Published in final edited form as:

J Youth Adolesc. 2017 August ; 46(8): 1643–1660. doi:10.1007/s10964-017-0631-6.

The Role of Adolescent Friendship Group Integration and Cohesion in Weapon-Related Violent Crime as a Young Adult

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Abstract

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Authors' Contributions

MPM conceived and designed the study, performed the statistical analysis, and drafted the manuscript; OPA participated in the design and interpretation of the data and drafted the manuscript; MTF participated in the design of the study and helped to draft the manuscript; LIZ participated in the design of the study and helped to draft the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors report no conflict of interests.

Compliance with Ethical Standards

Ethical Approval

The Add Health study was approved by the Institutional Review Board of the University of North Carolina-Chapel Hill.

Informed Consent

Add Health participants provided written informed consent for participation in all aspects of Add Health in accordance with the University of North Carolina School of Public Health Institutional Review Board guidelines that are based on the Code of Federal Regulations on the Protection of Human Subjects 45CFR46.

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Weapon-related violent crime is a serious, complex, and multifaceted public health problem. The present study uses data from Waves I and III of Add Health (n=10,482, 54% female) to examine how friendship group integration and cohesion in adolescence (ages 12–19) is associated with weapon-related criminal activity as a young adult (ages 18–26). Results indicate that greater cohesion in friendship groups is associated with significantly lower weapon-related criminal activity in young adulthood. In addition, for adolescent girls, a greater number of close friendship ties—an indicator of friendship group integration—is associated with less weapon-related criminal activity in young adulthood. These findings suggest that school-based initiatives to facilitate inclusive and cohesive adolescent peer communities may be an effective strategy to curb weapon-related criminal activity in young adulthood.

Keywords

weapon-related crime; adolescent friendship groups; social networks; integration; cohesion; social network analysis

Introduction

Weapon-related violent crime is an urgent, complex, and multifaceted problem in the United States (US), generating significant public health consequences. According to the National Crime Victimization Survey, 466,000 persons were victims of firearm-related violence in 2014 (Truman and Langton 2015). The total cost of medical care, criminal justice proceedings, new security precautions, and reductions in quality of life associated with such crime amounts to over \$174 billion annually in the US (Miller 2012). Alarming, about one in four school-age youth report having been a victim of at least one incident of weapon-involved violence (Mitchell et al. 2015).

Despite the prevalence, magnitude, and heavy societal burden inflicted by weapon-related violence, theoretically-informed adolescent predictors of involvement in weapon-related crime in young adulthood are poorly understood. Weapon carrying by adolescents, as well as negative peer effects, delinquent lifestyles, and safety concerns (Benda and Tollett 1999) are associated with juvenile weapon-related violence, but little research has adequately addressed the adolescent precursors to weapon-related violent behavior among young adults (Brennan and Moore 2009; Henrich et al. 2005; Thurnherr et al. 2009; Tracy et al. 2016). Furthermore, although literature shows that gender, race/ethnicity, substance abuse, and involvement in risky health and delinquent behaviors are significant predictors of weapon-related violence, only a few studies have examined friendship networks as determinants of weapon-related violence perpetration (Brennan and Moore 2009; Henrich et al. 2005; Thurnherr et al. 2009; Tracy et al. 2016). To the best of our knowledge, no studies have investigated how various characteristics of adolescent friendship networks relate to adolescents' perpetration of weapon-related violence as they mature into young adulthood and whether such friendship network effects are moderated by gender. Moreover, although adolescents' friendship network characteristics are important predictors of juvenile delinquent behavior, long-term implications of adolescent friendship networks for weapon-related violence in young adulthood have yet to be explored. From a policy perspective,

empirical evidence on the role of adolescent friendship group cohesion and integration on future perpetration of weapon-involved violence is essential for understanding of the origins of these detrimental behaviors in young adulthood.

The purpose of the present study is to examine whether characteristics of adolescent friendship networks (i.e., integration and cohesion) influence weapon-related violence perpetration in young adulthood. The study employs social network analysis to data from the first and third waves of the National Longitudinal Study of Adolescent Health (Add Health). As an extension of the core analyses, the article also examines whether the estimated peer network effects are moderated by gender.

Adolescent Friendship Group Integration and Cohesion and Crime/Delinquency

Adolescent friendship networks are comprised of the “patterns of friendship, advice, communication, and support” that exist among adolescent group members (Valente 1996, p. 70). Prior research shows that individuals adopt behaviors based on direct relations with others in their social groups, and various aspects of social networks may directly or indirectly influence individual criminal behavior (Akers 1998; Ennett et al. 2006; Valente 1995; Young and Rees 2013).

Earlier studies have explored social integration of adolescents into friendship networks and its potential preventive influence on juvenile delinquency (Ennett et al. 2006; Young and Rees 2013). In accord with traditional sociological perspectives regarding social group integration, most researchers postulate that greater social embeddedness reduces individual involvement in harmful behaviors (Durkheim 1966; Hirschi 1969). One common indicator of social integration previously explored in social network studies of crime and delinquency is youth popularity in a group. Consistent with social control theory (Hirschi 1969), which posits that stronger social bonds to group members prevent delinquent behaviors, popular or prominent adolescents who enjoy high social status in their networks may have stronger social ties to more individuals, have more constraints on their behavior, and can exert more influence—as well as be influenced by more peers—in their networks (Ellis and Zarbatany 2007; Haynie 2001; Young and Rees 2013). In addition, contemporary scholars of social networks and crime suggest that unpopular adolescents may pay the price of not having access to others outside of their already weak friendship networks, be disadvantaged in acquiring important social skills, which are learned in the context of friendship, and, subsequently, are less successful in achieving positive outcomes (Young and Rees 2013). Although these theoretical arguments emphasize the crime-reducing effects of strong social ties, according to the tenets of social learning theory (Akers 1998), the effects of popularity may be more complex and depend on network orientation, with popular individuals in deviant friendship groups more likely to engage in misbehavior.

Empirical research on popularity has produced mixed results showing both the crime-preventive as well as criminogenic effects of popularity in highly delinquent peer networks (Allen et al. 2005; Ennett et al. 2006; Haynie 2001; Moody et al. 2011). Furthermore, past studies indicate that the way in which popularity is measured might be consequential. Namely, preferred sociometric measures of popularity linked to social preference and likeability are associated with more prosocial behavior and less involvement in juvenile

delinquency than those of perceived popularity (Asher and McDonald 2009; Farmer et al. 2003; Mayeux et al. 2008; Moody et al. 2011; Prinstein and LaGreca 2004; Young 2014).

