Published in final edited form as:
J Adolesc Health. 2012 July ; 51(1): 45–52. doi:10.1016/j.jadohealth.2011.11.008.

Racial/Ethnic Differences in Trajectories of Aggression in a Longitudinal Sample of High-Risk, Urban Youth

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Abstract

Purpose—To estimate trajectories of aggression among African Americans and Hispanics using a longitudinal sample of urban adolescents, and test multiple domains of risk factors to differentiate profiles of aggression.

Methods—Participants included 3,038 adolescents followed from 6th–8th grade. Trajectories of aggression were estimated for African Americans and Hispanics separately, and multinomial regression procedures were used to evaluate the effect of multiple domains of risk and protective factors. Mediation analyses were conducted to evaluate the indirect effects of contextual variables on aggression.

Results—Four profiles of aggression were identified. Among Hispanics, groups included: 1) low-aggression, 2) desistors, 3) escalators, and 4) consistent aggression; among African Americans: 1) low-aggression, 2) escalators, 3) moderate-consistent aggression, and 4) consistent aggression. Differences in the multiple domains of risk factors emerged between racial/ethnic groups.

Conclusion—Contextual variables (peer alcohol use, adult alcohol consumption, and home access to alcohol) increased risk for aggression differentially by racial/ethnic group.

Keywords

trajectory; aggression; longitudinal; adolescents; drug; alcohol

Introduction

Adolescent aggression constitutes a serious public health problem. Approximately 700,000 adolescents and young adults (10–24) are treated annually in the emergency room for

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injuries related to violent activity.[1] Evidence suggests that adolescents who engage in violent delinquency are more likely to engage in other high-risk activities, including alcohol and other drug use, dropping out of school, gun ownership, gang membership, risky sexual activity and familial independence,[1–3] and increase their risk of serious injury and death[4].

While the evidence in support of individual-level risk factors for aggression is strong, [5,6] behavioral risk factors within the family and peer group are less studied. Hawkins et al. [7] found that delinquent peers and gang membership have been predictive of violent behavior; however, the effect of peer and parental substance use is unclear. 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 [8]. Although many studies have analyzed multilevel risk and protective factors for violence, few have assessed the degree to which contextual variables are mediated through proximal variables.

Racial/ethnic differences in the prevalence of aggression have been identified. For example, Williams et al.[9] found that self-reported violence initiation was higher for African Americans compared to Whites for major delinquency, aggression, and juvenile justice involvement.[9] Additionally, Williams et al.[9] reported African Americans' higher rates of violence when compared to Whites. McNulty and Bellair [10] found that African Americans, Hispanics, and Native Americans have higher involvement in serious aggression compared to White adolescents at ages 15 to 16. [10]

Several theoretical frameworks provide insight on the rationale behind racial and ethnic differences in the predictors of aggression. First, social learning theory suggests that adolescents learn deviant behavior from peers and parents.[11] Peer drug and alcohol use has been significantly related to individual-level alcohol and drug use,[12] and drug use has consistently been linked with aggression.[13] Parental bonding and monitoring has been shown to decrease behavioral problems among adolescents, including alcohol, drug use and violent behavior.[14] Similarly, parental drug use has been associated with adolescent drug use and risk behavior.[14] At the community level, Shaw and McKay[15] suggest that the lack of social control in disadvantaged neighborhoods allows crime to multiply. At the community level, the density of alcohol outlets and perceived number of adults who consume alcohol in the home appear to be indicators of community risk.[16] Each of these contextual influences was included in the scope of the current study.

To further explore the factors explaining racial/ethnic differences in risk factors for aggression, this study examined trajectories of aggression among African American and Hispanic adolescents, including the direct and mediated effects of multiple domains of risk and protective factors for membership in each trajectory group. This study contributes substantially to the literature on disparities and etiology of aggression among high-risk youth. We hypothesize that the trajectories of aggression differ between African Americans and Hispanics, and African Americans are more likely to be involved in high levels of aggression. Finally, we hypothesize that these differences in aggression are attributable to differences risk factors, and distal risks are mediated through proximal influences.

