Published in final edited form as:
Youth Violence Juv Justice. 2012 July ; 10(3): 261–277. doi:10.1177/1541204011431589.

Risk and Protective Factors for Trajectories of Violent Delinquency Among a Nationally Representative Sample of Early Adolescents

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Abstract

To estimate trajectories of violence using a longitudinal sample of adolescents, considering the effects of multiple domains of influences as differentiators between profiles of violent behavior. A nationally representative sample of 9,421 adolescents ages 15–26. Trajectories were estimated, and multinomial regression procedures were used to evaluate factors predicting membership in high-violence trajectory groups. Mediation analyses were conducted to evaluate the mediated effect of distal influences on violence. Three groups of violence trajectories were identified: (a) nonviolent (73.1%); (b) escalators (14.6%); and (c) desistors (12.3%). Peer alcohol use predicted both escalation and desistance; however, these effects were mediated through individual-level variables. Aside from baseline violence, no other risk factor predicted membership in the "escalator" group. The lack of significance in predicting escalation highlights the need for further study on the etiology of late onset violence. Implications for violence prevention are discussed.

Keywords

trajectory; violence; adolescence; longitudinal; mediation

Introduction

Each year, nearly 700,000 adolescents and young adults (10–24) are treated in the emergency room for injuries related to violent activity (Center for Disease Control and Prevention, 2009). Evidence suggests that adolescents who engage in delinquent behavior are more likely to engage in other high-risk activities (e.g., alcohol and other drug use, dropping out of school, gun ownership, gang membership, risky sexual activity, and familial independence; Center for Disease Control and Prevention, 2009; Thornberry, 1995) and increase their risk of negative health-related consequences (including serious injury and death; Conseur, Rivara, & Emanuel, 1997; Farrington & Loeber, 2000).

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Declaration of Conflicting Interests The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

The evidence is clear that individual- and family-level factors increase the risk for violent behavior. Neurological deficiencies and cognitive impairments (Moffitt, Caspi, Rutter, & Silva, 2001), low IQ, hyperactivity, difficulty concentrating at school, beliefs and attitudes favorable to violence, antisocial behavior, and impulsivity have been consistently associated with violent behavior (Hawkins et al., 2000). At the family level, parental criminal behavior, child maltreatment, low levels of parental involvement, parental attitudes favorable to violence and drug/alcohol use, and separation of the parent and child have been identified as risk factors in a meta-analysis of longitudinal studies of risk factors for violence (Hawkins et al., 2000). Each of these factors has been consistently associated with violence and delinquency.

Despite the strong evidence in support of some risk factors for violence, other behavioral risk factors within the family and peer group are less studied. Hawkins et al. (2000) found that delinquent peers and gang membership have been predictive of violent behavior; however, the effect of peer and parental substance use is unclear. Academic failure and dropout has also been associated with violence, but less drastic measures of academic success have not been evaluated in the empirical literature on violence (Hawkins et al., 2000). Community-level influences such as availability of firearms, exposure to violence, and exposure to racism in the neighborhood have consistently been linked to violent behavior (Kaufman, 2005; Reingle, Jennings, & Maldonado-Molina, 2011). Finally, although many studies have analyzed the multiple domains of risk and protective factors for violent behavior, few have assessed the degree to which contextual variables have indirect effects through more proximal influences at the individual level. This mediation analysis is necessary to understand the mechanism by which contextual variables affect the individual. Traditional regression analyses might include both contextual- and individual-level variables in the model; however, the stronger, proximal effect of individual behaviors will likely mask the effect of more distal influences. We need to understand these mechanisms, as problem behavior generally initiates during adolescence (Jessor, 1977). These risk and protective factors that present early in life are important to identify as targets for violence prevention programming prior to the onset of violent behavior.

Although many of these studies provide insight as to the longitudinal predictors of violent behavior at multiple levels of influence, no studies to our knowledge have used multiple domains of predictors while differentiating patterns of serious violence among adolescents over time. Consistent with the life-course perspective (Moffitt et al., 2001), not all offenders are the same in their patterns of violent behavior. According to Moffitt et al (2001), most offenders will desist after participating in violence during their adolescent years, while a small proportion will continue offending over the life-course. These “life-course persistent” offenders will commit more serious crimes and will do so over a longer time period than “adolescent-limited offenders.” The current study will estimate trajectories of violence to differentiate these two groups of offenders and assess the predictors for each group independently.

A review of the extant literature on trajectory modeling of violence and delinquency shows that most longitudinal studies of violence among adolescents report between three and five trajectory groups, regardless of the methodology or sample (Piquero, 2008). Piquero (2008) found support for the “age-crime” curve (e.g., the aging out of criminal activity over the life-course; Farrington, 1986; Hirschi & Gottfredson, 1983), and varying profiles of violent behavior in a variety of populations. These findings have since been replicated in subpopulations of racial/ethnic groups and across gender groups (Jennings et al., 2010; Maldonado-Molina, Jennings, & Komro, 2009; Maldonado-Molina, Reingle, & Jennings, 2011).