Cohesion of peer groups is another characteristic of friendship networks that plays a role in explaining juvenile deviant and delinquent behaviors. Cohesive networks are dense (have many direct ties) and characterized by a high frequency of reciprocal (i.e., mutual dyadic friendships) and transitive ties (i.e., adolescents are interconnected in three-peer friendships). Consistent with social control and social support theories of crime (Hirschi 1969; Cullen 1994), cohesive friendship networks may facilitate development of stronger social bonds among members and provision of social support, and thereby discourage engagement in future criminal behavior. In particular, more cohesive networks are posited to have more peer interactions and communication, have closer relationships and greater emotional attachment between group members, share more behavioral norms, have higher levels of regulated behaviors, and place more constraints on activities of group members. As a result, they dissuade deviations from group norms, leading to less criminal behavior if the group's orientation is prosocial (Ennett et al. 2006; Ennett et al. 2008; Faris and Ennett 2012; Haynie 2001; Lakon and Valente 2012). In addition, youth in less cohesive networks, because of their weak friendship groups and limited access to individuals outside of them, may also lack in the acquisition of essential social goods nurtured within the context of strong adolescent peer groups (Young and Rees 2013). Finally, networks with dense social connections may also serve as an important moderator of positive associations between peer and individual delinquency, amplifying misbehavior in the presence of more delinquent peers (Falci and McNeely 2009; Haynie 2001). In support of these propositions, various dimensions of friendship network cohesion have been found to have both independent and conditioning effects on juvenile delinquent behavior (Ennett et al. 2006; Ennett et al. 2008; Haynie 2001; Haynie 2002; Lakon and Valente 2012; Young and Rees 2013).

Weapon Carrying and Its Predictors

To date, the literature on associations between adolescent peer network characteristics and weapon-related violence perpetration is scant (see Brennan and Moore 2009 and Tracy et al. 2016 for reviews), and no study has examined how peer group cohesion and integration affect weapon-involved violent behavior among young adults. However, a substantial body of research exists on the related issue of weapon carrying by adolescents, a correlate of actual weapon use (Benda and Tollett 1999; Brennan and Moore 2009). These studies have identified a number of factors associated with weapon carrying. They range from demographic characteristics such as gender to peer influences and aggressiveness (Bailey et al. 1997; Barlas and Egan 2006; Dijkstra et al. 2010; Dijkstra et al. 2012; Lowry et al. 1998; Luster and Oh 2001; Myers et al. 1997; Steinman and Zimmerman 2003; Webster et al. 1993; Williams et al. 2002). Furthermore, perceptions of low school safety and collective security are negatively related to carrying weapons by adolescents (Esselmont 2014; Goldstein et al. 2008; Wilson 2004). Weapon carrying is also linked to the desire of adolescents to protect themselves from attacks by other students (Cobbina et al. 2010).

To summarize, weapon carrying is a somewhat distinct type of delinquency that may not necessarily be anticipated by traditional explanations of crime such as social control or

social learning theory. For example, weapon carrying (and perhaps related acts such as the use of weapons) may be affected by factors found in the developmental contexts in which adolescents often find themselves (e.g., neighborhood disadvantage and criminogenic exposure, school bullying and victimization) and at least partially motivated by intentions of self-defense or precautions against environmental dangers (Anderson 2000; Brennan and Moore 2009; Harding 2009; Sharkey 2006; Stewart and Simons 2010). Indeed, in some contemporary theorizing, weapon carrying has been considered as an example of the instrumental use of tools for defensive reasons (Brennan and Moore 2009). Consequently, it is possible that the associations between peer group integration and cohesion and the use of weapons may not operate through more traditional mechanisms such as social bonds, but rather through characteristics of cohesive pro-socially organized friendship networks in which one is embedded that make adolescents feel safe and protected from threats of victimization and risks of dangerous environments. Moreover, weapon-related violence perpetration may be lower among those who are well integrated and belong to more cohesive friendship groups. These individuals are more likely to have greater perceptions of personal safety and collective security and less need to rely on weapons as a means of self-help (Ennett et al. 2006).

Adolescent Peer Group Integration and Cohesion, and Crime over the Life Course

Existing empirical research has focused on adolescent group integration and cohesion as correlates of crime and delinquency, either concurrently or over the short run, primarily during the teenage years. The long-term impact of these factors on criminal behavior has yet to be examined. Several perspectives can help explain why cohesion and integration of friendship networks during adolescence may exert an impact that lasts beyond the school-age years. First, life-course theoretical perspectives in criminology such as Sampson and Laub's (1993) age-graded informal social control theory emphasize the importance of continuity in many behavioral predictors over an individual's life course. Specifically, childhood/adolescent social bonds, or social ties to various people and institutions formed during earlier stages of life, may affect outcomes later in life. Moreover, as some social network researchers argue (Young and Rees 2013), those who are unpopular and have minimally cohesive friendship networks may not acquire valuable social skills preparing them for adulthood, which are often learned by adolescents in this important developmental context. They may suffer from various negative consequences of this deficiency, including possible criminality, during later stages of their lives. Lastly, more cohesive adolescent friendship networks with denser ties and associated higher levels of social support may also have an impact on adolescents' future perceptions of their personal safety and their engagement in weapon-related violent crime later in life.

Adolescent Friendship Group Integration and Cohesion, Gender, and Crime/Delinquency

To date, no study has examined whether associations between integration and cohesion in adolescent friendships and weapon-related violence as a young adult is conditioned by gender. It is conceivable that gender serves as a moderator in these relationships for several reasons. First, girls form more emotionally involved friendships than boys do (Waldrop and Halverson 1975). Similarly, girls value and spend time cultivating close friendship relationships whereas boys tend to have loose friendships and assign more importance to

simply being involved in different activities with their friends (Rose and Rudolph 2006). Consistent with Hirschi's (1969) social control theory, more intimate and close friendships among girls are likely to lead to stronger bonds of attachment to their friends. Thus, not being strongly integrated or embedded in a cohesive peer group may be more consequential for girls. Girls' social networks are also known to be more conventionally oriented and have more potential to discourage violence than those of boys' (Brown 2003). Hence, higher levels of social network integration and cohesion may be more salient for girls for this reason as well.

Furthermore, existing research indicates gender differences in social network influences on adolescents' delinquent outcomes. Using a nationally representative longitudinal sample, Haynie, Doogan and Soller (2014) find that girls are more likely than boys to be influenced by their peers' involvement in violence, and girls have a stronger tendency than boys to select friends based on their involvement in violence. Another study utilizing Add Health data uncovers gender differences in network influences on depressive symptoms, a known predictor of juvenile delinquency, finding that the deleterious effects of over-integration are observed at low levels of friendship network cohesion for girls (Falci and McNeely 2009). Based on the aforementioned theoretical arguments and findings from past research, it is important to examine gender differences in the effects of adolescent friendship group integration and cohesion on weapon-related violence perpetration in young adulthood.

Current Study

The current study builds upon past theoretical and empirical research to: (1) investigate whether integration into adolescent friendship groups relates to weapon-related violent behavior in young adulthood; (2) explore whether cohesion of adolescent friendship groups is associated with weapon-involved violence in young adulthood; and (3) examine whether gender moderates these relationships.

This research uses social network analysis, a mathematical algorithm describing social connections among individuals, to rigorously study the relationships between adolescent social network characteristics and weapon-related violence in young adulthood. Recent studies (Braga et al. 2001; Fleisher 2006; Hughes 2013; Papachristos et al. 2013; Roman et al. 2012) have successfully employed social network analysis to study group social networks and delinquent behavior, and our research will advance this literature. The data for our analyses come from Add Health, a nationally representative U.S. survey of 7th through 12th grade students, which is well-suited for social network analysis.