Methods

Data were collected during Project Northland Chicago (PNC), a randomized alcohol prevention program implemented during 6th through 8th grades in Chicago, Illinois schools.[17] The sample included participants who were present at baseline (6th Grade, Fall) and completed at least one additional survey throughout 6th through 8th grades. This cohort consisted of 3,038 adolescents, of which 57% were African American, and 43% identified as Hispanic (Table 1). Due to sample size limitations in the estimation of trajectory groups for

Whites and other racial/ethnic subgroups, only African Americans (n=1,732) and Hispanics (n=1,306) were included.[1]

Measures

Baseline measures (6th grade, Fall, Age 11) were included as covariates to examine trajectories of aggression.

Physical Aggression—To create profiles of aggressive behavior, three items were used to evaluate prior month physical aggression. These items included, "how many times have you pushed, shoved, pulled someone's hair, or grabbed someone?"; "how many times have you kicked, hit, or beat up another person?"; and "how many times have you told someone you were going to hit or beat them up?". All items included the following response options, "Never", "1–3 times", "4 or more times". These items were coded as "0", "2", and "4" at each follow-up. At baseline, adolescents were considered to exhibit "aggressive" or "non-aggressive" behavior.

Risk Factors for Aggression

Contextual-Level Measures—At baseline, the number of off-premise alcohol outlets per 1,000 population (alcohol outlet density), adolescents' perception of the number of adults who consume alcohol in their neighborhood (higher values indicate more perceived alcohol consumption), parental involvement (1–20; higher values indicate higher risk), home access to alcohol, and peer alcohol use (having friends who use alcohol or not) were included as risk factors for aggression.

Individual-Level Measures—Sadness or depression, poor academic achievement (higher scores indicate lower achievement), alcohol and marijuana use, unsupervised time (higher values indicate more unsupervised time), and group fighting were included as risk factors for aggression.

Demographics—Demographic characteristics included adolescents' living arrangements (e.g., living with both parents together versus other arrangements), receipt of free/reduced price lunch, gender, age, and language spoken at home was included for Hispanic adolescents only.

Analytical Methods

Trajectory groups were fitted to the data using group-based trajectory modeling.[18,19] Group-based trajectory models are finite mixture models, which use single- and multiple-group model structures.[19] The trajectory groups that are created using these analyses are derived from maximum likelihood estimation. In this case, aggression data follows a Poisson distribution with a large number of non-violent events (zero aggressive events). Therefore, a zero-inflated Poisson (ZIP) distribution was specified in the model. Models were tested until the most parsimonious number of trajectory groups maximized the Bayesian Information Criterion (BIC). SAS PROC TRAJ was used to estimate the trajectories.

Bivariate and multivariate multinomial regression procedures were used to estimate odds-ratios for risk and protective factors on membership in each group for Hispanics and African Americans separately. Any risk and protective factors that were not significantly associated with membership in an aggressive group were excluded from multivariate modeling. Multinomial regression procedures were adapted to the multilevel nature of the data. The

[1]All secondary analyses were approved by the Institutional Review Board at the University of Florida.

PNC sampling design features students nested within schools. Clustered robust standard errors were estimated to produce error estimates that take into account the autocorrelation due to the sampling design. Due to the relatively small size of some trajectory groups (e.g., low-aggression, African Americans), a three-level model (e.g., census tract, school, and individual-level) was not employed in this analysis. Clustering at the school level was accounted for in the models, taking into account the similarity of adolescents who attend the same schools. Previous studies have found larger ICCs at the school-level compared to the neighborhood-level for adolescents, [20,21] so we are confident that accounting for school-level variance adjusts for clustering. STATA 11 software (College Station, TX) was used for regression analyses.

Mediation analyses were conducted to evaluate the indirect effect of community-, parent- and peer-level variables on aggressive trajectory membership. Trajectory groups were dichotomized into "aggressive trajectory member" (if classified as a desistor or an escalator) and "non-aggressive trajectory member" (if non-aggressive) groups for logistic regression modeling. For each mediator and contextual variable, four logistic regression models were examined: 1) the effect of the contextual variable on the mediator (slope *a*); 2) the effect of the mediator on the outcome (aggressive trajectory membership, slope *b*); 3) the direct effect of the contextual variable on the outcome (slope *c*); and 4) the adjusted effect of both the contextual variable and the mediator on the outcome (estimating parameters for both slope *b* and slope *c*). All regression models were adjusted for other risk factors, demographics, and sampling design.

