Violent Firearm-Related Conflicts among High-risk Youth: An Event-level and Daily Calendar Analysis

Patrick M. Carter, MD[1,2,3], **Maureen A. Walton, MPH PhD**[1,3,4], **Jason Goldstick, PhD**[1,2,3], **Quyen M. Epstein-Ngo, PhD**[1,2,5], **Marc A. Zimmerman, PhD**[1,3,6], **Melissa C. Mercado, PhD**[7], **Amanda Garcia Williams, PhD**[7,8], and **Rebecca M. Cunningham, MD**[1,2,3,6,9]

[1]University of Michigan Injury Center, University of Michigan School of Medicine, 2800 Plymouth Road, NCRC 10-G080, Ann Arbor, Michigan, 48109

[2]Department of Emergency Medicine, University of Michigan School of Medicine, 1500 East Medical Center Drive, Ann Arbor, Michigan, 48105

[3]Michigan Youth Violence Prevention Center, University of Michigan School of Public Health, 1415 Washington Heights, Ann Arbor, Michigan, 48109

[4]University of Michigan Addiction Research Center, Department of Psychiatry, University of Michigan School of Medicine, 4250 Plymouth Rd. Ann Arbor, Michigan, 48109

[5]Institute for Research on Women and Gender, University of Michigan, 204 S. State Street, Ann Arbor, Michigan, 48109

[6]Department of Health Behavior & Health Education, University of Michigan School of Public Health, 1415 Washington Heights 3790A SPH I, Ann Arbor, Michigan, 48109

[7]Division of Violence Prevention, National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, 4770 Buford Hwy NE, Mailstop F-64, Atlanta GA 30341-3717

[8]Epidemic Intelligence Service, Epidemiology Workforce Branch, Centers for Disease Control and Prevention, 1600 Clifton Road NE, Mailstop E-92, Atlanta, GA 30329-4027

[9]Hurley Medical Center, Department of Emergency Medicine, 1 Hurley Plaza, Flint, Michigan, 48503

Corresponding Author: Patrick M. Carter, MD: Department of Emergency Medicine, University of Michigan, 2800 Plymouth Road, NCRC 10-G080, Ann Arbor, Michigan, 48109. cartpatr@med.umich.edu Phone: 781-820-1881.

Abstract

Firearm homicide is the leading cause of violence-related youth mortality. To inform prevention efforts, we analyzed event-level data to identify unique precursors to firearm conflicts. Youth (ages:14–24) seeking Emergency Department (ED) treatment for assault or for other reasons and reporting past 6-month drug use were enrolled in a 2-year longitudinal study. Time-line follow-back substance use/aggression modules were administered at baseline and each 6-month follow-up. Violent non-partner conflicts were combined across time-points. Regression analyzed: a)antecedents of firearm-related conflicts (i.e., threats/use) as compared to non-firearm conflicts; and b)substance use on conflict (vs. non-conflict) days for those engaged in firearm conflict. During the 24-months, we found that 421-youth reported involvement in violent non-partner conflict (n=829-conflicts;197-firearm/632-non-firearm). Among firearm conflicts, 24.9% involved aggression and 92.9% involved victimization. Retaliation was the most common motivation for firearm-aggression (51.0%), while "shot for no reason" (29.5%) and conflicts motivated by arguments over "personal belongings" (24.0%) were most common for firearm-victimization. Male sex (AOR=5.14), Black race (AOR=2.75), a ED visit for assault (AOR=3.46), marijuana use before the conflict (AOR=2.02), and conflicts motivated by retaliation (AOR=4.57) or personal belongings (AOR=2.28) increased the odds that a conflict involved firearms. Alcohol (AOR=2.80), marijuana (AOR=1.63), and prescription drugs (AOR=4.06) had a higher association with conflict (vs. non-conflict) days among youth reporting firearm conflict. Overall, we found that firearm conflicts are differentially associated with substance use and violence motivations. Addressing substance use, interrupting the cycle of retaliatory violence, and developing conflict resolution strategies that address escalation over infringement on personal belongings may aid in decreasing and preventing adolescent firearm violence.

Keywords

INTRODUCTION

Firearm homicide is the leading cause of violence-related mortality for U.S. youth aged 14–24.[1] In fact, youth firearm homicide rates are twice those of U.S. adults[1] and forty-nine times those of youth in other high-income countries.[2] Health disparities persist, with 68% of firearm-related homicides among youth occurring among Black youth.[1] Non-fatal firearm injuries resulting from assault have accounted for an average of more than 58,000 visits to U.S. Emergency Departments (EDs) annually in the past five years, almost half involving youth aged 14–24.[1] The Institute of Medicine[3] has responded to this public health issue by emphasizing the need for additional firearm research, especially research informing prevention initiatives.

Research has identified aggregated risk factors associated with an increased risk for firearm violence among high-risk youth, including prior violence involvement, firearm possession, attitudes favoring retaliation, higher severity substance use, and several specific mental health diagnoses.[4] Among youth seeking ED treatment for assault, 25% report owning or carrying a firearm in the prior 6 months, with those youth who endorse firearm possession

also reporting higher rates of firearm victimization and aggression.[5] Substance use has also been identified as a key risk factor for a series of high-risk firearm behaviors, including illicit firearm possession,[5] unsafe weapon storage,[6] weapon carriage,[6,7] and firearm threats against others.[8] In addition, it is estimated that 50% of high-risk youth involved in firearm violence meet criteria for a recent mental health diagnosis (e.g., depression), with PTSD predictive of future firearm violence risk.[4]

While studies using aggregated measures (e.g., past 6-month substance use) have identified important risk factors for firearm violence,[4,9] such research is limited — it does not characterize the unique set of factors that directly precedes firearm-related conflicts or the specific motivations underlying a conflict.[10,11] Research employing timeline follow-back (TLFB) methodology collects data on daily behaviors using an event calendar, allowing for a detailed examination of factors influencing behaviors at the incident level.[10,11] To date, TLFB studies have focused on factors influencing daily substance use,[10] or have explored the relationship between substance use and intimate partner violence[11] or adolescent peer violence.[12] No TLFB studies have focused on understanding the distinctive contextual factors differentiating nonpartner conflicts involving a firearm from other forms of non-partner conflict. Such data has the potential to influence the design of evidence-based firearm violence interventions addressing upstream factors related to this more lethal form of violence.

