20-year-old arriving for a medical complaint or unintentional injury who also reported past 6-month drug use. Surveys were administered privately (family and friends could not participate or observe) and were paused for medical evaluations and procedures to avoid interfering with care. Youth enrolled in the longitudinal study completed an ~90-minute baseline survey, including both a self-administered and an RA-structured interview¹⁸ and were reimbursed \$20. In-person follow-up assessments were completed in the ED or community (eg, library, jail) at 6, 12, 18, and 24 months. Participants were remunerated \$35, \$40, \$40, and \$50 at each sequential follow-up.

Measures

Firearm Violence

The main outcome measure was a composite of self-reported firearm aggression or victimization and objective measures of firearm injury/mortality within 24 months of the baseline assessment. Self-reported aggression (threatening with a firearm, use against others) or victimization (threatened with a firearm, shot at) were assessed using measures from the National Longitudinal Study of Adolescent Health (Add-Health)²⁷ and revised Conflict Tactics Scales (CTS2).^{28–30} Self-report data were supplemented with objective ED medical chart review of firearm injuries at each follow-up. RAs

categorized firearm assaults from medical charts using standard E-codes³¹ and calculated injury severity scores (ISS).³² Medical charts were audited (error rate <5%).³³ Out-of-hospital firearm mortality was assessed through family members during attempted follow-up and supplemented with both chart review at the study hospital and review of local media and public mortality records (ie, vital records database).

Sociodemographics

Demographics and socioeconomic measures were from the National Longitudinal Study of Adolescent Health and the Drug Abuse Treatment Outcome Studies.^{27,34–36}

Substance Use

The Alcohol Use Disorders Identification Test^{37,38} and the substance use involvement screening tests (NIDA-ASSIST)^{25,26} assessed past 6-month substance use, including alcohol, marijuana, nonmedical prescription drugs (stimulants, sedatives, and opiates), and illicit drugs (cocaine, inhalants, street opioids, methamphetamine, and hallucinogens). Binge drinking was defined as ≥ 5 drinks at once. The RA-administered Mini International Neuropsychiatric Interview (MINI, version 6.0, January 1, 2010) assessed diagnostic criteria for an alcohol or drug use disorder (ie, abuse or dependence).^{39,40} Substance use variables were dichotomized.

Firearm Carriage and Possession

As in previous work,¹³ past 6-month firearm possession was a composite of 5 measures from the Tulane Study^{41,42} characterizing firearm ownership/carriage. Measures excluded hunting or sporting activities. An affirmative answer to any individual measure was coded as firearm possession. Carriage under the influence of drugs or alcohol was measured using 2 Add-Health²⁷ measures. A modified CTS2 response

scale was used, and measures were collapsed for analysis.

Retaliation

Retaliatory attitudes were assessed by using a retaliation subscale of children's perceptions of environmental violence.^{43,44} Items were reverse coded (higher scores indicated more willingness to endorse retaliation). A mean participant summary score was created and then averaged for an overall summary score.

Mental Health

Mental health disorders, including a major depressive episode (past 2 weeks) and PTSD (past month), were assessed by using the RA administered MINI/MINI-KID,^{39,40} reflecting *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* diagnostic criteria.

Criminal Justice/Gang Involvement

A yes/no item from the Addiction Severity Index⁴⁵ was used to assess legal status (probation/parole). Gang membership was assessed with a question from the Tulane Study.^{41,42}

Statistical Analyses

Firearm violence rates within 24 months were calculated for the sample overall and by cohort (AIG or CG). Bivariate associations with the outcome of interest (ie, 24-month firearm violence) were evaluated. Poisson regression identified baseline characteristics associated with firearm violence. Independent variables were chosen based on bivariate significance and/or theory.^{18,46–49} Drug use disorder was retained over alcohol use disorder in the final model given that the incidence of drug use disorders (58.4% vs 18.0%) was higher. Firearm behaviors could not all be included in the final model because of multicollinearity; firearm possession was included because it is a theoretically important predictor for violence.^{46–49} Because only 5.8%

of the sample ($n = 28$) endorsed gang membership, it was not included in the model.