There are several theoretical perspectives that will be used to explain the role of multiple risk and protective factors on trajectories of violent behavior. First, social learning theory (Akers, 1973) emphasizes the role of the adolescents' social surroundings (peers, adults, siblings, etc.) and their influence on violent and delinquent behavior. Second, social bond theory (Hirschi, 1969) describes protective factors at the individual level (e.g., commitment to school, education, family and peers; attachment to parents, involvement in prosocial extracurricular activities, and beliefs in the moral values of society) for violent delinquency. Finally, social disorganization theory (Shaw & McKay, 1942) focuses on the external influence of the communities in which adolescents' reside, and how the community influences delinquent behavior. Taken together, these three theoretical frameworks informed the selection of the multiple domains of risk and protective factors.

To our knowledge, no longitudinal studies to date have evaluated the direct and indirect effects of multiple domains of risk factors (independent of baseline violence) on trajectories of violent behavior among adolescents. As such, the purpose of this study is to examine the differential risk and protective factors for violence over the life-course. Specifically, the following three hypotheses were evaluated (a) between three and five distinct profiles of violent behavior will be identified; (b) exposure to multiple domains of risk factors at age 15 (community, family, peer, and individual level) will increase violent behavior into adulthood; and (c) distal risk factors will be mediated through more proximal risk factors.

Method

Design

The National Longitudinal Study of Adolescent Health (Add Health) is a school-based panel study conducted from 1994 (Wave I) through 2008 (Wave IV), when participant ages ranged from 11 to 32 (Chantala & Tabor, 1999). Eighty communities were selected to ensure demographic representative-ness (ethnic composition, region of the country, urbanicity, school size, and school type) of students in the United States. Schools (n = 132) were eligible if they enrolled more than 30 students and had an 11th grade. All students who were enrolled in the school and were present on the survey day were eligible for participation in the study. Approximately 200 students were randomly selected from strata of grade and sex, resulting in a final cohort sample of 9,421 adolescents. Secondary analyses were approved by the Institutional Review Board at the University of Florida.

The sample used in this study includes participants who were present at all four waves of data collection (n = 9,421). This cohort was 42.8% male, 64.5% White, 23.6% African American, 14.8% Hispanic, 5.8% Asian or Pacific Islander, 4.1% American Indian, and 1.1% “Other Race.” The average age at Wave I was 15.4 (SD = 1.6), 16.3 (SD = 1.6) at Wave II, 21.7 (SD = 1.6) at Wave III, and 26.5 (SD = 1.8) at Wave IV. Mean violence at Wave II was .52 (SE = .04), .28 (SE = .03) at Wave III, and .91 (SE = .04) at Wave IV. Additional descriptive information for the independent and dependent variables are detailed in Table 1.

Measures

Violent Delinquency: Violence was measured using 3 items that were measured across each of the four waves of data collection: In the past 12 months, have you (a) hurt someone badly enough that he or she needed care from a doctor or nurse? (b) pulled a knife or gun on someone? and (c) shot or stabbed someone? Response options included, “zero times,” “one to three times,” and “four or more times” for hurting someone badly enough to need care from a doctor or nurse, and “yes” or “no” for the remaining 2 items. For consistency, a value from 0 to 12 was assigned to each participant at each wave, where a value of “0,” “2” (mean

of one to three events), or “4” was assigned for each of these violent acts in which the individual has participated in during the past year. A zero was assigned for each item if the participant did not report the behavior. A two was assigned if the adolescent reported hurting someone badly enough to need care from a doctor or nurse one to three times in the past year. A four was assigned for each of the following occurrences: (a) shooting or stabbing someone; (b) pulling a knife or gun on someone; or (c) hurting someone badly enough to need care from a doctor or nurse four or more times in the past year. A “4” value for these 2 items was chosen to reflect the severity of these two behaviors, compared to a “2” value. These values were used to create trajectories of delinquency across Waves II–IV.

Risk Factors for Violence

Community-level influences

Racial dispersion: Racial dispersion is a measure (ranging from 0 to 1) of the racial heterogeneity in a neighborhood. Dispersion is equal to zero when all census tract members are members of the same racial group, and equal to one when residents are equally distributed among White, African American, Asian, Native American, and Other races. This measure was included to evaluate racial tension within the neighborhood, as evidence suggests that exposure to racism in the community may increase risk of violence participation (Kaufman, 2005).

Poverty: Poverty was measured using the percentage of families in the respondents' census tract whose income was at or below the poverty level.

Urban neighborhood: All addresses were geocoded at the time of the interview, and these addresses were linked to 1990 U.S. Census data to determine the urbanicity of the residence. Addresses were considered “completely urban” or “not completely urban.” Both poverty and urbanicity were included as direct measures derived from Shaw and McKay's (1942) theory of social disorganization.

