Peer Factors as Mediators of Relations Between Exposure to Violence and Physical Aggression in Middle School Students in a Low-Income Urban Community

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Abstract

Objective: Although prior research has demonstrated that peers influence both physical aggression and exposure to violence during adolescence, few studies have investigated the extent to which peers play a role in relations between physical aggression and violence exposure. This longitudinal study examined peer pressure for fighting, friends' delinquent behavior, and friends' support for fighting as mediators of relations between exposure to violence through witnessing and victimization, and adolescents' frequency of physical aggression.

Method: Participants were 2,707 adolescents attending three urban middle schools (*M*age = 12.4; 52% female; 79% African American, 17% Hispanic/Latino). Participants completed measures of their frequency of physical aggression, witnessing community violence, victimization by violence, and negative life events, and peer variables at four waves within the same school year.

Results: Cross-lagged analyses indicated that the role of peer variables as mediators varied as a function of the type of exposure and the direction of effects. Whereas peer pressure for fighting mediated relations between witnessing violence and changes in physical aggression, friends' delinquent behavior mediated relations between physical aggression and changes in witnessing violence and victimization. In contrast, violent victimization was not associated with changes in any of the peer factors when included in the same model as witnessing violence.

Conclusions: These findings highlight the role of peers as both a cause and a consequence of adolescents' aggressive behavior and exposure to violence. They suggest focusing on peer variables as targets for interventions to disrupt connections between exposure to violence and physical aggression during early adolescence.

Keywords

Witnessing violence; victimization; physical aggression; peer influence; early adolescence

The relation between exposure to community violence and physical aggression during adolescence has been well established (for a review see Fowler et al., 2009). Although

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longitudinal studies have typically examined exposure to violence as a cause (e.g., Goodearl et al., 2014), or as a consequence (e.g., Esposito et al., 2017) of aggressive behavior, other studies have found evidence of bidirectional effects. A recent study focusing on a sample of adolescents in an underserved urban community found that their frequency of witnessing violence and experiencing victimization predicted subsequent increases in their frequency of physical aggression, and conversely, their frequency of physical aggression predicted subsequent increases in witnessing violence and experiencing victimization (Farrell et al., 2020). These effects were consistent across sex and middle school grades. The presence of bidirectional influences is consistent with the ecological-transactional model, which maintains that children's contexts and their behavior mutually influence each other (Cicchetti & Lynch, 1993). It suggests an escalating feedback loop such that exposure to violence increases adolescents' engagement in aggressive behavior, which in turn increases their risk of further exposure to violence. This highlights the need for research to identify the underlying factors that account for these relations to guide intervention and prevention efforts to break this cycle.

The strong influence of peers on adolescents' behavior suggests that peer variables may play a role in mediating relations between exposure to violence and aggression. Early adolescents increasingly rely on peers for social support, and on peer norms, beliefs, and expectations to guide their behavior (Brown & Larson, 2009). During adolescence, youth spend increasing amounts of unsupervised time outside the home as they attempt to develop their autonomy from caregivers (Crockett & Crouter, 1995). This may increase their exposure to community violence and deviant peers. The goal of this study was to examine three distinct peer variables— friends' delinquent behavior, friends' support for fighting, and peer pressure for fighting— as mediators of bidirectional relations between exposure to violence (witnessing and victimization) and physical aggression across four waves of data. The specific focus was on a sample of early adolescents (79% African American, 17% Hispanic/Latino) in urban neighborhoods with high rates of poverty and violence.

Peer Variables as Mediators of Relations Between Exposure to Violence and Physical Aggression

The notion that peers mediate the impact of exposure to violence on physical aggression is based on the premise that witnessing violence and victimization lead to changes in peer variables, which in turn, lead to changes in adolescents' frequency of physical aggression. There is theoretical and empirical support for both assumptions. Adolescents in neighborhoods with high rates of violence are likely to befriend peers who have a "tough" reputation as a means of seeking protection, particularly if they believe that adults are not able to support or protect them from violence and other adverse experiences (Farrell et al., 2007). Prior studies have demonstrated associations between community violence exposure and affiliation with delinquent peers. A cross-sectional study of adolescents in Chicago neighborhoods found that those who had been exposed to violence were more likely to affiliate with delinquent peers compared with those who were not exposed (Kirk et al., 2014). This was also supported by a longitudinal study of a sample of 5th through 7th graders (52% African American, 31% Caucasian, 4% Hispanic, 10% multiracial) that found

associations between exposure to community violence and affiliation with delinquent peers (Low & Espelage, 2014).

There is also support for the influence of peers on the development and maintenance of aggressive behavior during adolescence. A systematic review reported that nine out of 12 studies using social network analysis found relations between adolescents' and their friends' aggressive behavior (Sijtsema, & Lindenberg, 2018). Peer influence may occur through a variety of mechanisms. Peers may influence adolescents' attitudes and behavior via deviancy training, which involves modeling and reinforcement of deviant acts (Dishion & Tipsord, 2011). This is supported by studies that found that adolescents' perceptions of their friends' delinquent behavior positively predicted their own frequency of aggressive behavior over time (e.g., Farrell et al., 2011; Thompson, Mehari, et al., 2020), and studies indicating that adolescents' self-reported aggressive behavior becomes more similar to their friends' self-reports (e.g., Logis et al., 2013). Social information processing theory suggests that adolescents' aggressive behavior is also influenced by perceptions of how their friends will view their behavior (Crick & Dodge, 1994). Adolescents are more likely to act aggressively if they believe it will maintain or boost their social status, or that *not* acting aggressively will result in peer rejection (Farrell et al., 2007). Peers may also exert direct influence through encouragement to behave in a certain manner (e.g., Santor et al., 2000). A recent study found that peer pressure for fighting predicted adolescents' aggressive behavior based on self- and teacher-report, even after accounting for other peer variables (Thompson, Mehari, et al., 2020). Although peer variables tend to be correlated, there is evidence that they represent distinct constructs that exert unique influences on aggressive behavior (Farrell et al., 2017). Differentiating among these domains of influence is critical to advancing theory and guiding future research.

Two prior studies have examined peer factors as a mediator of relations between exposure to violence and physical aggression. A study of adolescents (65% Hispanic, 32% Black) from urban communities with high crime rates found that friends' antisocial behavior in 7th grade mediated the relation between exposure to community violence in 6th grade and aggressive behavior in 8th grade (Goodearl et al., 2014). A study of Chinese adolescents found support for deviant peer affiliation as a mediator of the relation between community violence exposure and subsequent aggression between the fall of 7th and 8th grades (Lin et al., 2020). Both studies examined change across school years, investigated a single peer factor, and neither examined alternate models that considered peer factors as mediators of relations between victimization and aggression.