To test the significance of the mediator, the Sobel test was used to generate a *z* statistic and standard error. [22,23,24] The percent mediation for each mediator was calculated using the formula: $ab/a_1b_1 \ldots a_xb_x + c$. In this formula, *a* represents the effect of the contextual variable on the hypothesized mediator, and *b* represents the effect of the mediator on the outcome variable (in this case, aggression). *C* represents the direct effect of the contextual variable on the outcome. All of these standardized estimates (including all other variables in the model) were used to calculate the proportion of the variance in each contextual variable on aggression that is mediated through each proximal variable. These percentages were summed to estimate the proportion of the contextual variable's effect on aggression mediated through proximal variables. Percent mediated may be interpreted as the percentage of the contextual variable that is mediated through each individual-level variable.

Results

Racial/Ethnic Differences in Trajectories of Aggression

Results of the trajectory modeling suggest four distinct profiles of aggression. Among African Americans, 7.9% were in the low-aggression group, 19.5% were escalators, 8.4% had moderate-consistent aggression patterns, and 64.0% were in the consistent aggressive group. Among Hispanics, 17.1% were in the low-aggression group, 18.1% were desistors, 21.6% were escalators, and 43.3% were in the consistent aggression group.

For each racial/ethnic group, a four-group model showed the lowest AIC and BIC compared to a higher-class model. For African Americans, the AIC and BIC for the 4-class model were −10,437 and −10467, respectively. For Hispanics, the AIC and BIC were −8,333 and 8,362, respectively, for the 4-class model. The posterior probabilities ranged from (0.79–0.91) for African Americans and Hispanics. Figure 1 displays the trajectories of aggression from grades 6–8.

Multivariate Results Adjusted for Baseline Aggression

African Americans—The multivariate model adjusted for baseline aggression is presented in Table 2. For the consistent aggression group, the perceived number of adults in the neighborhood who use alcohol was a risk factor (OR = 1.75; 95% CI 1.16–2.64). Depression was a risk factor among the high-aggression group (OR = 1.63; 95% CI 1.61–5.39) even after controlling for several risk/protective factors, including baseline aggression. Group fighting was only significant among youth in the consistent aggression trajectory (OR = 2.95; 95% CI 1.61–5.39) and baseline aggression was a risk factor for membership in all groups (OR = 2.64; 95% CI 1.79–3.91 for desistors, OR = 1.84; 95% CI 1.21–2.81 for escalators, OR = 5.67; 95% CI 4.01–8.02 for consistent aggression).

Hispanics—The model adjusted for baseline aggression for Hispanics is presented in Table 2. Among desistors, having peers who use alcohol (OR = 2.57; 95% CI 1.46–4.55), low academic achievement (OR = 1.82; 95% CI 1.08–3.06), unsupervised time (OR = 1.69; 95% CI 1.20–2.38), and baseline aggression (OR = 3.28; 95% CI 2.09–5.13) increased risk for membership in this group. Having home access to alcohol (OR = 0.65; 95% CI 0.46–0.92) and speaking Spanish in the home (OR = 0.54; 95% CI 0.35–0.83) reduced the likelihood that adolescents would be desistors. Among escalators, only baseline aggression (OR = 2.38; 95% CI 1.49–3.80) was identified as a risk factor. Among those who displayed consistent aggression, having peers who use alcohol (OR = 2.28; 95% CI 1.35–3.88), low academic achievement (OR = 1.59; 95% CI 1.02–2.47), group fighting (OR = 2.00; 95% CI 1.13–3.55), and baseline aggression (OR = 8.23; 95% CI 5.67–11.94) were identified as risk factors. Protective factors included higher parental involvement (OR = 0.95; 95% CI 0.91–0.99) and speaking Spanish in the home (OR = 0.56; 95% CI 0.34–0.90).

Mediation

The mediated effects of each contextual variable through each individual-level variable are detailed in Table 3. Among African Americans, 65.2% of the effect of parental involvement on aggression was mediated through individual-level variables. For parental alcohol use 15.9% of the effect was mediated, and for peer alcohol use 69.4% of the effect on aggression was mediated through individual-level variables. Parental involvement was equally mediated through group fighting and baseline aggression (15.7%), as was parental alcohol use (15.8 and 15.9%, respectively). Effects of peer alcohol use on aggression were mediated primarily through baseline aggression (21.1%), followed by group fighting (17.2%).

Among Hispanics, 65.9% of the effect of parental involvement was mediated through individual-level variables. The majority of the effects of parental alcohol use (71.7%), home access to alcohol (77.9%), and peer alcohol use (66.7%) were mediated through proximal variables. The variable accounting for the largest percentage of the indirect effect of these contextual variables was through baseline aggression. The second largest mediator for peer alcohol use (12.5%) was group fighting, while alcohol use was a significant mediator for effects of home access to alcohol (16.7%), parental alcohol use (11.9%), and parental involvement (12.5%).