The Flint Youth Injury (FYI) Study[4,9,13] is a two-year longitudinal study examining violence and substance use outcomes among drug-using youth seeking ED care for assault and a comparison cohort of youth with drug use seeking care for other (non-violence) reasons. In addition to aggregate measures, participants completed TLFB calendars at each time point. The primary objective of this analysis is to utilize TLFB data to characterize the circumstances surrounding non-partner firearm violence, both in terms of contrasting firearm with non-firearm conflicts, and contrasting firearm conflict days with non-conflict days among those engaging in non-partner firearm conflict.

METHODS

Study Design and Setting

Data for this secondary analysis are from the FYI Study.[9,13] The UM and Hurley Medical Center (HMC) IRBs approved all study procedures; A NIH Certificate of Confidentiality was obtained. The study was conducted in Flint, Michigan at HMC. Flint crime and poverty rates are comparable to other urban centers.[14] The study population reflects the ethnic/racial characteristics of Flint,[15] which is 50–60% African American.[16,17]

Study Procedures

Detailed study procedures have been published.[9,13] Youth (ages 14–24) seeking ED care for assault with past 6-month drug use (AIG), as well as a proportionally sampled comparison group (CG) of youth presenting for other reasons who also reported past 6-month drug use were eligible for the longitudinal study. Following written assent/consent (parental consent if <18 years-old), participants self-administered the screening survey. Assault was defined as

any intentional injury caused by another person. Past 6-month drug use was assessed using the National Institute on Drug Abuse Alcohol, Smoking, and Substance Involvement Screening Test.[18] If screening positive for assault and past 6-month drug use (i.e., any use within the past 6-months), youth were enrolled in the AIG cohort. The CG was recruited in parallel to limit seasonal/temporal variation and youth were systematically enrolled to balance the cohorts by sex and age (i.e., 14–17, 18–20, 21–24). Participants were enrolled 12/2009–9/2011. Eligible AIG and CG youth completed a baseline assessment that included a self-administered computerized survey and a structured interview conducted by the Research Assistant (RA). In-person follow-ups were at 6, 12-, 18-, and 24-months.

Measures

Daily- and Event-level Measures

<u>Non-Partner Conflicts:</u> For the event analysis, the *main outcome measure* was firearm conflicts, which included non-partner conflicts involving firearm aggression (firearm threats, used a firearm) or victimization (threatened with a firearm, shot at with a firearm). Non-firearm conflicts, or those involving all other non-partner violence behaviors (e.g., pushed, shoved, stabbed), served as the comparison. Non-partner was defined as anyone other than a dating (boyfriend/girlfriend) or intimate partner (fiancée, wife/husband), and included friends, co-workers, family, strangers, acquaintances, police, or gang-members. For the daily calendar analysis, firearm conflict days was the *main outcome measure*, defined as any day involving a non-partner firearm conflict. Non-conflict days, or days without any non-partner violence (firearm or non-firearm), served as the comparison.

The RA-administered TLFB-Aggression Module (TLFB-AM)[10] was used to measure nonpartner violence (firearm and non-firearm) conflicts at baseline enrollment (past 30-days) and each 6-month follow-up (past 90-days). Participants were shown a monthly calendar, and RAs worked backwards to identify dates of interpersonal conflict. For each conflict, participants identified their relationship with the person (e.g., friend), the outcome (e.g., went to doctor), and substance use within the 3-hours preceding the conflict. Participants identified the type and severity of aggression (i.e., they did to someone) and victimization (i.e., someone did to them) behaviors; response scales mirrored those of the Conflict Tactics Scale (CTS-2).[19]

RAs asked participants to indicate conflict motivations, irrespective of whether they were the aggressor or victim. Response options[11] were derived from qualitative work:[20] 1) power/ respect (e.g., so others will show respect/leave me alone); 2) territory (e.g., motivated by someone who "doesn't belong in my school/neighborhood"); 3) personal space (e.g., infringement over personal space/touching); 4) rumors (e.g., reaction to things said); 5) jealousy (e.g., boyfriend/girlfriend); 6) personal belongings (e.g., argument over cell phones, argument over buying/selling drugs); 7) retaliation (e.g., to "get even"); 8) arguments resulting from an angry/bad mood; 9) bullying; 10) drunk/high on alcohol/drugs (e.g., due to acute intoxication); 11) alcohol/drug use (e.g., argument over on-going drug/alcohol use); 12) aid of friend/family member under physical/verbal assault; 13) jumped/mistaken identity (i.e., no reason); 14) got shot (e.g., no reason or "wrong place/wrong time"); 15) sex (e.g. fighting over having sex; excludes sexual assault); and, 16) other.

Substance Use: In addition to the TLFB-AM, daily alcohol/drug use was assessed using the RA-administered TLFB.[21] RAs administered a 30-day calendar at baseline and 90-day calendars at follow-ups. Beginning on the day of assessment, RAs work backwards to identify the participant's daily use of alcohol, marijuana, illicit drugs (cocaine, inhalants, street opioids, methamphetamine, and hallucinogens) and non-medical use (e.g., "to get high"; "taking more than prescribed") of prescription drugs (stimulants, sedatives, and opiates). This included any use occurring throughout the day – broader than the substance use assessment included in the TLFB-AM, which specifically asked about substance use preceding the conflict. Binge drinking was defined as 5 or more drinks on a single occasion. For both the TLFB and TLFB-AM, interviews were audiotaped and an independent RA reviewed all coded participant responses. Discrepancies were resolved through RA consensus.