Peers as Mediators of Relations Between Physical Aggression and Exposure to Violence

The notion that peers may mediate the impact of physical aggression on witnessing violence and victimization assumes that engaging in physical aggression leads to changes in peer variables, which in turn leads to changes in the frequency of exposure to witnessing violence and victimization. Although we could not find a study that specifically examined mediation, there is theoretical and empirical support for both assumptions. Theories of peer selection

or homophily (e.g., Dishion et al., 1994) have been supported by studies indicating that adolescents select friends with similar levels of aggressive behavior (e.g., Kornienko et al., 2018; Thompson, Mehari, et al., 2020). There is also support for the notion that affiliating with delinquent peers increases adolescents' risk of exposure to community violence. For example, a study of youth (46% Hispanic, 34% African American, 15% White) in Chicago neighborhoods found associations between delinquent peer affiliation and community violence exposure (Antunes & Ahlin, 2015). Similarly, a longitudinal study of adolescents (87% African American, 13% European American) found that affiliation with delinquent peers in the 6th grade was associated with increases in witnessing community violence through high school (Lambert et al., 2013). Associations between peer delinquency and violent victimization were also found in a cross-sectional study of a nationally representative sample (Schreck & Fisher, 2004). One potential mechanism to account for this association is that contact with aggressive peers may increase the time adolescents spend in unsupervised, high-risk contexts, which increases the chances that they will witness community violence or be victimized.

Sex Differences

There is mixed support for sex differences in relations among adolescents' exposure to violence, peer variables, and physical aggression. Prior studies have found that male adolescents report higher frequencies of experiencing physical assault (Finkelhor et al., 2015; Ng-Mak et al., 2004) and community violence exposure (Cooley-Quille et al., 2010) than female adolescents. However, sex differences in the consequences of exposure to violence are less evident. A meta-analysis by Fowler et al. (2009) found no sex differences in relations between community violence exposure and externalizing symptoms. Evidence regarding sex differences in susceptibility to deviant peer influence has also been mixed. McCoy et al. (2019) discussed competing theories suggesting that: (a) female adolescents are *more* resistant to deviant peer influences out of concern that it may influence their relationships with parents, teachers, and friends, (b) female adolescents are *less* resistant to peer pressure because of heightened attunement to social-evaluative cues and the need for approval; and (c) the extent to which male and female adolescents are susceptible to peer influences is more a function of their degree of peer orientation than their sex. In their review of 26 studies examining sex differences in susceptibility to deviant peer pressure, McCoy et al. (2019) found that nearly half did not find evidence of sex differences. Of those that did, peer influence for risk-taking behavior was stronger for male than for female adolescents, with the exception of two studies that found stronger effects for female adolescents. There is also evidence that sex differences are influenced by context. More specifically, that high rates of violence in urban under-resourced communities may result in socialization processes that lead female and male adolescents to exhibit similar rates of aggression (e.g., Bradshaw et al., 2010).

The Present Study

This study was designed to build upon prior research that found bidirectional relations between exposure to violence and physical aggression (e.g., Farrell et al., 2020) by investigating peer factors as mediators of bidirectional longitudinal relations between

adolescents' frequency of exposure to violence and their frequency of physical aggression. This was accomplished through analysis of four waves of longitudinal data collected from students in three middle schools that served students from urban communities with high rates of poverty and crime. We hypothesized that friends' problem behavior, friends' support for fighting, and peer pressure for fighting would mediate relations between exposure to violence and changes in the frequency of physical aggression (Hypothesis 1). More specifically, that witnessing violence and victimization would be uniquely associated with changes in each of the three peer variables, and that changes in these peer variables would, in turn, lead to increases in adolescents' engagement in physical aggression through peer socialization. Conversely, we examined peer factors as potential mediators of relations between engaging in physical aggression and exposure to violence (Hypothesis 2). Based on theories of peer selection, we hypothesized that adolescents who engaged in higher rates of physical aggression would be more likely than other adolescents to form friendships with peers who engage in delinquent behaviors and support fighting, and that these peer affiliations would increase the time adolescents spend in contexts or situations where they are likely to witness violence or experience victimization. We also examined the extent to which our findings differed for male and female adolescents, but considered these analyses exploratory based on competing theories and mixed findings of prior studies examining sex differences.

This study makes several important contributions to the existing literature. Many prior studies investigating longitudinal relations between exposure to community violence and aggression have combined witnessing violence and violent victimization (e.g., Goodearl et al., 2014; Lin et al., 2020), despite evidence that they differ in their associations with aggression (Farrell et al., 2017). We addressed this limitation by investigating them as distinct constructs. We also included a broad measure of negative life events to control for other negative life experiences often experienced by youth in communities that expose them to high levels of violence. In addition, we examined the role of specific peer variables. The unique and cumulative impact of multiple forms of peer variables is not well understood due to an abundance of studies that have examined a single dimension (Prinstein & Galetta, in press). This study also differs from prior longitudinal studies that have investigated change across school years (e.g., Esposito et al., 2017; Goodearl et al., 2014; Lambert et al., 2005), by investigating changes across multiple waves within the same school year and following summer. This is important because the middle school years are a time when adolescents experience frequent changes in the structure of peer groups and broader experiences (e.g., Chan & Poulin, 2007). Finally, we focused on adolescents from urban, low-income communities with high rates of poverty and crime, most of whom were African American. This population is important to examine not only because they experience high rates of exposure to violence (Richards et al., 2015), but because their communities are also often under-resourced, leaving residents without access to services and opportunities that could mitigate the negative consequences of exposure to community violence. The findings of this study have the potential to inform effective interventions for youth exposed to community violence.

Method

Participants and Setting

This study was based on data collected as part of an 8-year project that evaluated a bullying prevention program (see Farrell, Sullivan et al., 2018 for details). Participants were a random sample of students from three public middle schools in the southeastern United States that served urban neighborhoods with high rates of poverty and violence-related crime. The majority of students at these schools (74% to 100%) were eligible for the federal free lunch program. A random sample of 619 students (194 to 214 from each grade) was recruited during the first year of the project (2010). During each subsequent year an additional 295 to 340 students were recruited. These included random samples from incoming 6th graders and from 7th and 8th graders to replace those who left the schools or withdrew their participation. Participants remained eligible until they completed the 8th grade, left the school, or chose to withdraw. The study was approved by the institutional review board of the authors' university. Participants provided written parental consent and informed assent. Close to 80% of eligible participants were recruited. Students received a $5 gift card for returning consent forms whether or not their parents gave consent for participation in the study. The final sample of 2,707 students included 934 6th graders, 869 7th graders, and 904 8th graders who had a mean age of 12.4 ($SD = 1.0$) years at Wave 1. School records identified 52% as female and 48% as male. Seventeen percent identified themselves as Hispanic or Latino. Within the sample, 12%, most of whom (79%) identified themselves as Hispanic or Latino, did not endorse any category for race, 6% identified multiple categories, 79% identified as African American (including 6% who endorsed multiple categories), 6% as White, and 3% identified other racial categories. Twenty five percent reported living with both parents, 25% with a single mother and no other adult, and 23% with a parent and stepparent. About two-thirds (65%) participated in a year that the intervention was implemented at their school.

Procedure

The project that provided the data used a multiple baseline experimental design to evaluate the Olweus Bullying Prevention Program, a multi-component school-based intervention designed to reduce school bullying (Olweus & Limber, 2010). The order and timing of initiating the intervention at each school were randomized. The intervention was implemented at one of the schools beginning in the second year of the project, at a second school in the third year, and at the third school in the sixth year, and continued at each school until the end of the 8-year project. School-level components of the intervention included an assessment of the nature and prevalence of bullying in the school, the formation of a coordinating committee to oversee the program, and staff training. Classroom components included defining and enforcing rules against bullying and class meetings to reinforce anti-bullying values and norms. Individual components included intervention by school staff who witness bullying behavior. The intervention did not explicitly target reducing exposure to community violence and other negative life events or the impact of exposure to violence. Additional details about the intervention and its implementation are reported in the intervention study (Farrell, Sullivan et al., 2018).