Discussion

The present study examined the number and shape of aggression trajectories among African American and Hispanic urban adolescents, including the direct and mediated effects of risk and protective factors for membership in each trajectory group. The trajectory models reported four-group models for each racial/ethnic subgroup. Among African Americans, the four groups included a low-aggression group, escalators, moderate-consistent aggression,

and consistent aggression. Among Hispanics, the groups included a low-aggression group, desistors, escalators, and consistent aggression.

There were differences between African Americans and Hispanics in the level of aggression longitudinally. As expected, African Americans were more likely to exhibit physical aggression (64.0%) compared to Hispanics (43.3%), and less likely to be in the non-aggressive group (7.9% were non-aggressive among African Americans, 17.1% among Hispanics).

These differences in trajectory membership indicate that African Americans were more likely to consistently participate in aggression, and were less likely to be non-aggressive, compared to Hispanics. These results are consistent with previous research on trajectories of aggression among youth. Four trajectory groups were extracted from the data, and this is consistent with the extant literature that suggests there are between three and five patterns of aggressive behaviors among adolescents [25,26]. These groups are also consistent with the other studies which have investigated the patterns of delinquency specifically among Hispanic adolescents [27].

Despite differences in the prevalence of physical aggression, there were a number of similarities in the risk and protective factors across African Americans and Hispanics. For example, baseline aggression was a significant predictor of all trajectory groups. Peer alcohol use also had a direct and mediated effect for both racial/ethnic groups. For Hispanics, peer alcohol use predicted membership in all three aggressive groups, while this effect was only significant among the consistent aggression group of African Americans.

Consistent with the literature, this study also found a substantial number of differences in the predictors of membership in each trajectory group between African Americans and Hispanics. Among the Hispanics who displayed consistent aggression, the perception that more adults in the neighborhood use alcohol, having access to alcohol at home, and having peers who use alcohol all had both direct and mediated effects increasing the risk of membership in the high-aggression group. Also among Hispanics, low academic achievement (consistent aggression and desistors), unsupervised time (desistors), and group fighting (consistent aggression) were risk factors for membership in an at-risk trajectory group. Speaking Spanish at home was protective from consistent aggression and desistance, and parental involvement was protective for consistent aggression. Among African Americans only, the number of adults who consumed alcohol and number of peers who use alcohol had a direct effect on membership in the consistent aggression group, and an indirect effect on aggression. Among African Americans only, depression was a risk factor for membership in the consistent aggression group.

This study identified a variety of factors that predicted aggressive trajectory membership. These findings are consistent with literature on the disparities by race/ethnicity on community-, family- and peer-level risk factors for physical aggression. Specifically, the finding that the perceived number of adults who use alcohol in the neighborhood and peer alcohol use both increase the risk for consistent aggression across race/ethnicity supports the peer and parental effects of social learning on aggression.[28]

The effect of social learning through contextual alcohol use appears to operate differently between African Americans and Hispanics. Specifically, among Hispanics, the effect of adults and peers who use alcohol is mediated through individual-level alcohol use. This mediated effect was not observed for African Americans, suggesting that adult and peer use is a direct risk for aggression, regardless of individual alcohol use. However, the mediated effects of contextual variables through individual variables are largely similar across African Americans and Hispanics. The mediation results indicate that contextual factors mostly

influence aggressive trajectories by increasing individual-level risk factors (with 65–78% of the effects of contextual variables mediated through the set of individual variables).

Group fighting was significant in predicting membership in the consistent aggression group of Hispanics only. This finding is supported in the literature on racial/ethnic differences in aggression, [110] as gang membership was a predictor of serious violence among Hispanics only. The higher prevalence of gang membership among consistently aggressive Hispanics in this sample may be driving the relationship between group fighting and consistent aggression. This finding also indicates that group fighting operates independent of aggression, as both constructs predicted consistent aggression. Therefore, combining group fighting with other violence and aggression may be inadequate, as these two behaviors appear to have independent effects on aggression.