RESULTS

Baseline Sample and Follow-up Rates

Overall, 599 youth (AIG = 349, CG = 250) were enrolled in the longitudinal study (Fig 1). Baseline characteristics have been previously reported, and characteristics of individual AIG and CG cohorts are summarized in Fig 1.¹⁸ Of note, we found no difference between the baseline cohorts with regards to age, gender, race, and socioeconomic status.¹⁸ In the AIG, 20% ($n = 70$) sustained a firearm-related injury (mean ISS = 7.2) as the mechanism of injury at baseline.¹⁹ Follow-up rates for the entire cohort were 85.3%, 83.7%, 84.2%, and 85.3% at 6, 12, 18, and 24 months, respectively,¹⁹ with no differential follow-up by cohort. Among the baseline cohort, 483 participants (80.6%) had completed data at all time points or had an affirmative answer to the subjective/objective firearm violence measures at 1 or more time points, allowing for definitive assessment of firearm violence within 24 months and inclusion in this analysis.

Rates of Firearm Violence Within 24 Months of the Baseline ED Visit

Almost 60% of the AIG reported firearm violence within 24 months of the index visit, an almost 40% higher risk than was observed among the CG (59.0% vs 42.5%; relative risk = 1.39; $P < .001$). Of those reporting firearm violence ($n = 252$), 96.4% ($n = 243$) reported victimization, including being threatened/shot at with a firearm ($n = 238$; 94.4%), sustaining a firearm injury requiring ED care ($n = 19$; 7.5%, mean ISS = 7.0), or death from a firearm ($n = 2$). In addition, 31.7% ($n = 80$) of those with firearm violence reported aggression, including threatening or shooting at someone with a firearm. Among those with aggression, more than half

($n = 42$; 52.5%) reported owning or carrying a firearm at the time of the baseline visit. Among those in the AIG who presented with a firearm injury at baseline and were included in the follow-up cohort ($n = 62$), 82% ($n = 51$) reported firearm violence, with 5 (8%) sustaining either a nonfatal ($n = 4$) or fatal ($n = 1$) firearm injury. Among those with firearm violence ($n = 252$), most ($n = 194$, 77.0%) reported >1 incident (Table 1). In addition, the majority (63.5%) reported ≥ 1 incident within the first 6 months, with rates higher among AIG participants at 6 months (Fig 2; $P < .05$).

Baseline Characteristics Associated With 24-Month Firearm Violence

Table 2 presents the bivariate analysis. Those with firearm violence were more likely than those without firearm violence to have endorsed high-risk firearm/violence behaviors at baseline, including firearm possession or carriage ($P < .001$) and attitudes favoring retaliation ($P < .001$), endorsing statements such as “I believe that if someone hits you, you should hit them back,” “I believe to survive you should always be willing to fight back,” and “I believe that it is okay to hurt people if they hurt you first.” Among those reporting possession of a firearm at the baseline visit, 65% ($n = 87$) were involved in firearm violence during follow-up. Furthermore, the majority (64.4%; $n = 38$) of those noting their motive for firearm possession was “protection” ($n = 59$) also reported engaging in firearm violence, with 63.2% ($n = 24$) using that firearm in an aggressive act.

Those with firearm violence were more likely than those without to meet criteria for an alcohol ($P < .001$) or drug use disorder ($P < .001$) at baseline, as well as combine their substance use with high-risk firearm behaviors such as carriage while impaired ($P < .001$). In addition, half of those endorsing firearm violence (50%, $n = 126$) met diagnostic

criteria for a recent mental health illness (eg, depression), with significantly higher rates of PTSD ($P < .05$) among those with subsequent firearm violence.

Poisson regression modeling (Table 3) identified that male gender ($P < .001$), African American race ($P < .01$), ED presentation for assault ($P < .001$), firearm possession ($P < .05$), retaliatory attitudes ($P < .01$), and meeting criteria for a drug use disorder ($P < .05$) or PTSD ($P < .01$) were predictive of subsequent firearm violence. Baseline age, socioeconomic status, and criminal justice involvement were not significant in the model.