Participants completed measures in the fall, winter, spring, and summer (waves 1 to 4, respectively) of each school year between 2010 and 2018 with the following exceptions. The first wave was collected in the winter, the last wave in the spring, and a change in funding prevented the collection of data in the fall of Year 6. The mean interval between waves was 92 days. Participants completed measures on a computer-assisted interview. During the school year, students completed measures individually or in small groups, typically in the library or resource room during class electives. Students completed summer assessments in their homes or another community location. Participants received a $10 gift card at each wave. The project used a planned missing design such that each participant was randomly assigned to participate at two of the four waves during each project year. Random assignment to waves reduces potential bias by providing data that are missing completely at random. The development of modern methods of addressing such data have made these designs increasingly popular in developmental research (Rhemtulla & Hancock, 2016). Proponents of such designs argue that they can provide unbiased estimates of parameters and tests of hypotheses nearly as powerful as traditional designs, while decreasing costs and increasing quality by reducing testing effects, participant burden, fatigue, and attrition (e.g., Graham et al., 2001; Rhemtulla & Hancock, 2016). Planned missing designs are particularly well suited for longitudinal studies because repeated measures tend to be highly correlated. Most of the recruited students (82.5%) participated at their assigned waves. Others had data missing because: (a) inability to schedule them (6.2%), (b) they left the school (6.1%), (c) they chose not to participate (3.1%), and (d) they were no longer eligible or withdrew from the study (2.1%). In addition, 1.8% of the completed measures were excluded because staff reported the participant appeared to be responding randomly or the completion time suggested they did not read the items.

Measures

Exposure Variables

Community violence and victimization.: The Survey of Exposure to Community Violence (SECV; Richters & Saltzman, 1990), including a variety of adapted versions, is perhaps the most frequently used measure to assess children and adolescents' exposure to violence. Scores of studies have supported its construct validity based on correlations with other measures (see meta-analysis by Fowler et al., 2009). The project used a shortened version (Thompson, Coleman, et al., 2020) that had 13 witnessing violence items (e.g., "Seen someone else getting beaten up or mugged") and 7 victimization items (e.g., "Been attacked or stabbed with a knife"). Participants rated their frequency of witnessing or experiencing each item in the past 3 months on a 6-point scale ranging from *Never* to *20 or more times*. They were instructed not to include things they had seen or heard about only in video games, on TV, radio, the news, on the internet, or in movies. Ratings were averaged across items to create separate scores representing witnessing and victimization.

Negative life events.: The Urban Adolescents Negative Life Experiences Scale (UANLES; Farrell et al., 2020) is based on items from qualitative studies that identified stressful life events encountered by minority youth from poor urban communities (Farrell et al., 2007). Participants rated the frequency of experiencing 20 stressful life events (e.g., "Someone in your family or living in your house was drunk or high," "Your parent lost a job") in the past

3 months on a 5-point scale ranging from *Never* to *Almost Every Day*. No items involved witnessing or experiencing violence. The construct validity of the UANLES is supported by associations with trauma-related distress, physical aggression, delinquency, and substance use (Thompson, Coleman et al., 2020). The total score was the mean rating across items.

Physical aggression—The frequency of physical aggression was assessed by the five-item Physical Aggression scale of the Problem Behavior Frequency Scale – Adolescent Report Version 2 (PBFS-AR; Farrell, Thompson et al., 2018). Students reported how often they engaged in each behavior (e.g., "Hit or slapped someone") in the past 30 days on a 6-point scale from *Never* to *20 or more times*. Support for the PBFS-AR's factor structure and strong measurement invariance across sex, grades, and sites was established in a multisite study (Farrell et al. 2016). Further support for measurement invariance across sex and grades was found in a study of students in urban middle schools (Farrell, Thompson et al., 2018). Its concurrent validity has been supported by correlations with measures of related constructs, teacher ratings, and school office referrals for disciplinary code violations (Farrell, Thompson et al., 2018). Items were recoded into a 4-point scale by combining the three highest categories on the frequency scale based on an item response theory analysis (Farrell, Thompson et al., 2018). The resulting responses were averaged to create a total score (alpha = .77).

Peer variables—Peer variables were assessed using measures evaluated in a prior study that found support for friends' delinquent behavior, friends' approval for fighting, and peer pressure for fighting as distinct dimensions of peer influences based on analyses of their structure and concurrent relations with adolescents' reports and teachers' ratings of adolescents' physical aggression (Farrell et al., 2017). It also found support for strong measurement invariance across sex and grades.

Friends' Delinquent Behavior.: The Friends' Behavior Scale assesses adolescents' perceptions of their friends' behavior. Respondents first indicate their number of close friends to orient them to the task. They then rate how many of them engage in ten specific activities such as aggression (e.g., "Been in a gang fight"), substance use (e.g., "Used marijuana or hashish"), and delinquency (e.g., "Gone into or tried to go into a building to steal something") within the past 3 months on a 5-point scale, ranging from *None of them* to *All of them*. The total score is the mean rating across the 10 items (alpha = .82).

Friends' Approval of Fighting.: The Friends' Reaction to Responses in Conflict Situations scale assesses adolescents' expectations of how their friends would react to specific responses to conflicts involving other peers. It describes five scenarios (e.g., "You and another teen get into an argument. Other students are there boosting it up saying, 'Fight, fight, fight.'") followed by an effective non-violent response (e.g., "tried to talk to the person calmly to settle the argument") and an aggressive response (e.g., "threw the first punch"). Responses include a positive (e.g., "They would think that I did the right thing"), a neutral (e.g., "They would not care"), and a negative reaction (e.g., "They would think I was a punk"). Negative, neutral, and positive responses are scored −1, 0, and 1, respectively. Scores can range from −1 to 1, with scores below 0 indicating disapproval and those above

zero indicating approval. The Friends' Support for Fighting Scale was used in the current study (alpha = .77).

Peer Pressure for Fighting.: The Peer Pressure for Fighting scale is a seven-item scale asking youth how frequently in the past 30 days they experienced various forms of pressure to fight from friends (e.g., "A friend wanted you to have their back in a fight") and from the larger peer group (e.g., "Others got into a fight and wanted you to join in"). Participants rated each item on the same 6-point scale as the PBFS-AR. We followed the recommended scoring, which involves calculating the mean response across items after recoding responses into a 4-point scale (alpha = .85).