Individual-level Baseline Measures

Violence: Past 6-month aggregated measures of violence were assessed using the adapted CTS-2.[19] Frequency of moderate (e.g., pushed/shoved) and severe (e.g., threatened/used a knife/firearm) behaviors were measured separately for victimization and aggression. Response scales ranged from 0 (never) to 6 (20 times). Measures were assessed separately for non-partners and partners. For descriptive analyses, measures of aggression and victimization during the 6 months preceding the baseline ED visit were combined, so that positive responses indicated violence-involvement (either non-partner or partner violence). Past 6-months firearm possession, as in prior work,[4] was a composite of five measures characterizing carriage/ownership.[22] Firearm possession for hunting/sporting was excluded. The retaliation subscale of children's perceptions of environmental violence[23,24] assessed retaliatory attitudes; a summary score was created. Community violence exposure was measured by the frequency of five neighborhood activities (e.g., heard gun shots, saw drug deals, had their homes broken into, saw gangs in the neighborhood, saw someone getting stabbed/shot) on a scale ranging from never (0) to many (3) times [range 0–15].[25]

Substance Use/Mental Health: Past 6-month substance use, including prevalence of alcohol, marijuana, illicit drug, and non-medical prescription drug use were measured using the Alcohol Use Disorders Identification Test (AUDIT)[26] and the Substance Use Involvement Screening tests (NIDA-ASSIST).[18] Variables were dichotomized to indicate any use. Diagnostic criteria for an alcohol or drug use disorder (i.e., abuse/dependence), major depressive episode (past 2-weeks), or PTSD (past-month) were assessed using the RA-administered Mini International Neuropsychiatric Interview (MINI).[27]

Background Characteristics: Socio-demographic measures were from the Adolescent Health and the Drug Abuse Treatment Outcome Studies.[28,29] Three items assessed school completion/average grades, which were collapsed to indicate whether the participant had failing grades or had dropped out.[29,30]

Data Analysis

Analysis focused on non-partner violence conflicts (firearm/non-firearm) in the 30 days prior to baseline and/or the 90 days prior to each follow-up; data from each time point was

collapsed and all data was analyzed cross-sectionally. Conflicts between partners and those involving sexual assault (e.g., rape) were excluded due to an inability to separately analyze the small number of partner-related firearm conflicts (n=8) in our sample. Two separate cross-sectional analyses were completed, examining: a) the characteristics of firearm-related conflicts as compared to non-firearm conflicts; and, b) the characteristics of days involving a firearm conflict as compared to those days without any violent conflict among the subsample of youth endorsing at least one non-partner firearm conflict. In the *first* analysis, we: 1) compared individual-level characteristics (e.g., demographics) of youth engaging in non-partner firearm conflicts with youth involved in other forms of non-partner conflict; 2) compared event-level characteristics (e.g., motivations) of firearm vs. non-firearm conflicts; and, 3) conducted logistic regression to estimate the adjusted effects of covariates distinguishing firearm from non-firearm conflict after adjusting for individual-level nesting using random effects. While conflict motivations were asked separately for aggression and victimization behaviors (descriptive comparisons are provided in the text), they were collapsed for bivariate and multivariate analyses given the small overall number of isolated aggression events that precluded a separate analysis, as well as the significant overlap between aggression and victimization behaviors reported by individuals within a firearm event.

For the *second* analysis, we restricted the sample to only youth reporting non-partner firearm conflict. By merging TLFB and TLFB-AM data, we analyzed any substance use on firearm conflict days vs. non-conflict days (i.e., including substance use occurring outside the 3-hour window before a fight). After descriptive comparisons, we conducted a second regression estimating the adjusted effects of concurrent substance use on conflict days vs. non-conflict days, correcting for individual-level nesting. Models were fit using the R package *lme4*.

RESULTS

Sample Characteristics

Overall, 599 youth (AIG=349; CG=250) were enrolled in the longitudinal study. Baseline characteristics and the study flowchart have been previously published.[9,13] Of note, we found no differences between cohorts with regards to baseline age, sex, race, or socio-economic status. Follow-up rates were >80% at each time-point, with no differential follow-up.[9] Within the longitudinal sample (n=599), 421 (70.3%) youth reported a non-partner firearm (n=143) or non-firearm (n=278) conflict on one or more days, allowing for inclusion within this analysis. Table 1 provides individual-level descriptive characteristics for this sub-sample. Youth engaging in nonpartner firearm conflicts were more likely male, black, and seeking care for an assault-injury at baseline.

Event-based Analysis

Youth reported 829 non-partner violence conflicts summed across time-points, of which 23.8% were firearm-related (n=197) and 76.2% were non-firearm (n=632) conflicts. Among firearm-related conflicts, 92.9% involved victimization and 24.9% involved aggression. Among non-firearm conflicts, 85.4% involved victimization and 82.1% involved aggression. Firearm-related conflicts were more likely to involve unknown assailant(s) or stranger(s)

(48.2%-vs.-27.3%,p<0.001), while non-firearm conflicts were more likely with family/friends or known acquaintance(s) (70.4%-vs.-48.7%,p<0.001). Overall, firearm-related conflicts resulted in more injuries requiring medical care (58.4%-vs-33.2%,p<0.001).

Conflict Motivations—Bivariate comparisons of conflict motivations for firearm conflict as compared to non-firearm conflicts are presented in Table 2. Overall, retaliation and personal belongings were more likely reported as the motivation for firearm conflicts, while jealousy or rumors, drugs or alcohol, and coming to the aid of a family member or friend were less likely identified as motivations for firearm conflicts. Among conflicts (n=49) where youth reported aggressive firearm behavior (i.e., they threatened/shot at someone with a firearm), the most common motivations were: 1) retaliation (51.0%); 2) power/respect (22.4%); and, 3) personal belongings (18.4%). For conflicts (n=183) where youth reported being victimized (i.e., threatened or shot at by someone else with a firearm), the most common motivations were: 1) got shot for no reason (29.5%); 2) personal belongings (24.0%); and, 3) retaliation (22.4%). Among those reporting "shot for no reason", 90.7% reported that the aggressor was unknown or a stranger. Among non-firearm conflicts, the most common motivations for conflict, both overall and when examined separately for aggression and victimization, were jealousy/rumors, power/respect, and, personal belongings.