Among Hispanics, speaking Spanish in the home was a protective factor from desistance and consistent aggression. This is consistent with prior literature on a variety of outcomes, as higher levels of acculturation have been strongly associated with adverse health outcomes, including driving under the influence of alcohol,[29,30] intimate partner violence, alcohol use, and violence [26]. It has been suggested that the stress associated with inter-generational conflict generated from internalization of American culture and values may increase problem behaviors among acculturated Hispanic youth. [31]

Among African Americans, we identified few direct effects of contextual variables on aggression among escalators and adolescents who exhibit moderate-consistent aggression. The lack of predictors may be due to the time-varying nature of aggression in these groups. Specifically, risk factors at time points more proximal to the aggressive behavior (e.g., late adolescence) may be more predictive of membership in this group. This finding highlights the need for future research among escalators, as unique risk factors may emerge.

This study had several limitations. First, we were unable to account for some of the variables associated with aggression, such as peer aggression, cognitive development, and psychological disorders. Second, latent-group based trajectory modeling provides an estimation of the type and number of groups in the data, and this process is exploratory. Despite the exploratory nature of trajectory estimation, the results of this study were consistent with the expected number and shape of trajectory groups from other studies.[25,32] Finally, the use of single-item indicators is not optimal (most notably, in measuring depression); however, the purpose of this item was not to measure clinical depression. Instead, this item was used to account for mood disorders, which have been linked to aggression.[33]

Despite these weaknesses, the current study had a number of strengths. First, data were derived from a unique sample of high-risk, urban adolescents who were followed longitudinally for three years. Second, the large sample size provided adequate power to stratify groups of African Americans and Hispanics to understand the differential risk factors. Third, although many studies have analyzed the multilevel risk and protective factors for aggression, few have assessed the degree to which contextual variables are mediated through proximal variables. The mediated effects allows us to acknowledge that contextual influences are important in predicting aggression even though their effects are mitigated using multivariate regression models. Finally, the trajectories estimated in this study are especially appropriate for studies of aggression, as patterns vary significantly over time [25].

Findings from this study indicate that there are similarities in the risk factors for aggression between African Americans and Hispanics. These predictors have significant implication for large-scale prevention programming. First, interventions should target multiple risk and

protective factors to maximize the preventive effect across demographic groups. Social influences, such as exposure to substance-using peers, and community-level exposure to alcohol influence adolescents' risk for aggression. These risk factors that were consistent across race/ethnicity may be targeted in a variety of populations to reduce participation in aggression. Second, aggressive behavior begins even before 6th grade in high-risk settings, indicating that current prevention programming occurs too late. Prevention programming should begin early in elementary school settings to prevent initiation of aggression. Third, there were some differences in the predictors of aggression between racial/ethnic groups. Therefore, the composition of the intervention population (e.g., characteristics of the social structure, community, family, etc.) should be considered before program administration. In conclusion, there are substantial similarities and differences in the trajectories of aggression by racial/ethnic group. These similarities provide a foundation for prevention programming targeting a wide range of multi-level risk and protective factors.