Peer and parental influences

Parental involvement: Parental influence and involvement was measured using a scale of 20 items (10 items for maternal involvement and 10 items for paternal involvement). Each individual item was dichotomized, and the scale is the sum of all 20 items (range: 0–20). The 10 items which comprised the scale included whether or not the respondent reported participating in the following activities with their mother and/or father in the past 4 weeks: (a) going shopping; (b) playing a sport; (c) attending a religious or church-related event; (d) talking about someone they are dating or a party they attended; (e) attending a movie, play, concert, or sporting event; (f) talked about a personal problem they were having; (g) had a serious argument about their behavior; (h) talked about work or grades; (i) worked on a project for school; and (j) talked about other things they are doing in school. Cronbach's coefficient α for this scale was .74. This scale was included as a covariate because evidence suggests that parenting variables (e.g., monitoring, involvement) are related to violence (Park, Morash, & Stevens, 2010). This scale has been validated and utilized in previous research using the current data set (Prado et al., 2009).

Parental alcohol use: At the Wave I survey, parents of surveyed adolescents were asked, “How often do you drink alcohol?” Response options included, “Never,” “Once a month or less,” “Two or three days a month,” “Once or twice a week,” “Three to five days a week,” and “Nearly every day.” Responses were dichotomized into “parents use alcohol” and “parents do not use alcohol” based upon the skewed distribution of the responses.

Peer alcohol use: Peer alcohol use was measured using 1 item, "Of your three best friends, how many drink alcohol at least once a month?" Respondents who reported having one or more friends who use alcohol monthly were coded as "1." These items were included because literature suggests that individuals who have peers who use alcohol (Herrenkohl et al., 2007; Kuntsche, Gossrau-Breen, & Gmel, 2009; Leech, Day, Richardson, & Goldschmidt, 2003) are more likely to engage in violent behavior.

Peer marijuana use: Respondents were asked, "Of your three best friends, how many use marijuana at least once a month?" Respondents who reported having one or more friends who use marijuana monthly were coded as "1." These items were included because literature suggests that individuals who have peers who use marijuana (Herrenkohl et al., 2007; Leech et al., 2003) are more likely to engage in violent behavior.

Individual-level risk factors

Depression: This mental health status variable was measured with 1 item, "How often in the past week have you felt depressed?" Values for this variable were dichotomized so that 1 = *One or more times* and 0 = *0 instances of depression* in the past week. Depression was included as a covariate because higher levels of depression have been associated with violence (Elbogen & Johnson, 2009; Senn, Carey, & Vanable, 2010; Thurnherr, Bechtold, Michaud, Akre, & Suris, 2008), and other risk behaviors (Latzman & Swisher, 2005; Senn, Carey, & Vanable, 2010).

Intention to attend college: Academic performance was measured using the variable, "On a scale of 1 to 5, where 1 is low and 5 is high, how likely is it that you will go to college?" This item was included as a covariate because academic achievement and IQ have been associated with increased risk of violence (Herrenkohl et al., 2007; Leech et al., 2003).

Alcohol use: Lifetime alcohol use was evaluated using the item, "Have you had a drink of beer, wine, or liquor—not just a sip or a taste of someone else's drink—more than 2 or 3 times in your life?" Those who responded affirmatively to this item were categorized as "Alcohol Users." This measure was included to account for the relationship between individual-level alcohol use and violent behavior (Maldonado-Molina et al., 2011), independent of contextual peer and parental effects.

Marijuana and other drug use: Marijuana use was measured using the item, "During your life, how many times have you used marijuana?" Responses were categorized into "users" and "nonusers." Other drug use was created using the self-reported number of times the respondent used cocaine, inhalants, or other drugs in their lifetime. If any of these drugs were used, respondents were categorized as "users." These items were included because evidence suggests that the use of marijuana and other drugs (Boles & Miotto, 2003; Dhungana, 2009; Herrenkohl et al., 2007) increases the risk of violent behavior.

Desire to leave home: This variable was measured using the following item, "How much do you feel that you want to leave home?" Respondents who reported "very much" or "quite a bit" were categorized as "1," others were categorized as "0." This variable was included because some evidence suggests that a negative home environment increases the likelihood of violent delinquency (Ou & Reynolds, 2010).

Group fighting: Group fighting was measured using the variable, "In the past 12 months, how often did you take place in a physical fight where a group of your friends was against another group?" Responses to this item include: 0 = *never*, 1 = *one or two times*, 2 = *three to four times*, and 3 = *five or more times*. These responses were dichotomized into 0 = *never*

group fighting and 1 = *group fighting* in the past year. This item was included separate from the baseline violence measure because previous research has identified the group fighting construct as independent of other violent behaviors (Reingle et al., 2011).

Analytical Strategy

Group-based trajectory modeling: To examine the number and shape of profiles of violence over time, trajectory groups were fitted to the data using group-based trajectory modeling (Nagin, 2005; Nagin & Land, 1993). Group-based trajectory models are finite-mixture models, which use single- and multiple-group models structures (Nagin, 2005). Finite-mixture models (also known as latent class models) represent the heterogeneity in a finite number on unmeasured (latent) classes. The trajectory groups that are created using these analyses are derived from maximum likelihood estimation. In this case, violence data follow a Poisson distribution with a large number of nonviolent events (zero violent events). Therefore, a zero-inflated poisson distribution was specified in the model (Jones, Nagin, & Roeder, 2001). Models were tested until the most parsimonious number of trajectory groups maximizes the Akaike information criterion (AIC), the Bayesian information criterion (BIC), and the posterior probabilities. The trajectories are descriptive in nature, and quadratic, cubic and linear models were tested to correctly depict the slopes represented in the data. SAS PROC TRAJ was used to estimate the trajectories (Jones et al., 2001; SAS Institute, 2004).