Analysis Plan

Because the multiple cohort design and annual recruitment of new participants limited the number of students who participated during all three grades, we conducted longitudinal analyses of four waves of data within a single school year for independent samples of 6th, 7th, and 8th grade students. For those who participated in more than one grade, we randomly selected data from one of their grades. We ran one-sided cross-lagged regression analyses using Mplus Version 8.4 (Muthén & Muthén, 2017) to provide explicit tests of each of our two hypotheses (see figures 1 and 2). One-sided models provide clearer tests of fit for model comparisons than bidirectional models because their fit is not influenced by misspecification of effects in the other direction. Moreover, as noted by MacKinnon (2008), including bidirectional effects violates the temporal precedence of the path from the predictor to the outcome via the mediators. Each model included autoregressive effects and controlled for dummy-coded covariates including male sex, grade (with 6th grade as the reference group), and intervention status (with data collected prior to implementing the intervention as the reference). This enabled us to evaluate each predictor's association with residual change in variables at the subsequent wave. The model included correlations among all variables within the same wave. We tested competing models to examine the consistency of effects across time and compared model fit based on the root mean square error of approximation (RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI), and scaled chi-square difference test (Satorra & Bentler, 2010). We computed standard errors using a robust estimator (i.e., MLR) to account for non-normality. We used full-information maximum likelihood estimates, which estimate parameters based on all available data. This is superior to traditional techniques (e.g., listwise deletion) and may be preferable to approaches assuming data are missing not at random that require tenuous assumptions (Enders, 2010). We estimated indirect effects using bias-corrected bootstrap estimation methods recommended by MacKinnon (2008).

We evaluated the adequacy of our sample size for our primary analyses based on the precision of our parameter estimates. This is in line with Goodman and Berlin (1992) and others (e.g., Smith & Bates, 1992) who have argued in favor of focusing on the size of confidence intervals rather than post hoc power analyses to evaluate the adequacy of sample size. In particular they noted that focusing on precision makes better use of the data obtained in a study, and is not limited to examining a range of potential values of power across sets of arbitrary estimates of population values for each model. This focus is also

consistent with calls by others (e.g., Cohen, 1994) to place greater emphasis on confidence intervals of effect sizes rather than on null hypothesis significance tests. Given the relation between confidence intervals and significance tests, we used the margin of error based on a 95% confidence interval (i.e., $1.96 \times$ standard error) to calculate the smallest sample coefficients that would be identified as significant at $p < .05$. Because standard errors varied across individual parameters, we report the range of values obtained across each set of coefficients. We modified this strategy for the bias-corrected bootstrap estimates by basing these calculations on the bootstrap confidence intervals.

Results

Descriptive Statistics

Stability coefficients across adjacent waves were generally high, ranging from .40 to .72 (median $r = .60$) for the three exposure measures, from .37 to .62 (median $r = .60$) for peer measures, and from .55 to .63 (median $r = .58$) for physical aggression (see Table S1 in online supplemental materials). Within each wave, the three peer measures were moderately correlated with each other (rs = .19 to .37); witnessing violence and victimization were highly correlated with each other (rs = .61 to .67) and with negative life events scale (rs = .40 to .53). Correlations between exposure and peer variables within each wave were all significant, but covered a broad range. The largest were between witnessing violence and peer pressure (rs = .41 to .52). The smallest were between victimization and friends' support for fighting (rs = .10 to .11). Similar patterns were generally observed across measures more than one wave apart, though their magnitudes were smaller.

Peer Variable Mediators of Relations Between Exposure and Physical Aggression

Overall Model—One-sided cross-lagged regression models evaluated Hypothesis 1, which stated that the three peer variables would mediate relations between exposure to violence and the frequency of physical aggression (see Figure 1). Witnessing violence, victimization, and negative life events were regressed on the demographic covariates, but were otherwise treated as exogenous variables (i.e., correlated with each other across all waves and with all endogenous variables within the same wave and at all prior waves). An initial model that allowed all path coefficients to vary across waves, had an acceptable fit based on an RMSEA of .023 and CFI of .982, but a marginally acceptable TLI of .924. Adding second-order autoregressive effects (i.e., each endogenous variable at waves 3 and 4 was regressed on its prior values at waves 1 and 2, respectively) improved model fit based on the scaled chi-square difference test (X^2 (8) = 79.98, $p < .001$) and all three fit indices (RMSEA = .013, CFI = .995, TLI = .978). We next examined the consistency of relations over time by constraining each cross-variable path coefficient across waves. This did not significantly decrease the fit (X^2 (42) = 57.69, $p = .054$). Standardized regression coefficients representing relations between Wave 1 variables and Wave 2 variables for this model are reported in Table 1 along with their standard errors. Statistically significant values are reported in Figure 1 for all waves (see Table S2 in the online supplemental materials for coefficients for all four waves). The margins of error based on 95% confidence intervals for standardized regression coefficients representing cross-variable relations over time ranged from .035 to .137. The majority (i.e., 32 of 36) coefficients had margins of error less than

.078. In other words, based on a $p < .05$, the sample size provided sufficient precision to identify sample estimates greater than .035 as significant for some of these regression coefficients, values greater than .078 as significant for most of these regression coefficients, and values greater than .137 as significant for all of these regression coefficients. The margins of error for bootstrap estimates of standardized indirect effects ranged from .003 to .013.

Mediation analyses supported Hypothesis 1 for witnessing violence, but not for victimization. Within this model, peer pressure for fighting was the only peer variable with a significant indirect effect ($\beta = .008$, 95% CI [.001, .020] across waves 1 to 3; $\beta = .009$, 95% CI [.001, .023] across waves 2 to 4). This reflects the effect of witnessing violence on subsequent changes in peer pressure for fighting ($\beta s = .09$, $p = .021$), and the effect of peer pressure for fighting on subsequent changes in the frequency of physical aggression ($\beta s = .09$ to .10, $p = .002$). The absence of significant indirect effects for the other peer variables was a result of one of these cross-wave paths failing to reach significance. Witnessing violence was positively associated with subsequent changes in friends' delinquent behavior ($\beta s = .08$ to .09, $p = .025$), but friends' delinquent behavior was not significantly related to subsequent changes in physical aggression ($\beta s = .02$, $p = .605$). In contrast, witnessing violence was not related to subsequent changes in friends' support for fighting ($\beta s = .02$, $p = .093$), although friends supporting for fighting was positively associated with changes in the frequency of physical aggression ($\beta s = .07$ to .08, $p < .001$). Support was not found for Hypothesis 1 with respect to victimization. The total indirect effect of victimization on physical aggression through the three peer variables was not significant ($\beta = -.006$, 95% CI [-.019, .003] across waves 1 to 3; $\beta = -.007$, 95% CI [-.022, .003] across waves 2 to 4). This was likely due to the absence of significant associations between victimization and changes in any of the three peer variables.

Sensitivity Analyses—Although the overall model included a covariate (i.e., intervention status) to control for mean differences on measures collected while the intervention was being implemented at each school (see Table S2), this does not address the more critical question of whether the intervention may have influenced the results of our mediation analyses, which focused on relations among the variables rather than on their means. We addressed this using multiple group analyses to determine if cross-variable coefficients in the final model differed across intervention conditions. A Wald test comparing all 21 cross-variable coefficients across intervention conditions was not significant, $\chi^2(21) = 25.50$, and none of the individual tests of the 21 coefficients was significant at $p < .05$. This suggests the relations among variables in our final model did not differ during the intervention phase.