Methods

Data

The analysis uses data from Waves I and III of Add Health. Participants were in grades 7–12—ages 12–19 years—at the Wave I survey. Add Health used stratified sampling to enroll high schools that were representative of institutions nationwide based on region of the country, urban location, school funding, and racial composition. The study enlisted corresponding middle school and junior high feeder schools for the participating high

schools. Add Health was approved by the Institutional Review Board of the University of North Carolina-Chapel Hill.

All 7th through 12th graders at the 132 participating schools were invited to complete an in-school survey at Wave I. Students who responded to the in-school survey (n=90,118) were then eligible to be randomly selected for a detailed Wave I in-home interview and parent survey. Of the youth selected for Wave I in-home interviews, 20,745 individuals completed in-home surveys (response rate = 79%). Wave I was conducted from September 1994 through December 1995. Add Health administrators re-contacted the original Wave I respondents between August 2001 and April 2002 for a Wave III survey. Of these young adults, 15,170 completed Wave III in-home surveys (response rate = 77%). Wave III participants were 18 to 26 years old.

Friendship network data were obtained via the in-school survey and the Wave I in-home questionnaire (Harris et al., 2003). For the in-school survey, adolescents nominated their five best male and five best female friends from the school roster (using a unique id). Because nominated school friends also completed the in-school interview, characteristics of respondents' friendship networks could be constructed by linking friends' data from the in-school questionnaire and constructing variables based on friends' actual responses. For the Wave I in-home interview, respondents nominated their best friend, as well as their romantic and sexual partners. If their friend or partner was also a member of the in-home sample, their data could be linked to construct friendship and partner contexts. In 16 schools that were part of a "saturated" sample, all students from the in-school sample were also interviewed in the Wave I in-home survey. Complete friendship and sexual networks can therefore be constructed with these data.

To be included in our analysis sample for the present study, subjects had to have complete social network data at Wave I and weapon-related violence data at Wave III. The Add Health administrators did not make available social network data for schools with less than a 50% completion rate on the social network items. As a result, 4,688 adolescents were excluded from the present study, resulting in a final analysis sample of 10,482 respondents (54% female).

Measures

The variables used in the present study include adolescent-specific measures collected at Wave I of Add Health and young-adult-specific outcomes collected at Wave III. The study uses longitudinal data to examine the effects of adolescent friendship group integration and cohesion along the life course, culminating in possible weapon-related violence in young adulthood. Appendix Table 1 presents descriptions and sources for all analysis variables.

Dependent variable

Young adult weapon-related violence—At Wave III, subjects responded to two weapon-related violence questions: "In the past 12 months, did you use or threaten to use a weapon to get something from someone?" and "In the past 12 months, did you use a weapon

in a fight?” Respondents who answered affirmatively to either of these two questions were coded as having perpetrated weapon-related violence as a young adult.

Independent variables

Adolescent friendship group integration: popularity—Drawing on previous research (Ennett et al. 2006; Ennett et al. 2008), popularity—one indicator of adolescent social status and integration in a friendship group—is measured by the Add Health calculated network variable (“in-degree”) constructed using friendship nominations data from the Add Health Wave 1 in-school survey. Specifically, respondents selected the names of their 5 best male and 5 best female friends from a school roster, and the in-degree variable was computed as the total number of friendship nominations an adolescent received from the other students in their school.

Adolescent friendship group cohesion: density, reciprocity, and transitivity—Friendship groups are defined as three-step reach social networks based on recent research supporting social contagion theory. Consistent with this theory, social networks tend to display “three degrees of influence,” showing that behaviors within social networks spread beyond the closest social ties to one- or two-step removed social connections (Christakis and Fowler 2013; Christakis and Fowler 2009; Payne and Cornwell 2007). Operationally, an adolescent’s best friends, friends of best friends, and friends of best friends’ friends were identified based on school friendship nominations for each student in the Add Health study. Each adolescent’s three-step reach network included all school classmates who could be reached by three or fewer steps via friendship ties (Valente 1995). Using social network analysis and following past research (Ennett et al. 2006; Ennett et al. 2008; Falci and McNeely 2009; Wasserman and Faust 1994), we then calculated three measures of group cohesion within each adolescent’s three-step reach network.

Density, the first cohesion measure, was calculated as the percentage of network ties present divided by the total possible network ties. The first panel of Figure 1 demonstrates a network with high density, or one which has many friendship ties present between the members, compared to a network that is sparse. Density is a measure of the overall connectedness within the network. To examine whether results were sensitive to a particular measure of group cohesion, two other indicators of group cohesion (reciprocity and transitivity) were calculated. Reciprocity is the percentage of friendship tie nominations in the network that were reciprocated to the sender. It taps mutual recognition of friendship ties within the network. Transitivity is the number of closed three-person triads in the network divided by the sum of closed three-person triads and open two-sided triads. Figure 1 provides a visual representation of a transitive as opposed to an intransitive triad. In the transitive triad (i, j, h), all three sides of the friendship triangle are present, whereas in the intransitive triad, the (i, h) link is missing. Transitivity represents the degree of clustering in the network. All three measures were computed using PROC IML in SAS.

Collectively, these three social network analysis measures describe the degree of cohesion within the three-step reach network from an aggregate perspective as opposed to an individual point of view. Bivariate correlations between the three indicators of group

cohesion and other primary predictor variables are shown in Appendix Table 2. Based on these results, only density is used in the core analyses because it is highly correlated with transitivity and reciprocity, and is the most commonly used indicator of group cohesion. The effects of the other two indicators (transitivity and reciprocity) are examined in a series of sensitivity analyses.

Control variables

Sociodemographic characteristics—All analyses incorporate several standard antecedent sociodemographic controls. *Gender* is a categorical variable (male=1). *Race/ethnicity* is entered as a series of dummy variables with Hispanic White as the reference group. *Age* is a continuous measure of the respondent's age in years. We also include total household income (logged) and several dummy variables indicating various levels of mother's and father's education, which were obtained via the parent survey at Wave I.

Individual characteristics

Informal social control: Previous research on crime has established the importance of informal social control on one's criminal involvement (Hirschi 1969; Sampson and Laub 1993). Hence, to guard against possible confounding effects, we include several variables pertaining to various types of informal social control. A *parental attachment* scale was calculated with two items: "How close do you feel to your mother/father?" Response categories range from 1=not at all to 5=very much. Missing values were recoded to "not at all." To control for adolescent academic achievement, grade point averages in their most recent English and math classes (*English grade* and *math grade*) and age-standardized scores on the 5-minute Add Health Picture Vocabulary Test, a computerized, abridged version of the Peabody Picture Vocabulary Test-Revised, (*Picture Vocabulary Test*), were used. Perceived *school safety* was measured by students' responses to the survey item "You feel safe in your school," with responses on the scale from 1=strongly agree to 5=strongly disagree. The categorical responses were recoded into a dichotomous variable with 1 corresponding to students answering 1, 2, or 3, and 0 for students answering 4 or 5.