Multinomial logistic regression: Once trajectory groups have been specified, bivariate and multivariate multinomial logistic regression were used to estimate odds ratios (ORs) for risk and protective factors on membership in each trajectory. This model is an extension of multiple logistic regressions; however, the model is more appropriate in this situation because trajectory group membership is a nominal variable, and this procedure compares membership in each trajectory group to a reference category (e.g., low-level violence; Hedeker, 2003).

Clustered robust standard errors were estimated to produce error estimates that take into account the autocorrelation due to the sampling design. STATA 11 software (College Station, TX) was used to conduct all multinomial logistic regression analyses.

The first stage of model selection involved a bivariate test of the association of each predictor variable with the trajectory groups. All variables that are not marginally predictive ($p < .10$) of any dependent variable (trajectory group) in the bivariate analyses were removed from the multivariate model. After this initial model selection, distal variables (e.g., community-level influences) were added to the model first, followed by parental- and peer-level influences, and then individual-level risk factors. The final model assessed the influence of all risk and protective factors, accounting for baseline violence.

Mediation analyses: Mediation analyses were conducted with any variables that are significantly associated with both the community-level variables and the outcome (violence). Due to methodological limitations in mediation analysis with multiple nominal outcome variables, violence trajectory groups were collapsed into “violent” (e.g., escalators and desistors) or “nonviolent” for logistic mediation analyses. Covariance matrices were generated and regression estimates were standardized in accordance with MacKinnon (2008) to obtain an overall mediated effect of each individual-level variable for each community-level variable.

To test the significance of the mediator, the Sobel test was used to generate a z statistic and standard error (Baron & Kenny, 1986; MacKinnon, Warsi, & Dwyer, 1995; Sobel, 1982).

The percentage mediation for each mediator was calculated using the formula: $ab/a_1b_1 \ldots a_xb_x + c$. All standardized estimates from regression modeling (including all other variables in the model) were used to calculate the proportion of the variance in each community-level variable on violence that is mediated by each proximal variable.

Finally, when baseline violence was a significant predictor of violent trajectory membership in the bivariate analyses, post hoc analysis was conducted to understand the risk factors associated with baseline violence. For this analysis, weighted proportions and means are calculated for each category of baseline violence (violent or nonviolent) to understand the differences in risk factors for violence at age 15.

Results

Trajectories of Violence

Three distinct trajectories were identified: nonviolent (73.1%), desistors (14.6%), and escalators (12.3%). Nonviolent adolescents had trajectories of violence that averaged zero at each of the three waves. Desistors participated in violence at earlier waves (II and III), but this violent behavior declined by Wave IV. Escalators had lower levels of violence at Waves II and III, but their violent behavior increased drastically at Wave IV. This three-group trajectory model showed the lowest AIC and BIC (AIC = −23,272, BIC = −17,354) when compared to a four- (did not converge), and two- (AIC = 7−0,235, BIC = −23,290) group model. The mean posterior probabilities ranged from (0.73 to 0.90), which are above the .70 cutoff provided by Nagin (2005). Figure 1 displays the trajectories of violence from ages 16 to 26. Mean violence for those in the nonviolent trajectory group was zero across all waves. The average violence for desistors was 3.18 ($SD = 3.29$) at Wave II, 1.53 ($SD = 2.28$) at Wave III, and 0.35 ($SD = 1.20$) at Wave IV. Mean violence for escalators was 0.20 ($SD = 0.82$) at Wave II, 0.28 ($SD = 1.11$) at Wave III, and 7.15 ($SD = 1.90$) at Wave IV.

Effects of Risk and Protective Factors at Age 15 on Trajectories of Violence: Bivariate Results