We also conducted sensitivity analyses to determine if the absence of significant indirect effects for friends' delinquent behavior and friends' support for fighting was due to the high correlations among the three peer variables. For each of these two variables we ran a separate model that excluded the other peer variables. This revealed a significant indirect effect of witnessing violence on physical aggression via friends' support for fighting ($\beta = .006$, 95% CI [.001, .013] across waves 1 to 3; $\beta = .006$, 95% CI [.001, .015] across waves 2 to 4). Within this model (see Table S3 in supplemental materials), witnessing violence was positively related to subsequent changes in friends' support for fighting ($\beta = .07$, $p = .03$).

This had not been significant in the overall model that controlled for the effects of the other peer factors at the prior wave on friends' support for fighting. In contrast, modeling friends' delinquent behavior as a mediator of relations between each of the three exposure variables and physical aggression did not reveal any significant indirect effects at $p < .05$.

The failure of victimization to predict changes in the peer variables was surprising given its strong cross-wave correlations with these variables (see Table S-1). We considered the possibility that this may have been due to including both exposure variables, which were highly correlated with each other, in the same model. A sensitivity analysis that excluded witnessing violence replicated the findings of the earlier model. None of the peer variables significantly mediated the effects of victimization on changes in physical aggression, and victimization was not significantly related to subsequent changes in friends' delinquent behavior ($\beta = .08$ to $.11$, $p = 129$), friends' support for fighting ($\beta = -.03$, $p = .221$), or peer pressure for fighting ($\beta = .01$, $p = .648$).

Peer Variables as Mediators of Relations Between Physical Aggression and Exposure

Overall Model—We also used one-sided models to evaluate whether the three peer variables mediated relations between physical aggression and each of the three exposure variables (i.e., Hypothesis 2; see Figure 2). Adding second-order autoregression effects to the initial model significantly improved the fit (X^2 (12) = 121.58, $p < .001$). Holding all cross-variable path coefficients constant across waves did not decrease the fit (X^2 (42) = 51.02, $p = .160$), and the resulting model fit the data very well (RMSEA = .010, CFI = .994, and TLIs = .984). Standardized regression coefficients representing relations between Wave 1 and Wave 2 variables for the constrained model are reported in Table 2 and statistically significant values are reported in Figure 2 for all waves (see Table S4 in online supplemental materials for all coefficients). The margins of error based on 95% confidence intervals for standardized regression coefficients representing cross-variable relations over time ranged from .033 to .137. The majority (i.e., 29 of 36) coefficients had margins of error less than .078. The margins of error for bootstrap estimates of standardized indirect effects ranged from .004 to .013.

Support for Hypothesis 2 was found for friends' delinquent behavior, but not for friends' support for fighting or peer pressure for fighting. Friends' delinquent behavior mediated the relations between physical aggression on changes in witnessing violence based on significant indirect effects for physical aggression on witnessing violence across waves 1 to 3 ($\beta = .010$, 95% CI [.003, .023]) and across waves 2 to 4 ($\beta = .014$, 95% CI [.004, .032]). It also mediated the effects of physical aggression on changes in victimization based on significant indirect effects across waves 1 to 3 ($\beta = .011$, 95% CI [.003, .028]) and waves 2 to 4 ($\beta = .017$, 95% CI [.004, .044]). This indirect effect reflects the significant relation between physical aggression and subsequent changes in friends' delinquent behavior ($\beta s = .08$ to $.11$, $p = .014$), which in turn, was associated with subsequent changes in both witnessing violence ($\beta s = .11$ to $.16$, $p < .001$) and victimization ($\beta s = .12$ to $.20$ $p < .001$). The absence of significant indirect effects for the other peer variables was again a result of one of the cross-wave paths failing to reach significance. Physical aggression was related to changes in friends' support for fighting ($\beta s = .06$, $p = .027$), but not to peer pressure

for fighting. In contrast, whereas peer pressure for fighting was associated with subsequent changes in witnessing violence (βs =.10 to .13, $p < .001$) and victimization (βs =.07 to .10 $p = .02$), friends' support for fighting was not related to subsequent changes in either form of exposure.

We had not formulated hypotheses for negative life events, which was included to control for other negative life experiences that may co-occur with witnessing violence and victimization. The model did, however, reveal a pattern similar to that found for witnessing violence and victimization. Friends' delinquent behavior significantly mediated associations between physical aggression and changes in negative life events across waves 1 to 3 (β = .007, 95% CI [.001, .016]) and across waves 2 to 4 (β = .007, 95% CI [.001, .017]). Within this model friends' delinquent behavior and peer pressure for fighting were each related to subsequent changes in the frequency of negative life events (βs =.07 to .08, $p = .005$, and βs =.10 to .11 $p < .001$, respectively).

Sensitivity Analyses—As in the previous model, multiple group analyses were used to determine if the findings differed as a function intervention status. A Wald test comparing all 21 cross-variable coefficients was not significant, $\chi^2(21) = 25.06$, $p = .245$, and none of the individual tests of the 21 coefficients was significant at $p < .05$. This suggests that the pattern of relations among the variables was not influenced by the presence of the intervention.

Sensitivity analyses that evaluated mediation in separate models for peer pressure for fighting and friends' support for fighting found only one significant effect. Friends' support for fighting predicted subsequent changes in negative life events (βs=.05, $p = .004$). This resulted in a significant indirect effect of physical aggression on negative life events at Wave 3 (β=.003, 95% CI[.001,.006]) and Wave 4 (β=.003, 95% CI[.001,.007]). No other evidence was found in support of additional peer factors as mediators of relations between physical aggression and any of the three exposure variables.

Sex Differences

The inclusion of sex as a covariate within each model provided a basis for examining sex differences in Wave 1 means and on changes in means on measures at subsequent waves (see Tables 1 and 2). These models revealed small sex differences at Wave 1 such that male adolescents reported higher levels of friends' delinquent behavior ($d = .14$, $p = .013$) and friends' support for fighting ($d = .13$, $p = .020$), and higher frequencies of victimization ($d = .26$, $p < .001$) and witnessing violence ($d = .14$, $p = .007$). Significant differences in Wave 1 means were not found for the frequency of physical aggression, peer pressure, or negative life events. Within the model examining the effects of exposure to violence on physical aggression there were small, but significant sex differences in residual changes for three of the five endogenous variables (i.e., $d = .14$ to .19 in absolute value). Within the model examining effects of physical aggression on exposure to violence, there were small, but significant effects on one of the four endogenous variables such that male adolescents reported higher levels of friends' support for fighting at Wave 2 and 3 (ds = .14 and .11, respectively, $p < .05$).

We also ran multiple group models in which parameter estimates were estimated separately for female and male adolescents to evaluate sex differences in cross-variable effects within the mediation models represented in Figure 1 and 2. Wald tests comparing all 21 cross-variable coefficients by sex did not reveal any significant differences for the model examining the peer variables as mediators of relations between exposure to violence and physical aggression, $\chi^2(21) = 18.21$, $p = .636$; or for the model examining peer variables as mediators of relations between physical aggression and exposure to violence, $\chi^2(21) = 18.16$, $p = .638$. Only one of the 42 individual significance tests was significant at $p < .05$. This again indicated no sex differences in cross-variable relations within the model.