Adolescent violent and delinquent behaviors: Consistent with prior research (Haynie 2002), several measures were constructed to control for adolescent violent and criminal behavior. A *violence index* was computed as the sum of two Add Health questions on violence (using a weapon in a robbery, getting into a fight) over the past year, with responses from 0 (not at all) to 3 (5 or more times). *Adolescent alcohol use* was assessed using adolescent reports of the number of days consuming alcohol in the past 12 months. Responses for the alcohol question range from 0 (never) to 6 (every day or almost every day). Finally, *weapon carrying in school* was measured using the survey item asking "During the past 30 days, on how many days did you carry a weapon—such as a gun, knife, or club—to school?" An indicator variable identifies students who reported carrying a weapon to school on one or more days.

Adolescent friendship group characteristics

Isolate: Following past studies (Ennett et al. 2006; Kreager 2004), to control for an adolescent's social position within a friendship group, the measure of youth isolation from

an adolescent friendship group was constructed. Students who did not nominate a friend and did not receive a nomination as a friend from any other school classmates were coded as “isolate.”

Group violence index: In addition to controlling for individual violent behaviors as an adolescent, a measure quantifying involvement in violence across the adolescent’s friendship group was computed as studies show that the number of violent friends is often related to an individual’s violence (Rappaport and Thomas 2004). Using the data on violence and social networks, the friendship group violence index within each individual’s three-step reach network was calculated by applying a kernel function with decay over increasing network distance. The kernel function characterizes a directly nominated friend as one step away, a friend of a friend as two steps away, and a friend of a friend of a friend as three steps away. The friendship group violence index was computed by summing the friend violence indices over the entire three-step reach network, after first multiplying friend violence indices for two-step friends by a decay parameter of 0.5, and multiplying friend violence indices for three-step friends by a decay parameter of 0.33.

Neighborhood characteristics—We were able to include median income per census block group in the analysis because Add Health linked 1990 U.S. Census block group data to student addresses or GPS locations (Pabayo et al. 2014). In addition, neighborhood safety was measured by the dichotomous survey item asking “Do you usually feel safe in your neighborhood?” (1=yes).

Data Analysis

Add Health data are clustered by schools and our outcome variable is dichotomous. Thus, we estimated multi-level logit models to examine the link between adolescent friendship group integration and cohesion, and weapon-related violence as a young adult after controlling for individual, family, and neighborhood characteristics. The models included two levels: (1) individual-level predictors and outcomes, and (2) school-level fixed effects, with clustering of standard errors by school. Multi-level modeling statistically adjusts parameter estimates and corresponding standard errors to account for the multi-level structure of the data. All multi-level models were estimated using the SAS PROC GENMOD procedure and checked for multicollinearity (VIFs did not exceed 3.0).

Initially, a series of multi-level logit models was estimated using the full sample (including both males and females). As a first step in the modeling process, a fully unconditional multi-level logit model determined the intra-class correlation coefficient (ICC). The ICC provides the amount of variation in young adult weapon-related violent crime that can be explained at the school level.

A second model incorporated the main indicators of adolescent friendship group integration and cohesion into the model:

$$\text{Logit}(\text{weapon})_{ij} = \alpha_0 + \alpha_1 z_j + \alpha_2 \text{NETWORK}_{ij} + u_{ij} \quad (1)$$

where $Logit(weapon)_{ij}$ is a dichotomous indicator for the individual's involvement in weapon-related violence at Wave III, z_j is a vector of school indicator variables, $NETWORK_{ij}$ is a vector of the main friendship group characteristics (popularity and density), and u_{ij} is the error term. The α 's are parameters to estimate.

To account for the influence of systematic differences in sociodemographic, individual, friendship group, and neighborhood characteristics, a third model (model 3) added all control variables in these four domains:

$$Logit(weapon)_{ij} = \alpha_0 + \alpha_1 z_j + \alpha_2 NETWORK_{ij} + \alpha_3 SOCIO_{ij} + \alpha_4 IND_{ij} + \alpha_5 FRIEND_{ij} + \alpha_6 NEIGH_{ij} + u_{ij},$$

(2)

where $SOCIO_{ij}$ is a vector of sociodemographic characteristics, IND_{ij} is a vector of individual characteristics, $FRIEND_{ij}$ is a vector of friendship group control variables, $NEIGH_{ij}$ is a vector of neighborhood characteristics, and all other variables are as defined earlier.

Next, model 4 adds the multiplicative interaction terms between gender and popularity and gender and density to test whether associations between friendship group integration and cohesion vary by gender. In addition, a series of sensitivity analyses is conducted. First, gender-specific models are estimated for males and females separately to confirm gender effects and to allow the coefficients for other variables to differ for each group (Kruttschnitt 2013). Second, additional indicators of group cohesion—transitivity and reciprocity—are examined.

Results

Table 1 presents descriptive statistics for all variables used in the analyses. About 46% of the participants were male and over 45% were minorities. The average number of friendship nominations from other students within the school was 4.5. Notably, girls who perpetrated weapon-related violence in young adulthood were significantly less integrated into their friendship networks (i.e., less popular) than those girls who did not participate in such behavior. Furthermore, boys who committed weapon-related violent crime as young adults had significantly less cohesive adolescent friendship groups compared to boys who did not engage in weapon-related violence. For boys who later committed a weapon-related violent crime in young adulthood, the mean density in their adolescent friendship group was 0.34, compared to a mean density of 0.38 for boys who did not engage in a weapon-related crime ($p < .05$). Similarly, boys who committed a weapon-related crime in young adulthood had lower reciprocity in their adolescent friendship groups (0.12 vs. 0.14, $p < .05$) and less transitivity among friends (0.54 vs. 0.59, $p < .05$). For adolescent girls who committed a weapon-related crime as a young adult, all adolescent friendship group cohesion indicators were lower, but only density (0.38 vs. 0.42, $p < .05$) and reciprocity (0.13 vs. 0.16, $p < .05$) were significantly lower compared to girls who did not commit a weapon-related crime in

young adulthood. Table 1 also shows that, regardless of gender, weapon-related violent crime participants at Wave III were younger, more likely to be African American, had lower Picture Vocabulary Test scores, and had lower parental attachment.

Table 2 reports estimation results for multi-level logit models with the full sample. A fully unconditional model indicated an intra-class correlation coefficient (ICC) of 0.141 ($p < .001$), suggesting that significant school-level variation was present in weapon-related crime in young adulthood to warrant hierarchical modeling. Results from Model 1 in Table 2 indicate that, in the full sample, less integration (i.e., lower popularity) is related to a higher likelihood of committing weapon-related violence in young adulthood. In particular, the regression coefficient for popularity indicates that an additional friendship nomination leads to a corresponding 5.4% (odds ratio = $\exp(-0.055) = 0.946$) decrease in the likelihood of weapon-related crime in young adulthood. Similarly, less cohesion in adolescent friendship networks (i.e., lower density) is associated with a significantly higher likelihood of weapon-related crime in young adulthood ($\beta = -0.961$, $p < .001$). Quantitatively, a 10% increase in adolescent friendship group density corresponds to a 9.2% (odds ratio = $\exp(-0.0961) = 0.908$) decrease in the likelihood of weapon-related crime in young adulthood.