Substance Use—Substance use occurred before the incident (<3 hours) in 41.9% of conflicts, with no difference in rates preceding firearm conflicts when compared with non-firearm conflicts (43.7%-vs.-41.3%,p=0.62). When examined by substance type, however, firearm conflicts (Table 2) were more likely preceded by marijuana (37.6%-vs-29.4%,p<0.05) and less likely preceded by alcohol (17.3%-vs-24.2%,p<0.05) when compared to non-firearm conflicts.

Multilevel Model—In the regression (Table 3), male sex, Black race, and having experienced an assault injury at baseline were associated with an increased odds that a given conflict involved a firearm. At the event level, marijuana use before the conflict and retaliation and/or personal belongings as the conflict motivation increased the odds that the conflict involved firearms.

Daily Calendar Analysis

In this analysis, conflict and non-conflict days were compared only among those involved in firearm conflict (n=143). Among these youth, 197 firearm conflicts occurred on 196 days (i.e., one day involved two conflicts). Tables 4 and 5 presents the unadjusted and adjusted comparisons. Alcohol, marijuana, and non-medical prescription drug use were positively associated with firearm conflict days after adjusting for individual-level factors.

DISCUSSION

This is the first study to characterize firearm-related conflicts using a TLFB approach; results have significant potential to inform violence prevention strategies. Data characterizing firearm conflict motivations is particularly novel. Retaliation, power/respect, and protection/retrieval of personal belongings were identified as key motivations. In

particular, conflicts where retaliation was the motivating factor were almost five times more likely to involve a firearm. This is consistent with research highlighting retaliation as a significant risk factor for firearm violence and that the perceived need for self-protection and revenge are common reasons for firearm possession among urban youth.[4,23] Youth perceive retaliatory violence as accomplishing multiple goals, including correcting perceived injustices, restoring self-worth/respect, and deterring future violence.[31] Given that such violence may be reactive (i.e., impulsive) or proactive (i.e., planned), findings underscore the need for both ED-based screening of retaliatory risk and prevention strategies addressing both aggression subtypes within the context of firearm violence. Strategies for addressing reactive firearm aggression could include developing skills in emotion regulation, impulse control, and anger management, while those for proactive aggression could include strategies for non-violent conflict resolution and violence alternatives (e.g., prosocial activities).[16,23] Interventions incorporating such approaches have been successful at decreasing aggression among both universal and selective at-risk adolescent ED samples.[16,32] Expanding on this framework as part of either novel ED-based interventions for higher-risk youth or as part of existing hospital-based violence interventions,[33] and tailoring these interventions to address situational differences in conflict motivations may be key to decreasing firearm violence.

Our finding that being shot for no reason was also a prevalent firearm motivation highlights the need for interventions focused at multiple socio-ecological levels, including those concentrated on neighborhood safety. Interventions increasing social capital and community engagement within neighborhoods with low levels of social organization[34] are theorized to enhance community organization and lead to less problem behaviors.[35] Within this context, interventions focused on improving vacant lots through greening have shown promise for decreasing firearm assaults, violent crime, and community stress, as well as enhancing neighborhood health and safety.[36] A recent study also demonstrated that combining multifaceted neighborhood interventions with hospital-based interventions can be effective as a comprehensive package decreasing violent crime and assaults throughout the community.[35] Finally, given the increased access of urban youth to illegal sources of highly lethal firearms,[5] our findings also emphasize the need for efforts that decrease firearm diversion and novel community-based intervention strategies that specifically focus on decreasing illegal firearm possession by high-risk youth. Taken together, our findings support the notion that these and other community-level interventions tailored to address firearm violence may aid in decreasing firearm victimization.

In line with research[4,9,17] demonstrating the link between substance use and violence, we found that almost half of non-partner conflicts were preceded by substance use, with variations based on substance type. Consistent with studies finding that alcohol increases aggression,[37] we found alcohol preceded a quarter of all non-partner conflicts. Alcohol consumption prior to the event, however, did not differentiate firearm conflicts from other forms of non-partner conflict in the regression, potentially reflecting lower overall rates of drinking when compared to drug use by youth in our sample. In contrast, marijuana use was found to double the risk that the conflict involved a firearm. While laboratory studies have found that marijuana does not routinely increase aggression,[38] some studies examining high-school students have identified aggression to be higher among marijuana users than alcohol

users – and highest among youth who use both.[39] These findings likely reflect socio-contextual factors, rather than acute intoxication effects. It is possible that aggressive individuals use marijuana prior to conflict due to a belief that it reduces negative affect or in an attempt to self-regulate aggressive impulses.[40] Alternatively, it may be that marijuana use is occurring within a social context that enhances violent conflict (e.g., buying/selling illicit drugs).[41] Further, given adolescent problem behavior theories,[42] it is also possible that youth with higher severity marijuana use may be more frequently exposed to situations involving firearms. Further research with real-time ecological momentary assessment studies may aid in clarifying this relationship.

Substance use was highly correlated with conflict days among youth engaged in firearm violence. The finding that alcohol use was almost three times more likely on conflict days is consistent with prior cross-sectional adolescent studies,[17] as well as adult laboratory and daily-calendar studies[10,37] linking alcohol and aggression. Decreases in inhibition resulting from acute intoxication may increase the likelihood that behaviors are interpreted as threatening, increasing violence risk, especially if a firearm is available. Alternatively, social situations involving alcohol (e.g., parties) may enhance contact between youth with prior conflicts or arguments, leading to retaliatory violence. Finally, it is possible that alcohol may serve as a means of coping with negative affect or to assist with sleep after a firearm conflict. Given that many prescription drugs, especially sedatives, are pharmacologically similar to alcohol and have been associated with aggression,[43] similar mechanisms likely underlie the within day associations observed for prescription drug use and firearm conflict. Regardless, these associations highlight the need to incorporate evidence-based substance use treatment and abuse prevention strategies within future interventions. Further studies should also consider the role of poly-substance use as a contributor to violence behaviors.