Discussion

The goal of this study was to examine peer variables as potential mediators of relations between exposure to community violence and adolescents' frequency of physical aggression. This study differed from previous studies in several important respects. It broadened the focus by examining three distinct dimensions of peer behavior as potential mediators of bidirectional relations between two forms of exposure (i.e., witnessing and victimization) and physical aggression, while controlling for the potential confounding influence of other negative life events commonly experienced by adolescents exposed to high levels of violence and victimization. It also examined these relations across multiple waves within the same school year and following summer, rather than across school years. The results revealed patterns that differed depending on the type of exposure, the specific peer variable, and whether peer variables were modeled as a cause or a consequence of exposure to violence and physical aggression. Although the magnitude of the indirect effects was small, this is typical when variables have high stability and concurrent cross-variable correlations (Adachi & Willoughby, 2015). This is compounded for indirect effects, which are based on product terms.

Peer Factors as Mediators of Relations Between Exposure and Physical Aggression

Partial support was found for Hypothesis 1, which stated that peer variables would mediate relations between exposure to violence and adolescents' frequency of physical aggression. Peer pressure for fighting and friends' support for fighting mediated relations between witnessing violence and changes in physical aggression when examined in separate models. However, peer pressure for fighting was the only significant mediator within the model that included all three peer variables. The influence of witnessing violence on all three peer factors supports the strong influence of contextual factors. Adolescents who spend time in unsupervised high-risk settings may be more likely than other youth to encounter and form friendships with peers who encourage the use of physical aggression. This was supported by Low and Espelage (2014) who found that witnessing community violence increased adolescents' affiliation with delinquent peers. Positive associations between peer pressure and friends' support for fighting and subsequent changes in adolescents' frequency of physical aggression is consistent with a considerable body of research examining peer influences on aggressive behavior (e.g., Santor et al., 2000). Cross-variable associations did not differ by sex. This is consistent with studies that have not found sex differences in

relations between community violence exposure and externalizing problems (e.g., Fowler et al., 2010) or susceptibility to peer influences (McCoy et al., 2019).

The lack of support for friends' delinquent behavior as a mediator of relations between witnessing violence and physical aggression was surprising. Although witnessing violence was associated with changes in friends' delinquent behavior, friends' delinquent behavior was not associated with changes in physical aggression. This finding differs from prior studies that found affiliation with delinquent peers to be a strong predictor of adolescents' frequency of physical aggression (e.g., Goodearl et al., 2007; Lin et al., 2020), but must be interpreted within the context of the overall model that controlled for the influence of witnessing violence, victimization, and negative life events on physical aggression. This highlights the importance of considering delinquent peer affiliation within the context of other factors that influence adolescents' physically aggressive behavior. The fact that peer pressure for fighting and friends' support for fighting both emerged as unique predictors of physical aggression within this context may reflect their more specific focus on aggressive behavior versus the broader focus of friends' delinquent behavior.

Support was not found for Hypothesis 1 with respect to peer factors as mediators of associations between victimization and changes in physical aggression. This suggests clear differences in the effects of the two forms of exposure. Whereas witnessing violence predicted changes in all three peer variables, victimization did not. This could reflect variability in how adolescents respond to victimization. Whereas some may seek out higher status "tough" peers for protection, others may seek protective factors, such as a supportive and caring relationship with an adult (Farrell et al., 2007) that reduce their likelihood of befriending peers who engage in delinquent behavior. These findings could also indicate differences in social-cognitive processes resulting from witnessing violence versus victimization. Youth who witness violence may perceive aggression to be acceptable or anticipate desirable outcomes from aggression and thus seek out peers who encourage and support aggressive behavior (Crick & Dodge, 1994), whereas youth who are victimized may not perceive such benefits.

Peer Factors as Mediators of Relations Between Physical Aggression and Exposure to Violence

Support for Hypothesis 2, which represented peer factors as mediators of relations between the frequency of physical aggression and exposure to violence also varied across the specific peer factors. Support was found for friends' delinquent behavior as a mediator of relations between physical aggression and subsequent changes in the frequency of witnessing violence, victimization, and negative life events. This supports the notion that adolescents who engage in physical aggression seek friends who engage in delinquent behavior, and that these associations increase their risk for exposure not only to witnessing violence, but also victimization and other negative life events. The association between adolescents' frequency of physical aggression and subsequent changes in friends' delinquent behavior and friends' support for fighting is consistent with theories that emphasize homophily, or the tendency for aggressive adolescents to seek out and interact with other aggressive adolescents (Dishion et al., 1994). The absence of a similar finding for peer pressure for

fighting may reflect the fact that it represents the broader peer context. Cross-variable findings did not differ for male and female adolescents.

Relations between friends' delinquent behavior and subsequent changes in witnessing violence, victimization, and negative life events supports the notion that affiliating with delinquent and aggressive peers leads adolescents to spend increasing time in unsupervised contexts where there is greater risk of witnessing violence and experiencing victimization. Salzinger et al. (2006) found similar effects across 1-year intervals. In contrast, Lambert et al. (2005) found that affiliation with deviant peers predicted witnessing violence but not victimization 1 to 2 years later and only for male adolescents. We also found relations between peer pressure for fighting and subsequent changes in both witnessing violence and victimization. We did not, however, find associations between friends' support for fighting and changes in witnessing violence or victimization, even in models that did not control for the other peer variables. This suggests that friends' support for fighting may have a direct effect on adolescents' frequency of physical aggression, but does not influence the settings where they spend their time.

Limitations

This study had several limitations that should be noted. It relied on self-report, which could reflect bias in responding. It should, however, be noted that adolescents are the only informant aware of their behavior and experiences across multiple contexts. This is supported by prior studies that have found that parents underestimate their adolescents' frequency of exposure to violence (Martinez & Richters, 1993). Adolescents who engage in physically aggressive behavior may overestimate the degree to which their peers also engage in physically aggressive behavior (Boman et al., 2012). This potential bias was partially addressed by controlling for adolescents' own prior level of aggression. Moreover, perceptions of friends' behavior may exert a stronger influence on adolescents' behavior than their actual behavior. This study examined changes within a specific school year across 3-month intervals, which represented changes across short spans of time. Because some effects may not emerge during the course of a school year, the current study's findings may differ across broader spans of time. Finally, the majority of participants in our sample were African American early adolescents in urban communities with high rates of violence. Results may not generalize to adolescents in other settings. Nonetheless, this is an important population on which to focus given their high risk for exposure. Further work is needed to understand the experiences of other groups of adolescents.

Research Implications

This study highlights the complex bidirectional relations among adolescents and the microsystems with which they interact—namely, their peer group and community context. Whereas all three peer variables were significantly correlated with the frequency of physical aggression and with all three exposure variables within and across waves, they showed very different patterns in the role they played in models evaluating their impact as mediators. Friends' support for fighting was not a significant mediator of effects in either direction, but was the only peer variable that significantly predicted subsequent changes in both of the other two peer variables over time. This suggests adolescents' perceptions of their friends'

approval for fighting may be associated with subsequent changes in perceptions of their friends' problem behavior and pressure to fight. This highlights the importance of going beyond the narrow focus on deviant peers to examine a broader set of peer variables within dynamic models of change (Prinstein & Galletta, in press). Similarly, the clear differences in findings related to the causes and effects of witnessing violence and victimization highlights the importance of examining witnessing violence and victimization as distinct constructs rather than combining them into a composite measure of exposure to violence (e.g., Goodearl et al., 2014; Lin et al., 2020). Although our analysis of sex differences revealed small mean differences, there were no significant differences in the cross-variable relations for coefficients in either model. This finding is consistent with suggestions that high rates of violence and other experiences faced by youth in under-resourced communities may result in socialization processes that have a negative impact on both male and female adolescents (e.g., Bradshaw et al., 2010). Further work is needed to determine if such effects are specific to this context.