For desistors, racial heterogeneity in the neighborhood (OR = 2.18; 95% confidence interval [CI; 1.42, 3.36]), peer alcohol use (OR = 1.93; 95% CI [1.52, 2.44]), peer marijuana use (OR = 2.21; 95% CI [1.78, 2.73]), alcohol use (2.33; 95% CI [1.92, 2.83]), marijuana use (OR = 2.52; 95% CI [2.07, 3.06]), other drug use (OR = 2.27; 95% CI [1.76, 2.94]), desire to leave home (OR = 1.33; 95% CI [1.16, 1.53]), group fighting (OR = 2.54; 95% CI [2.22, 2.92]), and baseline violence (OR = 11.96; 95% CI [4.93, 7.90]) were identified as risk factors for being in the “desistor” trajectory group compared to the nonaggressive group. Protective factors for desistors included higher levels of parental involvement (OR = 0.96; 95% CI [0.93, 1.00]; $p < .10$), parental alcohol use (OR = 0.84; 95% CI [0.68, 1.03]; $p < .10$), and intention to attend college (OR = 0.80; 95% CI [0.74, 0.86]). For escalators, racial dispersion (OR = 2.01; 95% CI [1.32, 3.07]), peer alcohol use (OR = 1.34; 95% CI [1.08, 1.65]), peer marijuana use (OR = 1.28; 95% CI [1.01, 1.62]), marijuana use (OR = 1.28; 95% CI [0.99, 1.67]; $p < .10$), desire to leave home (OR = 1.16; 95% CI [0.99, 1.34]; $p < .10$), group fighting (OR = 1.32; 95% CI [1.07, 1.63]), and baseline violence (OR = 2.74; 95% CI [1.30, 2.32]) were identified as risk factors. Intention to attend college (OR = 0.91; 95% CI [0.83, 1.01]; $p < .10$) was identified as a protective factor for membership in the escalator group compared to the nonaggressive group. Because poverty, urban neighborhood, and depression were not significant in predicting violence for either group, they were dropped from further analyses.

Effects of Risk and Protective Factors at Age 15 on Trajectories of Violence: Multivariate Results

When community-, parenting-, and peer-level influences were added to the multivariate model, racial dispersion (OR = 1.73; 95% CI [1.04, 2.91] for escalators) and peer alcohol use (OR = 1.89; 95% CI [1.50, 2.64] for desistors; OR = 1.31; 95% CI [1.02, 1.65] for escalators) were significant risk factors for both groups. Peer marijuana use remained a risk factor for desistors only (OR = 1.89; 95% CI [1.50, 2.64]). When individual-level risk factors were added to the multivariate model, racial dispersion among escalators was the only community-level variable that remained marginally significant. A number of individual-level risk factors were significant for desistors only. Specifically, alcohol use (OR = 1.68; 95% CI [1.29, 2.33]), marijuana use (OR = 1.25; 95% CI [1.03, 1.72]), and other drug use (OR = 1.27; 95% CI [1.09, 1.47]), and group fighting (OR = 2.02; 95% CI [1.64, 2.31]) were identified as risk factors for membership in the desistors trajectory group. No individual-level risk factors significantly predicted membership in the “escalator” trajectory group.

The full model, adjusted for baseline violence and all other risk and protective factors, is presented in Table 2. For escalators, racial dispersion remained marginally, and baseline violence was also identified as a risk factor (OR = 1.39; 95% CI [1.05, 1.86]). For desistors, marijuana use was no longer significant. However, alcohol use (OR = 1.55; 95% CI [1.21, 2.91]), other drug use (OR = 1.21; 95% CI [1.02, 1.41]), group fighting (OR = 1.69; 95% CI [1.36, 1.95]), and baseline violence (OR = 3.08; 95% CI [1.27, 4.09]) predicted membership in the desistor group.

Mediated Effects of Contextual Variables on Violent Trajectory Membership

The indirect effects of each community-level variable by each individual-level variable are detailed in Table 3. For the effect of parental involvement on violence, 55.1% of the effect was mediated through the individual-level variables. More than three quarters of the effect of peer alcohol (76.1%) and peer marijuana use (75.6%) on violence was mediated through proximal variables (such as individual-level alcohol and marijuana use, other drug use, intention to attend college, desire to leave home, group fighting, and baseline violence). For parental involvement, group fighting was the principal mediator (11.9%), followed by desire to leave home (11.0%). For the effect of peer alcohol use on violence, the greatest mediator was alcohol use (16.2%), followed by marijuana use (15.7%). For peer marijuana use, the most pronounced mediator was marijuana use (18.3%), followed by other drug use (11.9%).

Because baseline violence was a significant predictor of both violent trajectory groups, a post hoc analysis was conducted to understand the characteristics associated with baseline violence (Table 4). Higher levels of racial heterogeneity in the neighborhood; peer alcohol use and marijuana use; alcohol, marijuana, and other drug use; lower intention to attend college; greater desire to leave home; depression; group fighting; and various demographic variables (males, African Americans, and Asians) were all significantly higher among those who were violent at baseline.

Discussion

The present study examined the number and shape of trajectories of violence, as well as the direct and indirect effects of multiple domains of risk and protective factors for membership in each trajectory group. The group-based trajectory models best fit a three-group model: a nonviolent group, a group who desisted violence, and a group of escalators whose severity of violence increased over time. These results are consistent with previous research on trajectories of violence, and risk and protective factors for violent behavior among

adolescents. Three trajectory groups were identified, and this is consistent with the extant literature that suggests there are between three and five unique groups of adolescents who participate in violent behavior (Maldonado-Molina, Piquero, Jennings, Bird, & Canino, 2009; Maldonado-Molina, Reingle, Tobler, Jennings, & Komro, 2010; Piquero, 2008). The findings from this study are unique in that a late-onset group of aggressive adolescents was identified. Although some studies have found support for the existence of this group (D'Unger, Land, & McCall, 2002; Eggleston & Laub, 2002; Zara & Farrington, 2009), the majority of the literature on trajectories of delinquency supports the age–crime curve, in which adolescents "age out" of delinquent behaviors before age 20 (Farrington, 1986; Piquero, 2008).