DISCUSSION

This study found that 59% of assault-injured youth report violent firearm aggression, victimization, and/or a firearm injury within 2 years of their index ED visit, a 40% higher risk than was observed among nonviolently injured high-risk youth seeking medical/injury care in an urban ED. Although nearly all participants engaging in firearm violence reported victimization, almost a third also reported being the aggressor in an altercation, and nearly 8% sustained a fatal or nonfatal firearm injury. In addition, 77% of those endorsing firearm violence reported that their involvement was not limited to a single episode, with those engaged in firearm violence reporting an average of almost 8 incidents. Direct literature comparisons are limited because this longitudinal study, to our knowledge, is the first to comprehensively characterize such a broad range of firearm violence outcomes among a systematically sampled cohort of assault-injured youth. Observed rates of firearm behaviors, however, are higher than those in national adolescent samples,^{50,51} as well as in previous ED- and school-based studies that have focused on either violent injury

FIGURE 1

Flint Youth Injury Study Flowchart (December 2009–September 2011). * Assault-injured patients seeking care not during recruitment shifts, $n = 319$ (18.6%); only 18.6% of assault injured youth sought ED care during a time when RA was not present. ** See Methods for details. STD, sexually transmitted disease.

recidivism^{19,52–54} or examined surrogate markers (eg, firearm possession/carriage; severe peer violence)^{13,46,55,56} for firearm violence. Our results highlight that an

ED assault-injury visit is an important indicator of future firearm violence risk and emphasize the substantial need for evidence-based interventions addressing this risk.

The majority of those with firearm violence had at least 1 event within the first 6 months after the ED visit for assault. This, combined with the finding that baseline attitudes

TABLE 1 Mean Number of Firearm Violence Events per Participant Endorsing Firearm Aggression, Victimization, and/or Nonfatal Firearm Injury

Type of Firearm Violence	AIG, Mean (SD)	CG, Mean (SD)	Total Cohort, Mean (SD)
Firearm aggression (<i>n</i> = 80)			
Pulled a firearm	3.75 (5.93)	3.28 (3.27)	3.54 (4.90)
Used a firearm on a peer/dating partner	6.31 (7.83)	4.45 (3.89)	5.55 (5.63)
Any self-report of firearm aggression	6.36 (10.43)	6.13 (6.60)	6.28 (9.13)
Firearm victimization (<i>n</i> = 238)			
Someone pulled a firearm	3.58 (6.86)	3.00 (3.35)	3.37 (3.85)
Peer/partner used a firearm	3.72 (7.19)	3.65 (5.42)	3.70 (6.75)
Any self-report firearm victimization	6.17 (12.46)	4.78 (6.99)	5.71 (10.97)
Fatal or nonfatal firearm injury (<i>n</i> = 19)	1.23 (0.60)	1.17 (0.41)	1.21 (0.54)
Any firearm violence (<i>n</i> = 252)	7.92 (17.51)	6.65 (1.14)	7.54 (15.53)

No statistical differences were noted between the AIG and CG for mean number of events.

favoring retaliation were predictive of firearm violence in the regression model, raises concerns that retaliation may have been a significant motivation for the ensuing firearm violence. In fact, among our baseline sample, almost half of those seeking assault care did not feel the altercation prompting their visit was over, and almost a quarter indicated that they, or their friends or family would likely retaliate.¹⁴ This finding is consistent with research identifying the immediate post-ED time period as a high-risk time for retaliatory violence,^{57,58} as well as literature indicating retaliatory violence is a key

motivation for adolescent fighting.^{58,59} Taken together, this finding underscores the need for ED screening of retaliation risk and violence interventions that focus on alternatives means of conflict resolution.

Half of those with firearm violence also reported a mental health diagnosis at baseline, with PTSD predictive in the regression model. PTSD symptoms such as hyperarousal are suggested to contribute to an increased potential for violent aggression, whereas impaired processing, hypervigilance, and high rates of concurrent substance use are thought to decrease defensive signals

that can increase victimization.^{60,61} It is important to note that the overall sample in this urban low-resource community, including our comparison group, had high rates of depression and PTSD and could likely benefit from mental health services. Our findings also emphasized the association between firearm violence and substance use, with a drug use disorder predicting firearm violence in the regression model even among a sample of youth with drug use. Furthermore, almost a quarter of those with firearm violence reported recent firearm carriage while impaired, raising concerns that acute intoxication may contribute to impulsive firearm use during an altercation. Previous research has demonstrated that both single-session substance use²¹⁻²³ and combined multisession collaborative care interventions that simultaneously address multiple comorbidities (eg, PTSD, substance use, weapon carrying, psychosocial needs)⁶² are effective decreasing violence behaviors, including aggression and weapon carriage, among lower risk samples. This finding, combined with the overall high rates of violence, mental health disease, and substance-use disorders observed in our sample, emphasizes the need to consider such combined and sustained treatment strategies as a component of future prevention and intervention programs, especially among higher risk youth samples that commonly seek care in low-resource urban settings. Finally, although the firearms among this sample were largely obtained illegally,¹³ findings suggest that greater attention to mental health and substance use as a component of licensure for legal firearm ownership may also be warranted.