Individual-level socio-demographic associations with firearm conflict are consistent with prior research.[4,9,17] While males were five times more likely to be engaged in firearm than non-firearm conflict, it is notable that 20% of adolescents engaging in firearm conflict were female, highlighting the need for interventions applicable to both sexes. Black youth were nearly three times more likely to be involved in firearm than non-firearm conflict, highlighting both the health disparities associated with firearm injuries[1] and the influence of unmeasured socio-economic factors. Further study is needed to fully understand the range of factors that explain the substantially increased risk faced by Black youth living in urban settings. It is interesting to note that firearm possession was not higher among youth involved in firearm conflicts than those who were involved in non-firearm conflicts. Firearm possession was also not predictive of firearm conflict in the multivariate model. These findings may be related to whether the youth in our sample was actually carrying the firearm that they owned at the time of the conflict. Future TLFB or daily diary studies of firearm behaviors should consider measuring firearm carriage at the daily level, as well as the origin of the firearm used within a conflict.

Limitations

First, although a strength is the high number of firearm conflicts, it is noted that data is from a single urban ED, potentially limiting generalizability. Yet, given the sample is roughly

similar to the population demographics of Flint, this may not be a major issue. Our study suggests that future research employing a population-based sampling strategy would be worthwhile. Second, while the retrospective nature of TLFB data collection limits causality, temporal data on substance use and motivations preceding violence does provide contextual data on factors likely precipitating conflict. It should be noted that the contextual data only includes the perspective of the participant. Further, motivations attributed to "got shot for no reason" may have represented a "safe" response for youth not wanting to reveal underlying conflict motivations. Third, TLFB data was only collected for 30 days at baseline and 90 days at each follow-up, potentially missing conflicts not within this window. Finally, while self-report data are a potential limitation, TLFB methodology has been well validated[10,11] and self-report of risk behaviors has been shown reliable and valid when privacy/ confidentiality are assured.[44] Despite such limitations, study findings are novel and make important contributions to the literature.

Conclusions

Firearm violence remains a complex, but preventable public health problem. Findings confirm the need for interventions that address multiple socio-ecological levels and a variety of settings (e.g., ED/hospital based, neighborhood), as well as the need for prevention initiatives to incorporate tailored content that addresses factors unique to youth conflicts involving firearms.

Acknowledgments

Abbreviations

ED	Emergency Department
US	United States
HMC	Hurley Medical Center
UM	University of Michigan
IRB	Institutional Review Board
CDC	Centers for Disease Control
CTS	Conflicts tactics scale

References

1. Centers for Disease Control and Prevention (WISQARS). Web-based Injury Statistics Query and Reporting System. 2004–2014. http://www.cdc.gov/injury/wisqars. Accessed May 12, 2016

2. Grinshteyn E, Hemenway D. Violent Death Rates: The United States Compared to Other High-Income OECD Countries, 2010. The American Journal of Medicine. 2015; 129(3):266–273. [PubMed: 26551975]

3. Leshner, AI., Altevogt, BM., Lee, AF., McCoy, MA., Kelley, PW. Priorities for research to reduce the threat of firearm-related violence. National Academies Press; 2013.

4. Carter PM, Walton MA, Roehler DR, et al. Firearm violence among high-risk emergency department youth after an assault injury. Pediatrics. 2015; 135(5):805–815. [PubMed: 25847808]

5. Carter PM, Walton MA, Newton MF, et al. Firearm possession among adolescents presenting to an urban Emergency Department for assault. Pediatrics. 2013; 132(2):213–221. [PubMed: 23837181]

6. Wintemute GJ. Association between firearm ownership, firearm-related risk and risk reduction behaviours and alcohol-related risk behaviours. Injury prevention. 2011; 17(6):422–427. [PubMed: 21670071]

7. Steinman KJ, Zimmerman MA. Episodic and persistent gun-carrying among urban African-American adolescents. Journal of Adolescent Health. 2003; 32(5):356–364. [PubMed: 12729985]

8. Casiano H, Belik S-L, Cox BJ, Waldman JC, Sareen J. Mental disorder and threats made by noninstitutionalized people with weapons in the national comorbidity survey replication. The Journal of nervous and mental disease. 2008; 196(6):437–445. [PubMed: 18552620]

9. Cunningham RM, Carter PM, Ranney M, et al. Violent Reinjury and Mortality Among Youth Seeking Emergency Department Care for Assault-Related Injury. JAMA Pediatrics. 2015; 169(1): 63. [PubMed: 25365147]

10. Chermack ST, Grogan-Kaylor A, Perron BE, et al. Violence among men and women in substance use disorder treatment: a multi-level event-based analysis. Drug Alcohol Depend. 2010; 112(3): 194–200. [PubMed: 20667666]

11. Epstein-Ngo QM, Walton MA, Chermack ST, et al. Event-level analysis of antecedents for youth violence: Comparison of dating violence with non-dating violence. Addict Behav. 2014; 39(1): 350–353. [PubMed: 24182751]

12. Stoddard SA, Epstein-Ngo Q, Walton MA, et al. Substance Use and Violence Among Youth: A Daily Calendar Analysis. Substance Use & Misuse. 2015; 50(3):328–339. [PubMed: 25493643]

13. Bohnert KM, Walton MA, Ranney M, et al. Understanding the service needs of assault-injured, drug-using youth presenting for care in an urban Emergency Department. Addictive behaviors. 2015; 41:97–105. [PubMed: 25452051]