The relatively small body of literature on late-onset offending suggests that as many as 50% of offenders initiate criminal behavior as adults (Eggleston & Laub, 2002; McGee & Farrington, 2010). According to McGee and Farrington (2010), this adult-onset group of offenders committed undetected offenses as juveniles because these crimes were not sufficiently serious or frequent. Therefore, these adolescents may participate in status offenses and relatively minor acts of violence, escalating to more severe forms of violence and/or property crime in early adulthood. This is a possible explanation for the current results, as baseline violence was associated with a 39% increase in the probability of being an escalator. Given the modest magnitude of this effect, it is possible that the majority of the escalators were participating in minor offenses at Wave I and were therefore undetected in the "Wave I violence" measure.

This study identified a variety of risk and protective factors that significantly predicted violent trajectory group membership. These findings are consistent with prior literature on community-, parental-, and peer-level risk factors for violence. Specifically, parental involvement has been identified as a protective factor from violence (Hawkins et al., 2000), and this study found evidence of direct and indirect effects for parental involvement. Additionally, exposure to racism in the neighborhood has consistently been linked to violent behavior (Kaufman, 2005). This study found that racial heterogeneity in the neighborhood had a direct effect on violence escalation. This finding is consistent with the racial discrimination finding reported in previous literature, as racially homogeneous neighborhoods are likely to have less racism, whereas heterogeneous neighborhoods may foster more racial tension (Kaufman, 2005). Group fighting significantly predicted membership in the desistor group independent of other baseline violence, but group fighting was not significant in predicting escalation. Baseline violence was significantly associated with both desistance and escalation.

The results from this study did not identify patterns of predictors among escalators, a high-risk late-onset trajectory group. In the fully adjusted model, only baseline violence predicted membership in this high-risk group. The effect of peer alcohol use on violence was mediated through individual-level variables; specifically, individual-level substance use. Because methodological limitations for mediation analyses required combination of trajectory groups into "nonviolent" and "violent," this meditational effect may be restricted to desistors only given the lack of direct, unadjusted effects for individual-level alcohol use on violence among escalators. This finding highlights the need for future research on this group of escalators, as unique and early risk factors may be present. In one study that identified this late-onset escalator group (Zara & Farrington, 2009), a variety of psychological predictors were identified, including high anxiety, low IQ, delinquent friends, having few friends early in life, and late onset of sexual intercourse. These results indicate that childhood risk factors may predict this late-onset group of violent young adults, and more research on this unique group is necessary to further understand the etiology of late-onset escalation.

The number of risk factors for violent behavior that are present at baseline highlights the need for early violence prevention programming. Specifically, higher levels of racial heterogeneity in the neighborhood, peer alcohol use, peer marijuana use, individual-level alcohol and marijuana use, other drug use, lower intention to attend college, greater desire to leave home, depression, and group fighting were significantly more prevalent among those who were violent at baseline compared to those were not violent at baseline. These findings highlight the early risk factors that are present prior to age 15 that may serve as targets for large-scale violence prevention programming.

Effects of peer alcohol and marijuana use were mediated through individual-level alcohol and marijuana use, and the effect of parental involvement was mediated through multiple individual-level variables, including the adolescents' desire to leave home, as well as their drug and alcohol use. There has been some disagreement as to the role of peer substance use on adolescent violence (Hawkins et al., 2000; Mattila, Parkkari, & Rimpela, 2006). This study provides support for the argument that peer substance use indirectly effects violence, which is largely mediated through individual-level drug and alcohol use. However, this study is unable to account for the effect of peer delinquency, a historically potent predictor of individual violence (Hawkins et al., 2000; Huizinga, Loeber, & Thornberry, 1995). This study also found a significant relationship between higher intentions of college attendance and lower odds of membership in a violent trajectory group. However, although the effect remained in the expected direction, this effect was not significant once baseline violence was added to the model.

In light of the findings from this study, it is important that future research extend this focus on multiple risk and protective factor domains using multilevel modeling strategies. For example, using data from the Baltimore site of the National Collaborative Perinatal Project, Piquero, Moffitt, and Lawton (2005) provided a multilevel test of Moffitt's life-course perspective to assess race differences. Their results suggested that the process in which early life-course risk factors such as low birth weight and adverse familial environments affected chronic offending were more similar than different for African Americans and Whites, yet African Americans exhibited higher mean levels of risk. These results are also consistent with other research that has examined violence as a developmental process using multilevel models (Jennings, Maldonado-Molina, Reingle, & Komro, 2011). Furthermore, these results have a number of implications for the theoretical debates in criminology. First, consistent with the life-course perspective of criminal behavior, the trajectories of violence suggest that participation in violence is variable as adolescents age. Second, we found limited support for a theory of social disorganization, as contextual variables did not appear to exert a direct effect on violence. Instead, we found support for both the direct and the indirect effect of social learning, as the influences of parents and peers played an important role in predicting violence trajectories. Taken together, these findings support an integrated perspective, using both general theories of crime coupled with developmental or life-course theories of criminal behavior.