Model 2 in Table 2 incorporates a number of control variables including sociodemographic, individual, friendship group, and neighborhood characteristics. The findings from Model 2 show that, after adjusting for those additional control variables, the significant crime-reducing effects of social network integration and cohesion endure. In particular, young adults who committed weapon-related crimes were significantly less popular (regression coefficient of -0.033) as adolescents and belonged to significantly less dense adolescent networks (regression coefficient of -0.517), net of numerous controls. Consistent with past research, the coefficient estimates in Model 2 also indicate that young people who commit weapon-related violent crime are more likely to be males, younger, engaged in violent acts as adolescents, carry a weapon to school as an adolescent, and have lower grades in math and English.

Next, we examine whether the effects of popularity and density vary by gender by including interaction terms between gender and each of social network characteristics. The results from this analysis are shown in Model 3 of Table 2. The regression coefficient for the (male $\times$ density) interaction term is not significant, indicating the absence of gender differences in density effects. However, the regression coefficient for the (male $\times$ popularity) interaction term (0.084) is positive and significant ($p < 0.05$), suggesting a weaker crime-preventive effect of popularity among boys.

Sensitivity Analyses

To further examine the gender-specific results observed in the main analysis, additional gender-specific multi-level logit models were estimated. The findings from these analyses are reported in Appendix Table 3, Models 1 (males) and 2 (females). Consistent with the findings from the full sample, results from Model 1 in Appendix Table 3 indicate that, after adjusting for all control variables, lower adolescent friendship group density among boys is significantly associated with increased weapon-related crime as young adults ($p < 0.05$). Quantitatively, a 10% increase in network density is associated with a 5.6% (odds

ratio= $\exp(-0.0575)=0.944$) decrease in the likelihood of weapon-related crime in young adulthood. However, popularity is not significantly associated with weapon-related crime among males. In contrast, as shown in Model 2, popularity is negative and significant for girls ($p<0.05$). Quantitatively, one additional friend for an adolescent girl corresponds to a 8.6% (odds ratio= $\exp(-0.090)=0.914$) decrease in the likelihood of weapon-related crime as a young adult. Turning to the control variables in the male and female sub-samples, the direction and significance of the estimated effects are almost identical to those in the full sample models. One notable exception is group violence, which is non-significant in the full sample yet positive and significant among males ($p<0.05$).

We also estimated gender-specific logit regression models substituting density with other indicators of social network cohesion—transitivity and reciprocity. The findings from these analyses are shown in Models 3 and 4 of Appendix Table 3. They demonstrate that adolescent friendship group transitivity and reciprocity exhibit no significant effects on future involvement in weapon-related violence. Additional regression models incorporating each of the alternative cohesion indicators separately, and estimated with the full sample, produced the same non-significant results (not shown, but available upon request).

Finally, we constructed multi-level logit regression models using different forms of the weapon-related outcome measure. First, we analyzed weapon-related robbery and weapon-related fighting separately in individual logit models. Next, we examined the sum of these two ordinal scale measures in a linear regression model. The results of these sensitivity analyses (available upon request) were consistent in direction, magnitude, and significance with those of the core findings.

Discussion

Weapon-related violent crime is a serious and complex problem in the US. Despite its increasing prevalence and the substantial societal costs imposed by it, theoretically-informed studies of adolescent predictors of weapon-related violence perpetration in young adulthood are still rare (Brennan and Moore 2009). Although peer networks have emerged as one of the most important developmental contexts for adolescents and various aspects of adolescent friendship groups directly and indirectly influence youth delinquent involvement, the long-term effects of peer groups on weapon-involved violent behavior have yet to be examined (Tracy et al. 2016; Young and Rees 2013). In the past, some of the challenges of this line of research included the lack of detailed social network and longitudinal data, and limited analytical techniques for analyzing them. This study capitalizes on the extensive adolescent friendship network data reported in Add Health and advancements in methods available to analyze social networks. It connects important characteristics of social networks to later life outcomes via social network analysis and multi-level modeling. In particular, the present study is the first to rigorously evaluate the longitudinal relationships between adolescent friendship group integration and cohesion and weapon-related violence perpetration in young adulthood, and it provides a new and meaningful contribution to the research literature on adolescent health and life-course outcomes.

The main findings indicate that adolescent friendship group characteristics have a significant and lasting impact beyond the adolescent years, extending into young adulthood. In particular, our results show that, after adjusting for a variety of sociodemographic, individual, friendship group, and neighborhood characteristics, greater adolescent friendship group cohesion (as measured by density) and integration (as measured by popularity) are significantly related to the likelihood of weapon-involved violence in young adulthood, with the popularity results varying by gender. Although three indicators of adolescent friendship group cohesion (density, transitivity, and reciprocity) were examined, only density is significantly related to future weapon-related crime reduction. Greater density in adolescent friendship groups is associated with a significantly lower likelihood of weapon-related violent criminal activity among young adults. Moreover, the effect size of density is relatively large and robust, enduring even when multiple control variables are taken into account including such important predictors as past individual and friendship group violence. The effect of group density on weapon-related crime appears to be similar for males and females in the full sample analyses, suggesting that having adolescent friendship groups with more social connections may be equally beneficial for both genders.

Overall, these results suggest that this aspect of adolescent group cohesion may have a protective effect against involvement in future weapon-related violence in young adulthood. The findings are in agreement with social control theory, which emphasizes the strength and quantity of social bonds as an important mechanism for crime prevention (Hirschi 1969). Notably, the effect of density in adolescent friendship networks also persists net of parental attachment and school factors—other important indicators of the strength of social bonds and informal social control—thus confirming that peers constitute a very important and independent dimension of adolescent development. Consistent with another contemporary theoretical explanation of criminal behavior—social support theory—cohesive adolescent friendship networks that are more densely interconnected may offer social support through friendship connections, which, in turn, may prevent future involvement in violent behavior (Cullen 1994; Baerveldt et al. 2004).

The results also reveal that gender differences are present. Specifically, girls who are less popular in their adolescent friendship groups (i.e., have fewer best friends), are more likely to engage in weapon-related violent crime as young women, whereas popularity is not a significant predictor for boys. In addition, the estimated effect size of popularity for girls is relatively large. This interesting gender-specific finding in the crime-preventive effects of popularity has several possible explanations. First, girls' friendships are more intimate and emotionally engaging than boys' friendships (Waldrop and Halverson 1975). Thus, it is possible that close friendships among girls involve higher levels of attachment to their friends and are qualitatively different from those of boys whose friendships are not as intimate. In addition, whereas girls invest in close friendships, boys have looser friendships and tend to focus on a broad range of activities with their friends (Rose and Rudolph 2006). Adopting Hirschi's (1969) terminology from social control theory, girls' friendships may produce more stakes in conformity than boys' friendships, and not being integrated or embedded in a cohesive friendship group may have more severe consequences for girls. Furthermore, in comparison with boys' friendships, girls' social networks are known to be more conventionally oriented and have more potential to discourage violence (Brown 2003).

Our study is consistent with this interpretation, showing that average group violence is lower in girls' friendship networks. Hence, for girls, being popular when embedded in such networks may lead to a lower likelihood of violence as adolescents and young adults.