Firearm possession has been shown to increase the risk of both firearm homicide⁶³⁻⁶⁶ and nonfatal firearm assault⁴⁸ in national case-control studies or among adult ED samples. Consistent with this, we found that

FIGURE 2

Percent of respondents in follow-up sample reporting firearm violence by cohort assignment at 6-month intervals. * Indicates significant difference between groups at the .05 level.

TABLE 2 Bivariate Comparison of Baseline ED Visit Characteristics for Those Participants With and Without Firearm Violence at 24 Months Postindex ED Visit

	Firearm Violence <i>n</i> = 252 (52.2%)	No Firearm Violence <i>n</i> = 231 (47.8%)	RR (95% CI)
Demographic characteristics			
Age	19.97 (2.34)	19.91 (2.48)	1.00 (0.96–1.03)
Male***	173 (68.65)	104 (45.02)	1.63 (1.34–1.98)
African American*	171 (67.86)	131 (56.71)	1.27 (1.05–1.53)
Married/living with partner	70 (27.78)	61 (26.41)	1.03 (0.86–1.25)
Parent/self on public assistance*	182 (72.22)	186 (80.52)	0.81 (0.68–0.97)
Children	104 (41.27)	91 (39.39)	1.04 (0.87–1.23)
Index ED visit presentation			
Assault injury at baseline ED visit***	167 (66.27)	116 (50.22)	1.39 (1.15–1.68)
Past 6-mo substance use			
Marijuana use	247 (98.02)	226 (97.84)	1.04 (0.56–1.95)
Illicit drug use (excluding marijuana)	30 (11.90)	20 (8.66)	1.17 (0.92–1.49)
Binge drinking**	118 (46.83)	79 (34.20)	1.28 (1.08–1.51)
Alcohol use disorder (abuse/dependence)**	57 (22.62)	30 (12.99)	1.33 (1.11–1.60)
Drug use disorder (abuse/dependence)***	167 (66.27)	115 (49.78)	1.40 (1.16–1.69)
Past 6-mo violence behaviors			
Firearm possession***	90 (35.71)	46 (19.91)	1.42 (1.20–1.67)
Firearm carriage***	49 (19.44)	19 (8.23)	1.47 (1.23–1.76)
Firearm carriage under drugs/alcohol***	61 (24.21)	26 (10.82)	1.47 (1.24–1.75)
Retaliatory attitudes (summary score)**	18.39 (3.74)	17.21 (3.62)	1.05 (1.02–1.07)
Mental health disease			
PTSD (past month)*	33 (13.10)	16 (6.93)	1.33 (1.08–1.66)
Major depressive episode (past 2 wk)	40 (15.87)	27 (11.69)	1.17 (0.94–1.46)
Criminal justice involvement			
Probation/parole***	45 (17.86)	16 (6.96)	1.50 (1.26–1.79)

CI, confidence interval; RR, relative risk.

**P* < .05.

***P* < .01.

****P* < .001.

firearm possession at the baseline visit was predictive of subsequent firearm violence among our youth

TABLE 3 Poisson Regression Analysis of Baseline Visit Characteristics Predicting Firearm Violence Within 24 Months of an Index ED Visit for Assault or as Part of an Age- and Gender-Matched Comparison Group

Baseline Visit Predictor	RR (95% CI)
Age	1.01 (0.98–1.05)
Male***	1.51 (1.24–1.85)
Public assistance	0.93 (0.79–1.11)
African American**	1.26 (1.06–1.51)
AIQ***	1.35 (1.13–1.61)
Firearm possession*	1.23 (1.04–1.44)
Retaliatory attitudes**	1.03 (1.01–1.05)
PTSD**	1.39 (1.13–1.71)
Drug use disorder*	1.22 (1.01–1.46)
Criminal justice involvement	1.17 (0.98–1.41)

CI, confidence interval; RR, relative risk.