14. Federal Bureau of Investigation. Preliminary Annual Uniform Crime Report. Jan-Dec. 2010–2011 http://www.fbi.gov/about-us/cjis/ucr/crime-in-the-u.s/2010/preliminary-annual-ucr-jan-dec-2010. Accessed Mar 13, 2016

15. U.S. Census Bureau. State and County Quick Facts. http://quickfacts.census.gov/qfd/states/26/26107.html. Accessed March 11, 2016

16. Walton MA, Chermack ST, Shope JT, et al. Effects of a brief intervention for reducing violence and alcohol misuse among adolescents: a randomized controlled trial. JAMA. 2010; 304(5):527–535. [PubMed: 20682932]

17. Cunningham R, Walton M, Trowbridge M, et al. Correlates of violent behavior among adolescents presenting to an urban emergency department. J Pediatr. 2006; 149(6):770–776. [PubMed: 17137890]

18. National Institute on Drug Abuse. NIDA-Modified ASSIST-Prescreen V1.0. http://www.drugabuse.gov/nidamed/screening/nmassist.pdf. Accessed Mar 13, 2016

19. Straus MA, Hamby SL, Boney-McCoy S, Sugarman DB. The Revised Conflict Tactics Scales (CTS2) Development and Preliminary Psychometric Data. Journal of Family Issues. 1996; 17(3): 283–316.

20. Resko SM, Reddock EC, Ranney ML, et al. Reasons for fighting among violent female adolescents: a qualitative investigation from an urban, midwestern community. Social work in public health. 2016; 31(3):99–112. [PubMed: 27018828]

21. Sobell LC, Maisto SA, Sobell MB, Cooper AM. Reliability of alcohol abusers' self-reports of drinking behavior. Behaviour research and therapy. 1979; 17(2):157–160. [PubMed: 426744]

22. Sheley, JF., Wright, JD. PsycEXTRA Dataset. American Psychological Association (APA); 1998. High School Youth, Weapons, and Violence: A National Survey of Weapon-Related Experiences, Behaviors, and Concerns.

23. Copeland-Linder N, Jones VC, Haynie DL, et al. Factors Associated with Retaliatory Attitudes among African American Adolescents Who have been Assaulted. J Pediatr Psychol. 2007; 32(7): 760. [PubMed: 17403911]

24. Hill, H., Noblin, V. Children's Perceptions of Environmental Violence. Washington, DC: Howard University; 1991.

25. Richters, JE., Martinez, P. Things I have seen and heard: A structured interview for assessing young children's violence exposure. Rockville, MD: National Institute of Mental Health; 1990.

26. Chung T, Colby SM, Barnett NP, et al. Screening adolescents for problem drinking: performance of brief screens against DSM-IV alcohol diagnoses. J Stud Alcohol. 2000; 61(4):579–587. [PubMed: 10928728]

27. Sheehan DV, Sheehan KH, Shytle RD, et al. Reliability and validity of the Mini International Neuropsychiatric Interview for Children and Adolescents (MINI-KID). J Clin Psychiatry. 2010; 71(3):313–326. [PubMed: 20331933]

28. Sieving RE, Beuhring T, Resnick MD, et al. Development of adolescent self-report measures from the National Longitudinal Study of Adolescent Health. J Adolesc Health. 2001; 28(1):73–81. [PubMed: 11137909]

29. United States Department of Health and Human Services, National Institutes of Health, National Institute on Drug Abuse. Drug Abuse Treatment Outcome Study-Adolescent (DATOS-A). 1993–1995 ICPSR03404-v3.

30. Zimmerman M. Flint [Michigan] Adolescent Study (FAS): A Longitudinal Study of School Dropout and Substance Use, 1994–1997. 2014

31. Cota - McKinley AL, Woody WD, Bell PA. Vengeance: Effects of gender, age, and religious background. Aggressive Behavior. 2001; 27(5):343–350.

32. Carter PM, Walton MA, Zimmerman MA, et al. Efficacy of a Universal Brief Intervention for Violence Among Urban Emergency Department Youth. Acad Emerg Med. 2016

33. Purtle J, Rich JA, Fein JA, James T, Corbin TJ. Hospital-based violence prevention: progress and opportunities. Annals of internal medicine. 2015; 163(9):715–717. [PubMed: 26301734]

34. Sampson RJ, Groves WB. Community structure and crime: Testing social-disorganization theory. American journal of sociology. 1989:774–802.

35. Heinze JE, Reischl TM, Bai M, et al. A Comprehensive Prevention Approach to Reducing Assault Offenses and Assault Injuries among Youth. Prev Sci. 2016; 17(2):167–176. [PubMed: 26572898]

36. Garvin EC, Cannuscio CC, Branas CC. Greening vacant lots to reduce violent crime: a randomised controlled trial. Injury prevention. 2013; 19(3):198–203. [PubMed: 22871378]

37. Chermack ST, Giancola PR. The relation between alcohol and aggression: an integrated biopsychosocial conceptualization. Clin Psychol Rev. 1997; 17(6):621–649. [PubMed: 9336688]

38. Myerscough R, Taylor SP. The effects of marijuana on human physical aggression. Journal of Personality and Social Psychology. 1985; 49(6):1541. [PubMed: 3003332]

39. Mercado-Crespo MC, Mbah AK. Race and ethnicity, substance use, and physical aggression among US high school students. J Interpers Violence. 2013; 28(7):1367–1384. [PubMed: 23262830]

40. Martens K, Gilbert DG. Marijuana and tobacco exposure predict affect-regulation expectancies in dual users. Addictive behaviors. 2008; 33(11):1484–1490. [PubMed: 18715720]

41. Goldstein PJ. The Drugs/Violence Nexus: A Tripartite Conceptual Framework. J Drug Issues. 1985; 15:493–506.

42. Jessor R. Problem - behavior theory, psychosocial development, and adolescent problem drinking. British journal of addiction. 1987; 82(4):331–342. [PubMed: 3472582]