Prevention Implications

Our findings portray a pernicious cycle of peer selection and influence processes that result in increased exposure not only to witnessing violence, but also violent victimization and a broader array of negative life events. They also align with the ecological-transactional model, which maintains that adolescents are not only influenced by, but also exercise control over the contexts where they spend their time (Cicchetti & Lynch, 1993). This highlights the need for comprehensive prevention strategies to disrupt the cycle between exposure to community violence and engaging in physical aggression. This requires mitigating risk factors and enhancing protective factors at multiple levels. For instance, efforts at the community level might involve enhancing community members' collective monitoring of youth and creating spaces for youth to engage in positive social activities (e.g., sports teams, community centers) under the supervision of adults. Additionally, parents and service providers (e.g., coaches, teachers, community center staff) should take care to monitor youth appropriately across contexts to prevent deviancy training. This may involve establishing rapport and trust with youth to allow for open and honest communication about their activities with their peers. This may be particularly beneficial for youth in low-resourced communities with high rates of violence. At the school level, universal interventions that enhance youths' social and emotional skills may target some of the factors that have been identified as increasing youths' susceptibility to peer influence (Mrug et al., 2012) and mitigate norms supporting aggression more broadly. At the peer level, it is important that attempts are made to avoid the aggregation of youth who engage in problem behaviors in classrooms and extracurricular activities, which can result in iatrogenic effects (see Dishion & Tipsord, 2011). Ultimately, interventions that target multiple systems and their interactions within an adolescents' environment could interrupt mechanisms that underlie the bidirectional relations between community violence exposure and physical aggression.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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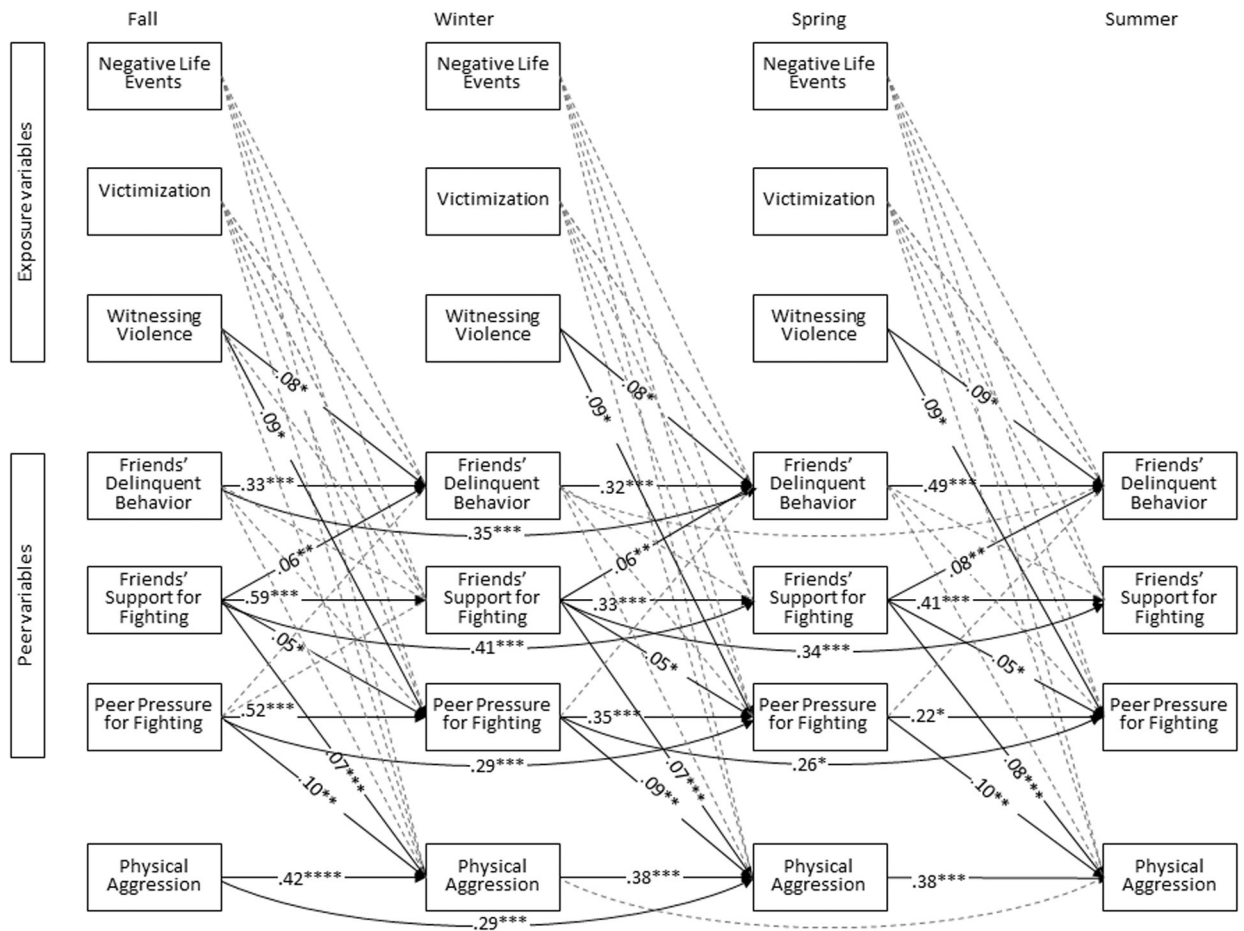
Figure 1:
Standardized path coefficients for model representing peer variables as a mediator of the relation between negative life events, victimization, and witnessing violence on changes in physical aggression. Paths represented by dashed lines were included in the model, but were not significant at p < .05. Effects of covariates (sex, grade, and intervention status) on each variable, correlations among all exposure variables, correlations of each exposure variable with peer variables and. physical aggression at the same wave and all prior waves, and correlations among residuals for peer variables and physical aggression variables within the same wave were included in the model, but are not shown in figure.
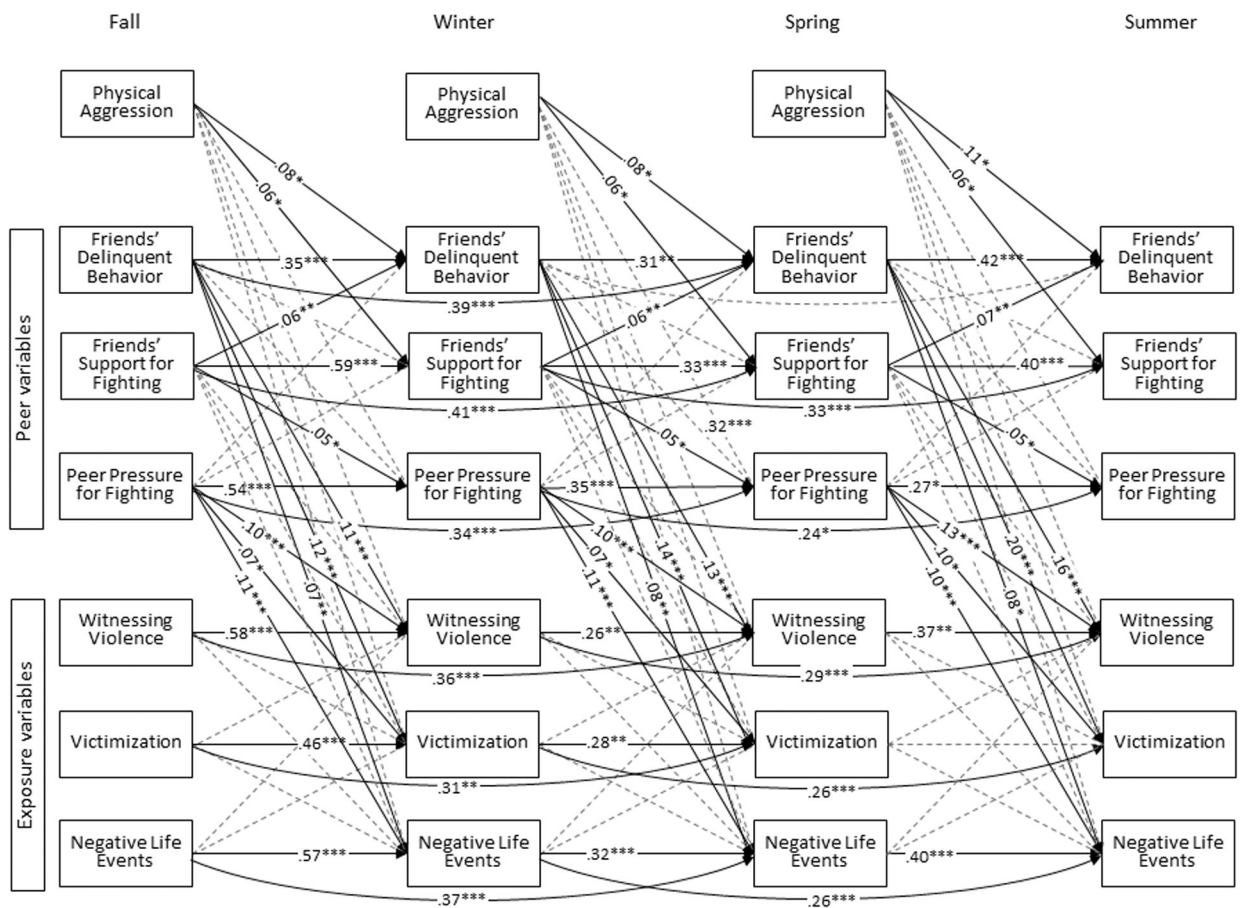
Figure 2:
Standardized path coefficients for model representing peer variables as mediators of the relation between physical aggression on changes in exposure variables. Paths represented by dashed lines were included in the model, but were not significant at $p < .05$. Effects of covariates (sex, grade, and intervention status) on each variable, correlations among all exposure variables, correlations of each exposure variable with peer variables and. physical aggression at the same wave and all prior waves, and correlations among residuals for peer variables and physical aggression variables within the same wave were included in the model, but are not shown in figure.