It is important to emphasize that the results of the present study suggest that the *degrees* of cohesion (for both genders) and integration (for girls) in one's friendship network in adolescence have an impact lasting beyond adolescent years. Uncovering these long-term effects of adolescent social ties confirms that, consistent with life-course theory and empirical research in criminology (Sampson and Laub 1993; Wright et al. 1999), social connections to peers formed early in life matter into adulthood. Adolescent boys and girls with dense networks as well as popular girls reap violence-preventive benefits when they are young adults. Stronger adolescent social bonds may provide the capacity to foster stronger social bonds at young adults, thereby creating more cohesive and integrated social networks, more social support, greater perceptions of safety and protection, and decreased use of weapons in young adulthood. Finally, some of the positive characteristics of social networks (e.g., having many social ties, being popular for girls) may increase the likelihood of acquiring important social skills, which has a positive impact on outcomes later in life.

Despite the significant results for adolescent friendship group integration and cohesion, those characteristics explain only a portion of weapon-related violence in young adulthood. Other important predictors are race (i.e., African American), weapon carrying in adolescence, and individual violence as an adolescent. These findings align with prior studies of youth violence (Bailey et al. 1997; Durant et al. 1994; Durant et al. 1995; Sheley et al. 1992; Valois et al. 1995). Group violence in adolescence, however, affects weapon-related violent crime involvement among young adulthood males, but not females. The interrelationships between group violence and the social network characteristics found to be important in this study should be investigated further in future research.

Our study has several limitations. First, the crime commission information is self-reported. Although the validity of properly collected self-reported crime data has been widely established (Hindelang et al. 1981; Thornberry and Krohn 2000), we cannot definitely verify crime reports for the study participants. It should be noted, however, that the Add Health survey administrators and interviewers were highly trained and experienced in sensitive data collection, which probably minimized measurement error in all areas. Second, while the study design benefits from the use of longitudinal data, it is not possible to conclusively determine whether adolescent friendship group characteristics *cause* weapon-related crime in young adulthood, nor can we establish specific causal pathways due to data limitations. For example, we cannot identify the specific motivations that violent adolescents may have in selecting friends. To partially control for the selection of violent adolescents as friends, we include a group violence index in adolescence in the empirical models. Third, our social network cohesion variables were constructed from the Wave I in-home survey—a random sample of students in the study schools—so the measures could potentially suffer from sampling bias. However, Smith and Moody (2013) have examined the impact of random sampling on social network measures and found that distance (number of friendship steps removed) and density are robust to random sampling. Lastly, the study results are potentially affected by sample attrition bias. Subjects were dropped from the study if they could not be

located at the time of the Wave III survey. A comparison of Wave III non-responders and responders indicated that non-responders were more likely to have committed violent acts in Wave I. Nevertheless, over 75% of eligible participants completed Wave III in-home interviews, making it unlikely that the results are meaningfully affected by response bias. Moreover, nonresponse has been investigated by the Survey Research Unit at the University of North Carolina and findings reveal that bias for measures of health and risk behaviors rarely exceed 1% (Kalsbeek et al. 2001).

Conclusion

Notwithstanding the limitations noted above, our study is the first to investigate the relationships between adolescent friendship group integration and cohesion and weapon-related violence perpetration in young adulthood using a social network analysis approach. We find that more densely connected adolescent friendship groups significantly decrease weapon-related violent crime in young adulthood. Among girls, an adolescent's popularity also emerges as a significant predictor. Empirical verification of the importance of adolescent friendship group cohesion among all adolescents and integration among girls is important for assembling a knowledge base on how social networks affect various life-course outcomes. We encourage future research on this topic to further examine whether selection processes play an important role in the formation of integrated and cohesive networks and whether those processes are moderated by gender.

Acknowledgments

This research uses data from Add Health, a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (<http://www.cpc.unc.edu/addhealth>). No direct support was received from grant P01-HD31921 for this analysis.

Funding

Dr. Mundt received support from the National Institute on Alcohol Abuse and Alcoholism (NIAAA), grant K01AA018410, for the design and conduct of this study. The findings and conclusions expressed are solely those of the authors and do not represent the views of their respective institutions, NIAAA, or any other agency of the Federal Government.

Appendix

Appendix Table 1

Analysis Variables from the Add Health Survey, Waves I and III

Variable	Description	Source	AddHealthVarName
<i>Weapon-Related Violence in Adulthood</i>			
Weapon carrying	Used weapon in a crime as a young adult	Wave III In-Home Survey	H3DS4, H3DS11
<i>Adolescent Characteristics</i>			
<i>Demographics</i>			

Variable	Description	Source	AddHealthVarName
Male	Male gender	Wave I In-Home Survey	BIO_SEX
Age	Age	Wave I In-Home Survey	H1GI1M, H1GI1Y
Non-Hispanic White	Non-Hispanic white race	Wave I In-Home Survey	H1GI8
African American	African American race	Wave I In-Home Survey	H1GI8
Native American	Native American race	Wave I In-Home Survey	H1GI8
Asian	Asian race	Wave I In-Home Survey	H1GI8
Individual Characteristics			
Picture Vocabulary Test	Add Health Picture Vocabulary Score	Wave I In-Home Survey	AH_PVT
Math grade	Self-reported most recent Math grade	Wave I In-Home Survey	H1ED12 (reverse coded)
English grade	Self-reported most recent English grade	Wave I In-Home Survey	H1ED11 (reverse coded)
Alcohol use	Frequency of alcohol use in past year	Wave I In-Home Survey	H1TO15
Close to mother	Parental attachment (mother)	Wave I In-Home Survey	H1WP9
Close to father	Parental attachment (father)	Wave I In-Home Survey	H1WP13
School safety	Perception of school safety	Wave I In-Home Survey	H1ED24
Violence as adolescent	Perpetrated violence as an adolescent	Wave I In-Home Survey	H1DS11, H1DS14
Weapon carrying	Carried weapon to school in past 30 days	Wave I In-Home Survey	H1FV9
Popularity	Number of friend nominations received	Wave I In-School Survey	IDGX2
Isolate	No incoming or outgoing friend nominations	Wave I In-School Survey	IDGX2, ODGX2
Household Characteristics			
Mom, high school grad	Mother high school graduate	Wave I In-Home Survey	H1RM1, H1NM4
Mom, some college	Mother attended college, did not graduate	Wave I In-Home Survey	H1RM1, H1NM4
Mom, college grad	Mother graduated college	Wave I In-Home Survey	H1RM1, H1NM4
Dad, high school grad	Father high school graduate	Wave I In-Home Survey	H1RF1, H1NF4
Dad, some college	Father attended college, did not graduate	Wave I In-Home Survey	H1RF1, H1NF4
Dad, college grad	Father graduated college	Wave I In-Home Survey	H1RF1, H1NF4
Household income (ln)	Natural log of household income/\$1000	Wave I Parent Survey	PA55
Neighborhood Characteristics			
Median income (\$1,000)	Median income in census block group/\$1000	1990 U.S. Census*	CST90582