**P* < .05.

***P* < .01.

****P* < .001.

cohort. Previous ED- and school-based studies^{13,67} indicate that youth principally report owning firearms for protection, citing high levels of community violence. Yet in our sample, almost 65% of those who noted their motive for firearm possession was “protection” were also involved in firearm violence during the follow-up period, the majority (63%) reporting that they used the firearm in an aggressive act. This finding is consistent with previous theories^{48,68,69} suggesting that having a firearm may empower youth to act more aggressively during a confrontation or enter dangerous environments they might normally avoid. It is also consistent with previous research indicating that after controlling for other effects, youth most commonly indicate that they carry firearms because they fear victimization⁷⁰ and may preemptively

act in an aggressive manner to prevent victimization.⁷¹ Regardless, results suggest that individual- and community-level interventions are needed to address perceived and real feelings of inadequate safety, as well as to identify alternatives to firearm carriage for protection among urban youth in low-resource communities. Among those endorsing firearm aggression, more than half reported having a firearm at the baseline visit. Because our previous work has shown that 80% of firearms in this population are obtained illegally,¹³ these results also emphasize the need for stronger enforcement of existing firearm diversion policies as well as the development of novel public policies that restrict illegal weapon access among high-risk youth.

As in previous violence studies,^{46,72,73} male gender was predictive of firearm violence. Consistent with epidemiologic data highlighting the disproportionate effect of violence among minority youth,¹ African American race was also predictive of firearm violence, likely reflecting unmeasured socioeconomic factors and/or high levels of neighborhood violence.

Several limitations should be noted. This study was conducted at a single urban ED, limiting generalizability to both suburban and rural settings. In addition, although our sample reflected the local population, future studies among other racial and ethnic groups are needed. The use of self-report survey data is a potential limitation, but previous studies support the reliability and validity of self-reported risk behaviors when privacy/confidentiality is ensured and when using self-administered computerized assessments.^{74–79} Because this was a sample of drug-using youth (including youth with any marijuana or other drug use in the past 6 months), our ability to generalize the study findings to assault-injured youth without past 6-month drug use or to examine

firearm violence rates among the assault-injured group compared with lower risk non-drug-using youth is limited, and therefore the relative risk of firearm violence reported here may be smaller than in a more general population. Finally, the inclusion of only participants with definitive responses to firearm violence measures may underestimate the degree of firearm violence within the follow-up sample.

CONCLUSIONS

Firearm violence is a complex but preventable public health problem.⁴ Until recently, most health care providers have focused on the

treatment of a patient's physical wounds without capitalizing on this teachable moment to intervene and address their underlying risk for future firearm violence.^{4,80} The current study highlights that this risk is substantial, with almost 60% of assault-injured, drug-using youth reporting firearm aggression, victimization, or injury over the subsequent 2-year period. Furthermore, secondary violence prevention initiatives that comprehensively address substance use, retaliatory violence, firearm possession, and mental health needs may have the potential to capitalize on this teachable moment and

decrease the morbidity and mortality associated with urban firearm violence.

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CALCULATING BENEFIT: *My sister, a highly educated woman, visited me last month. Over dinner one evening we got into a heated argument about health care in the United States. She was livid that her health care plan limited her options and would not pay for specialized MR imaging. When I suggested that perhaps the reason the plan would not pay for the MR imaging was because data showed that MR imaging did not change management or outcomes and only increased cost, she replied that her physician knows her best and should be able to decide which tests were most appropriate for her. We went through several permutations but, for whatever reason, I had difficulty explaining to her how to measure benefit and harm associated with medical interventions.*

As reported in The New York Times (The Upshot: January 26, 2015), one such set of numbers is the number needed to treat (NNT) and the number needed to harm (NNH). The NNT tells us the average number of patients who need to be treated to prevent one additional bad outcome. The NNH tells us the average number of patients treated (or exposed to the harm) to cause harm in one patient who would not otherwise have been harmed. In a perfect world, all our interventions would be associated with an NNT of 1 (the intervention helped every one) with a very high NNH. Alas, most interventions are associated with a remarkably high NNT. For example, using data from clinical trials, if 2,000 people who have at least a 10% risk of heart attack over the next 10 years take an aspirin a day for two years, one additional first heart attack will be prevented (NNT = 2,000). Of course, it is hard to predict who that one person will be. My sister would argue that as long as the intervention was not harmful (e.g. the NNH was greater than the NNT) the intervention is appropriate. I am less inclined to accept that approach. The hope is that in the future we can better identify the individuals most likely to benefit from our interventions. That way we can better tailor our therapy (and my sister and I will not argue quite so much).

Noted by WVR, MD