Table 1

Standardized Coefficients for Model Depicting Peer Variables as Mediators of Relations Between Exposure Variables and Changes in Physical Aggression.

	Wave 2 variables							
	Friends' Delinquent Behavior		Friends' support for fighting		Peer pressure for fighting		Frequency physical aggression	
Wave 1 variables	β	SE	β	SE	β	SE	β	SE
Male	.00	.03	.07***	.03	.00	.03	−.05	.03
Grade 7	.02	.03	.01	.03	.00	.03	.04	.03
Grade 8	.08*	.03	.02	.03	−.02	.03	.01	.03
Intervention status	−.02	.03	.01	.03	−.06*	.03	−.04	.03
Friends' delinquent behavior	.33***	.10	.00	.02	.04	.03	.02	.03
Friends' support for fighting	.06**	.02	.59***	.04	.05*	.02	.07***	.02
Peer pressure for fighting	.01	.03	.03	.03	.52***	.05	.10***	.03
Witnessing violence	.08*	.04	.06	.04	.09*	.04	.06	.04
Victimization	.05	.06	−.06	.03	−.04	.04	.01	.04
Negative life events	−.01	.02	.01	.03	.03	.03	.00	.03
Frequency of physical aggression	a	a	a	a	a	a	.42***	.05
R^2	.18*	.07	.38***	.04	.37***	.06	.30***	.05

Note. $N = 2{,}707$. Coefficients represent regression of wave 2 variables listed in column headings on Wave 1 variables listed in row headings. Table reports a subset of the results of a four-wave model in which each cross-variable coefficient was held constant across all waves.

[a] Peer factors were not regressed on physical aggression.

[*] $p < .05$. $p < .01$. $p < .001$.

Table 2

Standardized coefficients for Model Depicting Peer Variables as Mediators of Relation Between Physical Aggression and Changes in Exposure Variables.

	Wave 2 variables											
	Friends' delinquent behavior		Friends' support for fighting		Peer pressure for fighting		Witnessing violence		Victimization		Negative Life Events	
Wave 1 variables	β	SE	β	SE	β	SE	β	SE	β	SE	β	SE
Male	.02	.03	.07**	.03	.00	.03	.01	.02	.07**	.03	-.08**	.03
Grade 7	.01	.03	.01	.03	-.01	.03	.02	.03	-.01	.03	.04	.03
Grade 8	.06	.03	.01	.03	-.03	.03	-.03	.03	-.02	.03	-.02	.03
Intervention status	-.02	.03	.00	.03	-.07**	.03	-.04	.03	-.05	.03	-.05*	.03
Friends' delinquent behavior	.35***	.09	-.01	.02	.05	.03	.11***	.03	.12**	.04	.07**	.03
Friends' support for fighting	.06**	.02	.59***	.04	.05*	.02	-.02	.02	-.02	.02	.03	.02
Peer pressure for fighting	.02	.03	.02	.03	.54***	.06	.10***	.03	.07*	.03	.11***	.03
Physical aggression	.08*	.03	.06*	.03	.02	.03	.04	.03	.05	.03	.01	.03
Witnessing violence	a	a	a	a	a	a	.58***	.06	-.02	.06	-.03	.05
Victimization	a	a	a	a	a	a	.00	.07	.46***	.10	.02	.06
Negative life events	a	a	a	a	a	a	.02	.05	.04	.05	.57***	.04
R²	.18*	.07	.38***	.04	.35***	.06	.50***	.06	.34***	.08	.43***	.05

Note. $N = 2,707$. Coefficients represent regression of wave t variables listed in column headings on Wave t-1 variables listed in row headings. Table reports a subset of the results of a four-wave model in which each cross-variable coefficient was held constant across all waves.

[a]Variable not included in the model for this dependent variable.

*
$p < .05$. $p < .01$. $p < .001$.