Variable	Description	Source	AddHealthVarName
Safe neighborhood	Feeling safe in neighborhood	Wave I In-Home Survey	H1NB5
<i>Adolescent Friendship Group (3-step reach network)</i>			
Density	Density ^a of 3-step reach friendship group	Wave I Network Survey	H1MF1-5, H1FF1-5
Reciprocity	Reciprocity ^b in 3-step reach friendship group	Wave I Network Survey	H1MF1-5, H1FF1-5
Transitivity	Transitivity ^c in 3-step reach friendship group	Wave I Network Survey	H1MF1-5, H1FF1-5
Group violence index	Violence within 3-step friendship group	Wave I In-Home Survey	H1DS11, H1DS14

* GPS locations linked to U.S. Census data provide community contextual files for Wave I survey responses,

^aThe proportion of friendship ties present out of the total number of possible friendship ties,

^bThe number friendship nominations reciprocated out of the total number of friendship nominations given or received,

^cThe proportion of closed 3-person triads out of the number of total 3-person triadic connections observed

Appendix Table 2

Bivariate Correlation Matrix

	1	2	3	4	5	6	7	8	9	10
1. Weapon-related violence	-	-0.04 ***	0.03 **	0.08 ***	0.13 ***	0.04 ***	-0.04 ***	-0.03 **	-0.04 ***	0.00
2. Popularity		-	-0.23 ***	0.00	-0.02	0.09 ***	0.17 ***	0.07 ***	0.18 ***	0.04 ***
3. Isolate			-	0.02	0.03 **	-0.03 **	-0.35 ***	-0.16 ***	-0.40 ***	-0.03 *
4. Weapon carrying				-	0.31 ***	0.17 ***	-0.04 ***	-0.03 **	-0.04 ***	0.01
5. Violence index					-	0.23 ***	-0.04 ***	-0.02 *	-0.05 ***	0.03 *
6. Alcohol use						-	-0.01	0.02	-0.02	0.06 *
7. Density							-	0.62 ***	0.86 ***	-0.21 ***
8. Reciprocity								-	0.38 ***	0.09 ***
9. Transitivity									-	-0.08 ***
10. Group violence index										-

Pearson correlation (r),

* $p < .05$;

** $p < .01$;

*** $p < .001$

Appendix Table 3

Multi-Level Logit Regression Coefficients Estimating Effects of Group Integration and Cohesion Measures on Weapon-Related Violence in the Gender-Specific Sub-Samples

Parameter	Model 1			Model 2			Model 3		
	Males (n=4,852)			Females (n=5,630)			Males (n=4,852)		
	Beta	SE	Odds Ratio	Beta	SE	Odds Ratio	Beta	SE	Odds Ratio
<i>Friendship Group Integration</i>									
Popularity	-0.019	0.018	0.98	-0.090 *	0.037	0.91	-0.016	0.018	0.98
<i>Friendship Group Cohesion</i>									

Parameter	Model 1			Model 2			Model 3		
	Males (n=4,852)			Females (n=5,630)			Males (n=4,852)		
	Beta	SE	Odds Ratio	Beta	SE	Odds Ratio	Beta	SE	Odds Ratio
Density	-0.575[*]	0.292	0.56	-0.680	0.578	0.51			
Reciprocity							-0.440	0.485	0.64
Transitivity							-0.164	0.224	0.85
<i>Sociodemographic Characteristics</i>									
Age	-0.258^{***}	0.041	0.77	-0.208^{**}	0.072	0.81	-0.265^{***}	0.043	0.77
Non-Hispanic White	-0.244	0.221	0.78	-0.150	0.363	0.86	-0.270	0.218	0.76
African American	0.401	0.219	1.49	1.085^{***}	0.292	2.96	0.374	0.224	1.45
Native American	0.176	0.415	1.19	0.684	0.412	1.98	0.012	0.420	1.01
Asian	-0.312	0.250	0.73	0.309	0.557	1.36	-0.324	0.260	0.72
Mom, high school grad	0.036	0.184	1.04	0.272	0.259	1.31	0.023	0.180	1.02
Mom, some college	-0.067	0.299	0.94	0.300	0.334	1.35	-0.069	0.305	0.93
Mom, college grad	0.026	0.202	1.03	0.224	0.359	1.25	0.038	0.200	1.04
Dad, high school grad	-0.089	0.221	0.91	-0.039	0.284	0.96	-0.066	0.231	0.94
Dad, some college	-0.245	0.300	0.78	0.204	0.331	1.23	-0.247	0.308	0.78
Dad, college grad	0.123	0.230	1.13	-0.490	0.409	0.61	0.107	0.233	1.11
Household income (ln)	-0.067	0.089	0.93	0.027	0.177	1.03	-0.046	0.089	0.96
<i>Individual Characteristics</i>									
Picture Vocabulary Test	-0.002	0.005	1.00	0.004	0.009	1.00	-0.001	0.005	1.00
Math grade	-0.152[*]	0.060	1.16	-0.033	0.131	1.03	-0.158[*]	0.063	1.17
English grade	-0.151[*]	0.068	1.16	-0.140	0.132	1.15	-0.163[*]	0.069	1.18
Parental attachment (mother)	-0.241^{***}	0.073	0.79	-0.363^{***}	0.090	0.70	-0.241^{***}	0.073	0.79
Parental attachment (father)	-0.018	0.084	0.98	0.014	0.116	1.01	0.012	0.085	1.01
School unsafe	0.255	0.176	1.29	0.271	0.294	1.31	0.234	0.175	1.26
Violence index	0.310^{***}	0.061	1.36	0.356^{***}	0.080	1.43	0.312^{***}	0.061	1.37
Alcohol use	0.114[*]	0.048	1.12	-0.047	0.079	0.95	0.103[*]	0.048	1.11
Weapon carrying	0.503	0.261	1.65	0.623	0.429	1.86	0.415	0.263	1.51
<i>Friendship Group Characteristics</i>									
Isolate	-0.028	0.259	0.97	0.004	0.558	1.00	0.035	0.257	1.04
Group violence index	0.020[*]	0.013	1.02	-0.018	0.065	0.98	0.028[*]	0.011	1.03
<i>Neighborhood Characteristics</i>									
Median income (\$1,000)	-0.010	0.009	0.99	0.000	0.014	1.00	-0.008	0.009	0.99
Safe neighborhood	-0.187	0.205	0.83	0.183	0.297	1.20	-0.193	0.209	0.82
DF		140			140			141	
Pseudo R-squared (%)		3.3			4.4			3.2	

*
p<.05,**
p<.01,***
p<.001,

p<.001, Bold=significant at the p<.05 level

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Figure 1.