This study had several limitations. First, this study was unable to account for some of the variables that are important in predicting violence, such as IQ and psychological disorders. Second, the covariate measuring sadness or depression is not optimal for evaluating clinical depression; however, the purpose of this item was not to measure clinical depression. Instead, this item was used to account for potential mood disorders, which have been linked to violent behavior (Burns et al., 2004). Third, mediation analytical methods for multinomial models are not yet available for more than two nominal groups. Therefore, this study could not tease out the mediators specific to escalators or desistors. Instead, all mediators were identified for desistors and escalators combined into one “violent” category. Finally, Add Health data collection commenced when adolescents were between the ages of 11 and 19.

Risk factors that may have been present earlier in life (e.g., during the early to mid-childhood years) were not measured directly during data collection. In addition, the effect of risk and protective factors may be variable in their influences over time. Therefore, the inclusion of these early life-course and time-varying influences may shed light on the findings from the current study. Further investigation of these effects, especially among the late-onset group, is a subject for future studies.

Despite these weaknesses, the current study had a number of strengths. First, data were derived from a longitudinal, nationally representative sample of adolescents followed into young adulthood. This sampling design allows generalization to a national sample of adolescents across the United States. Second, although many studies have analyzed the multiple domains of risk and protective factors for violent behavior, few have assessed the degree to which the effects of contextual variables are mediated through more proximal variables at the individual level. The mediated effects allow this study to acknowledge that community-level variables are important in predicting violence even though their effects are mitigated using multivariate regression models. Finally, the trajectories estimated in this study are especially appropriate for studies of delinquency and violence, as patterns tend to change over time (Farrington, 1986; Piquero, 2008).

In conclusion, the findings from this study indicate that the risk and protective factors for membership in each of the three violence trajectory groups differ. Taken together, these findings have significant implications for violence prevention. Specifically, social influences, such as exposure to peers who use alcohol or marijuana, and community-level risk influence adolescents' likelihood for violent behavior. Furthermore, violent behavior begins even before age 15 in the general population, indicating that the current prevention programming strategies occur too late. Prevention programming should begin early in elementary school settings to prevent initiation of aggressive and violent behavior.

Acknowledgments

Funding The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was supported by R01 DA027951 (PI: Linda Cottler), RC2 HL101838 (PI: Linda Cottler), and K01 AA017480 (PI: Mildred Maldonado-Molina), from the National Institute of Drug Abuse and the National Institute on Alcohol Abuse and Alcoholism, and the Institute for Child Health Policy at the University of Florida. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institute of Health. 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.

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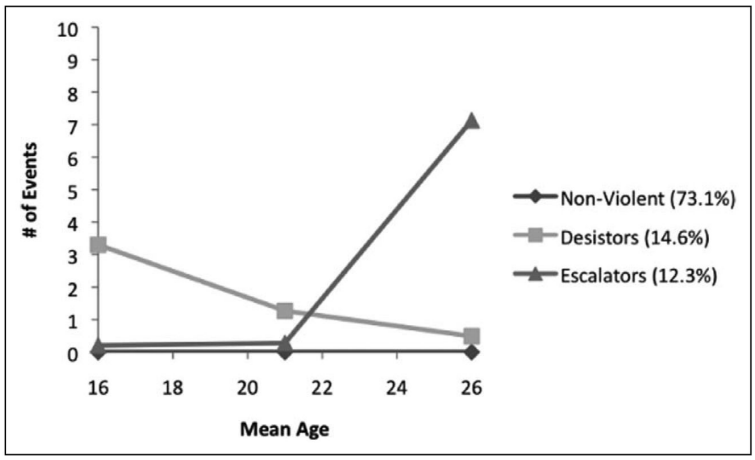

Figure 1.
Trajectories of violence over time, add health.

Table 1

Description of Sample, Add Health. $N = 9,421$.

Variable	%
Trajectory groups	
Violence, Wave II[a]	0.52 (0.04)
Violence, Wave III[a]	0.28 (0.03)
Violence, Wave IV[a]	0.91 (0.04)
Community level	
Racial dispersion[a]	0.31 (0.27)
% Poverty[a]	0.13 (0.03)
Urban area	61.8
Parental and peer influences	
Parental involvement[a]	5.81 (3.4)
Parental alcohol use	65.7
One or more peers use alcohol	57.6
One or more peers use marijuana	36.4
Individual-level risk factors	
Ever alcohol use	58.2
Ever marijuana use	30.5
Ever used other drugs	17.7
Depression	42.3
Intend to go to college	72.3
Desire to leave home	38.2
Speaking Spanish at home	6.14
Group fighting	22.1
Violence	
Baseline violence	22.0
Demographics	
Gender (male)	42.8
Age at baseline	15.4 (1.60)
White	64.5
African American or Black	23.6
Hispanic or Latino	14.8
Asian or Pacific Islander	5.8
Native American	4.1
Other race	1.1

Note.