43. Ben-Porath DD, Taylor SP. The effects of diazepam (valium) and aggressive disposition on human aggression: an experimental investigation. Addictive behaviors. 2002; 27(2):167–177. [PubMed: 11817760]

44. Brener ND, Billy JO, Grady WR. Assessment of factors affecting the validity of self-reported health-risk behavior among adolescents: evidence from the scientific literature. J Adolesc Health. 2003; 33(6):436–457. [PubMed: 14642706]

Highlights

- Among a sample of drug-using youth, ~25% of violent conflicts involved a firearm

- 42% of the sample reported substance use prior to a violent conflict

- Marijuana, but not alcohol use, was uniquely associated with firearm conflicts

- Firearm conflict was motivated by retaliation & arguments over personal belongings

- Alcohol, marijuana, & prescription drugs were associated with firearm conflict days

Table 1

Descriptive characteristics[#] of participants at the baseline ED visit who were involved in at least one non-partner violence conflict (firearm vs. non-firearm related) during the 24-month longitudinal study (n=421)

	Non-partner Violence Conflict		Odds Ratio (95% CI)
	Firearm-related (n = 143)	Non-Firearm (n = 278)	
Background Characteristics			
Age (mean, SD)	19.7 (2.4)	19.9 (2.4)	0.96 (0.89, 1.05)
Male (n, %)	115 (80.4)	155 (55.8)	3.26 (2.02, 5.25)
Black race (n,%)[b]	101 (70.6)	148 (53.2)	2.11 (1.37, 3.25)
Public Assistance (n, %)	104 (72.7)	199 (71.6)	1.06 (0.67, 1.66)
Married/Living with Partner (n, %)	29 (20.3)	79 (28.4)	0.64 (0.39, 1.04)
Failing Grades/Dropped Out (n,%)	65 (45.5)	112 (40.3)	1.24 (0.82, 1.86)
Children (n, %)	52 (38.8)	108 (41.1)	0.91 (0.59, 1.39)
ED Visit/Presentation			
Assault-Injury (n, %)	119 (83.2)	187 (67.3)	2.41 (1.46, 4.00)
Violence Behaviors			
Firearm Possession (n,%)	48 (35.0)	86 (31.7)	1.16 (0.75, 1.79)
Retaliatory Attitudes (mean, SD)	17.5 (3.6)	17.3 (3.7)	1.01 (0.96, 1.07)
Any Violence (n, %)	140 (97.9)	270 (97.1)	1.38 (0.36, 5.29)
Past 6-month Non-partner Violence (n, %)	128 (89.5)	232 (83.5)	1.69 (0.91, 3.15)
Past 6-month Partner Violence (n,%)	90 (62.9)	195 (70.1)	0.72 (0.47, 1.11)
Community Violence (mean, SD)	7.5 (3.4)	6.8 (3.5)	1.06 (1.00, 1.12)
Substance Use Behaviors			
Marijuana Use (n, %)	141 (98.6)	271 (97.5)	1.82 (0.37, 8.88)
Illicit Drug Use[a] (n, %)	16 (11.2)	34 (12.2)	0.90 (0.48, 1.70)
Alcohol Use Disorder (n, %)	26 (18.2)	66 (23.7)	0.71 (0.43, 1.18)
Drug Use Disorder (n, %)	94 (65.7)	169 (60.8)	1.24 (0.81, 1.88)
Mental Health Diagnosis[##]			
Major Depressive Episode (n, %)	18 (12.6)	40 (14.4)	0.86 (0.47, 1.56)

	Non-partner Violence Conflict		Odds Ratio (95% CI)
	Firearm-related (n = 143)	Non-Firearm (n = 278)	
Post-Traumatic Stress Disorder (n, %)	15 (10.5)	30 (10.8)	0.97 (0.50, 1.87)

CI: Confidence Interval

[#] Descriptive characteristics are based on baseline survey responses at the index ED visit of the 24-month longitudinal study and measure past 6 month behaviors in aggregate

[##] For mental health diagnosis, major depressive episode is within the two weeks preceding the baseline assessment and PTSD is within the month prior to the baseline assessment

[a] Illicit drugs combined cocaine, methamphetamine, inhalants, hallucinogens and street opioids

[b] Reference category for Black race is all other races/ethnicity

Table 2

Bivariate, event-level comparison of antecedents preceding firearm conflicts compared to non-firearm related conflicts among youth involved in non-partner violence (n=829 conflicts)

	Non-partner Violence Conflicts		Odds Ratio (95% CI)
	Firearm-related (n=197)	Non-Firearm (n=632)	
Motivation for Conflict[#]			
Power/Respect (n,%)	31 (15.7)	124 (19.6)	0.77 (0.50, 1.18)
Personal Belongings (n,%)	49 (24.9)	103 (16.3)	1.70 (1.16, 2.50)
Retaliation (n,%)	42 (21.3)	47 (7.4)	3.37 (2.15, 5.30)
Personal Space/Territory[##] (n,%)	14 (7.1)	65 (10.3)	0.67 (0.37, 1.22)
Jealousy/Rumors[##] (n,%)	20 (10.2)	160 (25.3)	0.33 (0.20, 0.55)
Other[###] (n,%)	6 (3.0)	27 (4.3)	0.70 (0.29, 1.73)
Drugs/Alcohol[##] (n,%)	6 (3.0)	77 (12.2)	0.23 (0.10, 0.53)
Aid of friend/family being assaulted (n,%)	16 (8.1)	89 (14.1)	0.54 (0.31, 0.94)
Jumped/Mistaken Identity (n,%)	11 (5.6)	21 (3.3)	1.72 (0.81, 3.63)
Got shot (no reason) (n,%)	54 (27.4)	N/A	–
Substance Use Prior to Conflict[####]			
Marijuana Use (n,%)	74 (37.6)	186 (29.4)	1.44 (1.03, 2.02)
Non-Med Prescription Drug Use[a] (n,%)	11 (5.6)	18 (2.8)	2.02 (0.94, 4.35)
Alcohol Use (n,%)	34 (17.3)	153 (24.2)	0.65 0.43, 0.99)
Other Illicit Drug Use[b] (excluding MJ) (n,%)	3 (1.5)	11 (1.7)	0.87 (0.24, 3.16)