Visual representation of social network analysis measures of cohesion, such as density and transitivity, in 3-step reach networks (i.e., adolescent friendship groups)

Table 1

Variable Means by Weapon-Related Violence and Gender (n=10,482)

	Weapon-Related Violence in Young Adulthood			
	Males		Females	
	Yes (N=239)	No (N=4,613)	Yes (N=89)	No (N=5,541)
<i>Adolescent Friendship Group Integration and Cohesion</i>				
Popularity	3.84 (3.81)	4.29 (3.79)	3.48 * (2.67)	4.74 * (3.63)
Density	0.34 * (0.23)	0.38 * (0.22)	0.38 * (0.21)	0.42 * (0.19)
Reciprocity	0.12 * (0.15)	0.14 * (0.17)	0.13 * (0.14)	0.16 * (0.17)
Transitivity	0.54 * (0.34)	0.59 * (0.31)	0.59 (0.31)	0.65 (0.27)
<i>Sociodemographic Characteristics</i>				
Age	15.2 * (1.6)	15.7 * (1.6)	14.9 * (1.7)	15.5 * (1.7)
Non-Hispanic White	0.44 * (0.50)	0.56 * (0.50)	0.29 * (0.46)	0.54 * (0.50)
African-American	0.32 * (0.47)	0.20 * (0.40)	0.53 * (0.50)	0.24 * (0.43)
Native American	0.02 (0.14)	0.01 (0.11)	0.03 (0.18)	0.02 (0.13)
Asian	0.06 (0.24)	0.09 (0.29)	0.06 (0.23)	0.07 (0.26)
White Hispanic	0.15 (0.36)	0.14 (0.34)	0.09 (0.29)	0.12 (0.33)
Mom, high school grad	0.41 (0.49)	0.42 (0.49)	0.45 (0.50)	0.41 (0.49)
Mom, some college	0.12 (0.32)	0.13 (0.33)	0.17 (0.38)	0.14 (0.34)
Mom college grad	0.29 (0.46)	0.30 (0.46)	0.24 (0.43)	0.27 (0.44)
Dad, high school grad	0.36 (0.48)	0.38 (0.49)	0.39 (0.49)	0.39 (0.49)
Dad, some college	0.09 (0.28)	0.12 (0.32)	0.13 (0.34)	0.10 (0.31)
Dad, college grad	0.28 (0.45)	0.29 (0.46)	0.17 (0.38)	0.27 (0.45)
Household income (ln)	3.46 * (0.77)	3.61 * (0.75)	3.43 (0.78)	3.58 (0.75)
<i>Individual Characteristics</i>				
Picture Vocabulary Test	99.9 * (14.2)	102.3 * (13.9)	97.2 * (11.7)	100.4 * (14.0)
Math Grade	2.36 * (0.98)	2.65 * (1.00)	2.51 * (0.94)	2.70 * (0.99)
English Grade	2.40 * (0.90)	2.69 * (0.93)	2.70 * (0.93)	3.01 * (0.90)
Alcohol Use	1.40 * (1.66)	1.07 * (1.49)	1.09 (1.46)	0.96 (1.32)
Parental Attachment (Mother)	4.40 * (0.89)	4.55 * (0.76)	4.03 * (1.03)	4.40 * (0.87)
Parental Attachment (Father)	3.95 * (1.03)	4.07 * (0.95)	3.62 (0.99)	3.79 (1.00)
School Safety	0.79 * (0.41)	0.87 * (0.33)	0.78 * (0.42)	0.87 * (0.33)
Violence Index	0.85 * (1.18)	0.34 * (0.78)	0.72 * (1.22)	0.22 * (0.59)
Carrying Weapon	0.16 * (0.37)	0.07 * (0.26)	0.11 * (0.32)	0.03 * (0.16)
<i>Adolescent Friendship Group Characteristics</i>				
Isolate	0.06 (0.24)	0.04 (0.20)	0.06 * (0.23)	0.02 * (0.15)
Group Violence	0.85 (2.89)	0.79 (2.57)	0.44 (1.35)	0.67 (2.32)
<i>Neighborhood Characteristics</i>				

Weapon-Related Violence in Young Adulthood

	Males		Females	
	Yes (N=239)	No (N=4,613)	Yes (N=89)	No (N=5,541)
Neighborhood Income	34.5 (8.5)	35.3 (8.7)	34.9 (8.3)	35.0 (8.8)
Neighborhood Safety	0.85 [*] (0.36)	0.90 [*] (0.30)	0.83 (0.38)	0.88 (0.33)

^{*}
 $p < .05$, Table values provide mean (standard deviation) for the gender/gun crime strata

Multi-Level Logit Regression Coefficients Estimating Effects of Popularity and Density on Weapon-Related Violence in the Full Sample (n=10,482)

Table 2

Parameter	Model 1			Model 2			Model 3		
	Beta	SE	Odds Ratio	Beta	SE	Odds Ratio	Beta	SE	Odds Ratio
<i>Friendship Group Integration</i>									
Popularity	-0.055**	0.019	0.95	-0.033*	0.016	0.97	-0.100**	0.037	0.91
Popularity × Male							0.084*	0.042	1.09
<i>Adolescent Friendship Group Cohesion</i>									
Density	-0.961***	0.243	0.38	-0.517*	0.248	0.60	-0.584	0.518	0.56
Density × Male							0.070	0.601	1.07
<i>Sociodemographic Characteristics</i>									
Male				1.164***	0.137	0.31	0.747**	0.252	0.47
Age				-0.260***	0.039	0.77	-0.245***	0.038	0.78
Non-Hispanic White				-0.286	0.185	0.75	-0.227	0.181	0.80
African American				0.561**	0.171	1.75	0.556**	0.170	1.74
Native American				0.146	0.358	1.16	0.259	0.358	1.30
Asian				-0.246	0.218	0.78	-0.207	0.218	0.81
Mom, high school grad				0.117	0.154	1.12	0.103	0.153	1.11
Mom, some college				0.072	0.227	1.07	0.061	0.223	1.06
Mom, college grad				0.121	0.185	1.13	0.076	0.181	1.08
Dad, high school grad				-0.068	0.163	0.93	-0.083	0.161	0.92
Dad, some college				-0.101	0.249	0.90	-0.079	0.249	0.92
Dad, college grad				-0.049	0.188	0.95	-0.026	0.186	0.97
Household income (ln)				-0.037	0.079	0.96	-0.023	0.081	0.98
<i>Individual Characteristics</i>									
Picture Vocabulary Test				0.001	0.004	1.00	0.002	0.004	1.00
Math grade				-0.112	0.058	1.12	-0.123*	0.059	1.13
English grade				-0.153**	0.056	1.16	-0.163**	0.056	1.18
Parental attachment (mother)				-0.284***	0.059	0.75	-0.287***	0.060	0.75

Parameter	Model 1			Model 2			Model 3		
	Beta	SE	Odds Ratio	Beta	SE	Odds Ratio	Beta	SE	Odds Ratio
Parental attachment (father)				0.040	0.065	1.04	-0.025	0.064	0.98
School unsafe				0.232	0.145	1.26	0.288[*]	0.142	1.33
Violence index				0.314^{***}	0.053	1.37	0.326^{***}	0.052	1.39
Alcohol use				0.081[*]	0.037	1.08	0.095^{**}	0.037	1.10
Weapon carrying				0.484[*]	0.225	1.62	0.518[*]	0.228	1.68
<i>Friendship Group Characteristics</i>									
Isolate				0.016	0.247	1.02	0.018	0.244	1.02
Group violence index				0.012	0.010	1.01	0.013	0.010	1.01
<i>Neighborhood Characteristics</i>									
Median income (\$1,000)				-0.004	0.008	1.00	-0.003	0.008	1.00
Safe neighborhood				-0.084	0.160	0.92	-0.104	0.152	0.90
DF		116			141			143	
Pseudo R-squared (%)		3.2			3.8			3.8	

* $p < .05$;

** $p < .01$,

*** $p < .001$, bold=significant at least at the $p < .05$ level