[a]Mean(*SE*) are reported.

Table 2

Multivariate Effects of Multiple Domains on Trajectories of Violence, Adjusted for Baseline

	Trajectory Group			
	Desistors		Escalators	
	OR	95% CI	OR	95% CI
Community level				
Racial dispersion	1.31	[0.72, 2.23]	1.68	[0.98, 2.88]
Parental and peer influences				
Parental involvement	1.01	[0.97, 1.05]	1.00	[0.89, 1.04]
Peer alcohol use	0.97	[0.76, 1.48]	1.22	[0.93, 1.58]
Peer marijuana use	1.26	[0.91, 1.82]	1.05	[0.79, 1.38]
Individual-level risk factors				
Alcohol use	1.55**	[1.21, 2.19]	0.97	[0.75, 1.23]
Marijuana use	1.12	[0.92, 1.55]	1.07	[0.78, 1.48]
Other drug use	1.21*	[1.02, 1.41]	0.92	[0.71, 1.20]
Intention to attend college	0.95	[0.86, 1.05]	0.93	[0.85, 1.04]
Desire to leave home	1.09	[0.96, 1.36]	1.10	[0.91, 1.31]
Group fighting	1 69***	[1.36, 1.95]	1.10	[0.89, 1.37]
Violence				
Baseline violence	3.08***	[1.27, 4.09]	1.39*	[1.05, 1.86]

Note. The “nonviolent” trajectory group serves as the reference category. All analyses are controlling for demographic variables.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 3

Mediated Effect of Parent- and Peer-Level Variables on Violence Trajectories

	Mediator	Indirect Effect[a,b]	z	*SE*	Percent Mediated
Parental involvement	Alcohol use	.199	13.01***	.01	10.2
	Marijuana use	.201	64.02***	.003	10.2
	Other drug use	.141	8.21***	.02	7.2
	Intention to attend college	.798	10.93***	.007	4.1
	Desire to leave home	.217	15.98***	.01	11.0
	Group fighting	.233	11.36***	.02	11.9
	Baseline violence	.010	9.25***	.03	0.5
	Total				55.11
Peer alcohol use	Alcohol use	.301	8.57***	.04	16.2
	Marijuana use	.291	7.41***	.04	15.7
	Other drug use	.209	5.41***	.04	11.3
	Intention to attend college	.036	7.95***	.005	1.9
	Desire to leave home	.20	9.60***	.02	1.1
	Group fighting	.266	7.36***	.04	14.3
	Baseline violence	.290	7.28***	.04	15.6
	Total				76.1
Peer marijuana use	Alcohol use	.054	7.89***	.03	3.1
	Marijuana use	.321	8.03***	.04	18.3
	Other drug use	.208	8.44***	.02	11.9
	Intention to attend college	.032	7.89***	.004	1.8
	Desire to leave home	.194	10.60***	.02	11.0
	Group fighting	.248	7.77***	.03	14.1
	Baseline violence	.271	6.96***	.04	15.5
	Total				75.6

Note. All models are adjusted for demographic variables.

[a]These mediated effects were generated in accordance with MacKinnon (2008) and Komro, Perry, Williams, Stigler, Farbakhsh, and Veblen-Mortenson (2001). The percent mediation was generated using the formula: [(a × b/(a × b + c); MacKinnon, 2008].

[b]Indirect effects are not directly comparable across variables. Percentage mediation is comparable across variables and groups of variables.

***$p < .001$.

Table 4

Post Hoc Description (Means and Percentages) of Adolescents Violent at Wave I

	Violence at Baseline		
	Violent	**Nonviolent**	***p***
Community level			
Racial dispersion (*M*)	0.29**	0.25	.009
Poverty (*M*)	0.13	0.13	.683
Urban area	0.12	0.39	.318
Parental and peer influences			
Parental Involvement (Mean)	5.57	5.85	.056
Parental alcohol use	0.59	0.58	.377
Peer alcohol use	0.71***	0.53	<.001
Peer marijuana use	0.52***	0.31	<.001
Individual-level risk factors			
Alcohol use	0.74***	0.53	<.001
Marijuana use	0.49***	0.25	<.001
Other drug use	0.24***	0.10	<.001
Intention to attend college	0.60***	0.74	<.001
Desire to leave home	0.46***	0.33	<.001
Depression	0.47***	0.40	<.001
Group fighting	0.50***	0.15	<.001
Demographics			
Male	0.68***	0.42	<.001
Age (*M*)	15.27	15.16	.117
White	0.66***	0.75	<.001
African American or Black	0.25***	0.17	<.001
Hispanic or Latino	0.14	0.11	.025
Asian or Pacific Islander	0.06**	0.03	.003
Native American	0.02**	0.03	.005

Note. Participants were considered violent at baseline if they reported any of the violence items that were used to estimate violence trajectories: shot or stabbed someone, used knife or gun in a fight, or hurt someone badly enough to need care from a doctor or nurse. The Wave IV weighting variable used for these analysis.

** $p < .01$.

*** $p < .001$.