CI: Confidence Interval; MJ: Marijuana

[#]Motivation Definitions: Power/Respect: Fighting so others will show me respect/leave me alone; Personal Belongings: Arguments over personal belongings (e.g., money, clothes, cell phones); Retaliation: Fighting to "get even"; Personal Space: Fighting stemming from infringement over personal space (i.e., touching you, mean looks); Territory: Fight motivated by someone who "doesn't belong at my school, or in my neighborhood"; Jealousy: Fights motivated by jealousy over another person's things (e.g., clothes, money, boyfriend/girlfriend); Rumors: Fighting stemming from rumors about the participant, the other person in the conflict or either of their family/friends; Drunk/High: Reason for fighting is acute intoxication of the participant or the other person; Alcohol/Drugs: Arguments about the participants or other persons on-going drug or alcohol use/misuse; Aid of family/friend: Reason for fighting is due to coming to the aid of a family or friend who was being verbally or physically assaulted; Jumped/Mistaken Identity: Fighting where the participant didn't know the person or there was no clear reason; Got Shot No Reason: Firearm conflict where they were in the "wrong place at the wrong time" or the reason was unknown.

[##]Note: Given similarities between motivations, territory and personal space were collapsed into a single category, as were rumors and jealousy. Drugs/Alcohol also includes both arguments resulting from acute intoxication and arguments about on-going drugs or alcohol use/misuse.

[###]Other = "Other" motivations include arguments resulting from an angry or bad mood, those resulting from bullying, and those that involved an argument over sex or when to have sex (not rape/sexual assault). These motivations were collapsed and included in the other category due to low incidence rates.

[####]Substance use measures indicate substance use within 3 hours of the conflict. Specifically, Alcohol Use indicates one or more drinks within 3 hours prior to the conflict.

[a]Non-medical prescription drugs combined sedatives, prescription opiates, and stimulants

[b]Illicit drugs combined cocaine, methamphetamine, inhalants, hallucinogens and street opioids

Table 3

Multilevel model characterizing individual- and event-level predictors of firearm-related conflicts, as compared to non-firearm related conflicts.

Type of Predictors	AOR (95% CI)
Individual-Level	
Male	5.14 (2.62, 9.73)
Black race[a]	2.75 (1.53, 5.08)
Age	1.02 (0.91, 1.16)
Public Assistance	1.71 (0.94, 3.11)
Assault Injury at Baseline	3.46 (1.79, 7.19)
Community Violence	0.99 (0.91, 1.08)
Gun Possession	0.92 (0.52, 1.65)
Drug Use Disorder	0.79 (0.45, 1.39)
PTSD	1.61 (0.70, 3.72)
Event-Level	
Marijuana Use	2.02 (1.21, 3.40)
Alcohol Use	0.68 (0.37, 1.25)
Retaliation	4.57 (2.19, 9.53)
Personal Belongings	2.28 (1.29, 4.02)

AOR: Adjusted Odds Ratio

CI: Confidence Interval

[a] Reference category for Black race is all other races/ethnicity

Substance use measures indicate substance use within 3 hours of the conflict. Specifically, Alcohol Use indicates one or more drinks within 3 hours prior to the conflict.

Table 4

Unadjusted bivariate comparisons of alcohol and drug consumption on firearm conflict days compared with non-conflict days among the subsample of youth involved in non-partner firearm conflicts.

	Firearm Conflict Days (n=196 days[#])	Non-Conflict Days (n=48,464 days)	Odds Ratios (95% CI)
Alcohol (n,%)	34 (17.3)	3,328 (6.9)	2.85 (1.96, 4.13)
Binge Drinking (5 drinks) (n,%)	19 (9.7)	1860 (3.8)	2.69 (1.67, 4.33)
Marijuana (n,%)	125 (63.8)	22,791 (47.0)	1.96 (1.48, 2.66)
Non-Med Prescription Drugs[a] (n,%)	30 (15.3)	1742 (3.6)	4.85 (3.28, 7.17)
Other Illicit Drugs[b] (n,%)	3 (1.5)	377 (0.8)	1.98 (0.63, 6.23)

CI:Confidence Interval

[#] Discrepancy between number of firearm conflict days and the 197 events noted in prior tables is due to one participant with two firearm events occurring on a single day.

[a] Non-medical prescription drugs combined sedatives, prescription opiates, and stimulants

[b] Illicit drugs combined cocaine, methamphetamine, inhalants, hallucinogens and street opioids Alcohol Use indicates one or more drinks during the entire day. Binge Drinking was defined as 5 or more drinks on a single occasion.

Table 5

Multilevel model of substance use on firearm conflict days vs. non-conflict days among the subsample of youth involved in non-partner firearm conflicts.

Type of Predictors	AOR (95% CI)
Individual-level	
Age	0.95 (0.88, 1.02)
Male	1.33 (0.86, 2.06)
Black race[a]	0.80 (0.55, 1.16)
Public Assistance	1.05 (0.71, 1.54)
Assault-Injury at baseline	1.58 (0.99, 2.53)
Community Violence	1.02 (0.97, 1.07)
Daily-Level	
Alcohol	2.80 (1.87, 4.17)
Marijuana	1.63 (1.19, 2.25)
Non-Med Prescription Drugs[b]	4.06 (2.60, 6.34)
Other Illicit Drugs[c]	1.43 (0.40, 5.10)

AOR: Adjusted Odds Ratio

CI: Confidence Interval

[a]Reference category for Black race is all other races/ethnicity

[b]Non-medical prescription drugs combined sedatives, prescription opiates, and stimulants

[c]Illicit drugs combined cocaine, methamphetamine, inhalants, hallucinogens and street opioids

Alcohol use indicates one or more drinks during the entire day.