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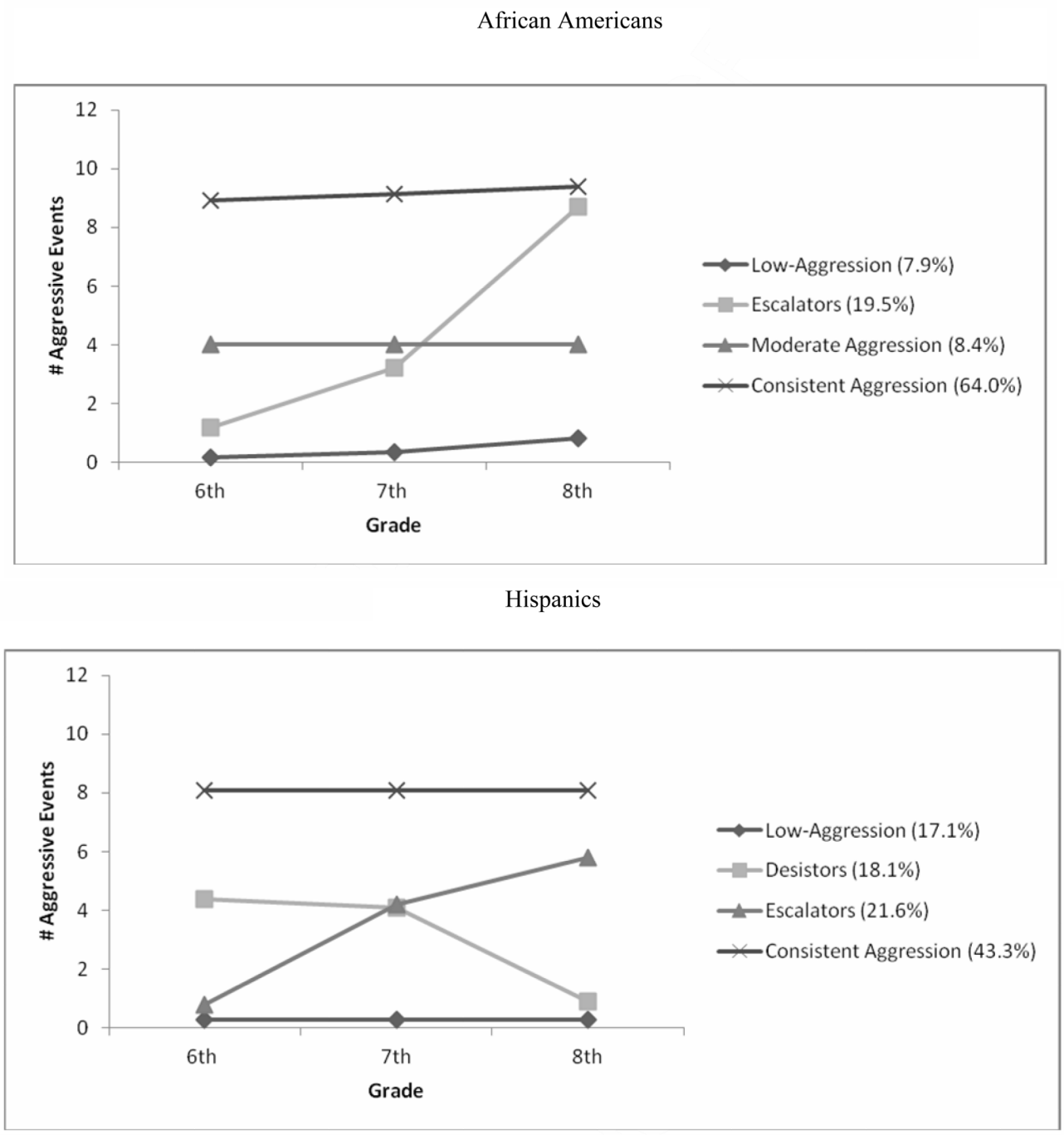

Figure 1.
Trajectories of physical aggression, PNC, 2002–2005, n=3,038.

Table 1

Description of sample, PNC. n=3038.

Variable	African American (%)	Hispanic (%)
	N=1732	N=1306
Aggression		
6th Grade [a]	6.50 (0.17)	4.42 (0.25)
7th Grade [a]	7.06 (0.24)	5.40 (0.23)
8th Grade [a]	7.38 (0.24)	5.12 (0.19)
Community-level		
Alcohol outlet density	0.24 (0.03)	0.21 (0.03)
Adults in neighborhood drink [b]	52.2	37.4
Parental and Peer Influences		
Parental involvement [a]	36.95 (0.30)	35.57 (0.29)
Home access to alcohol [b]	4.0	14.6
Peer alcohol use [c]	33.6	34.0
Individual-level Risk Factors		
Alcohol use in the past year	18.0	21.0
Marijuana use in the past year	6.4	4.0
Depression[d]	73.0	76.9
Unsupervised time [e]	70.9	71.5
Natural parent household	34.8	68.2
Free or reduced price lunch	73.1	74.6
Spanish at home	--	60.8
Low academic achievement [f]	67.3	68.5
Aggression		
Group fighting in prior month	33.5	23.6
Demographics		
Male	47.9	49.0
Age at baseline [a]	11.88 (0.02)	11.80 (0.01)

[a] Mean(SD) are reported.

[b] Many or almost all parents in the neighborhood use alcohol.

[c] Home access to alcohol was measured as last obtaining alcohol from either the home or the adolescents' parent.

[d] Depression was measured as feeling sad or depressed one or more times in the past month.

[e] Unsupervised time was measured as having one or more hours each day without being supervised by an adult.

[f] Low academic achievement was defined as having reported poor performance on a test or project in the past month.

[g] Some, many, or almost all peers use alcohol.

Table 2

Effects of multiple domains of risk factors on trajectories of aggression, adjusted for baseline physical aggression (6th grade, Fall).

	Trajectory Group					
	Desistors		Escalators		Consistent aggression	
	OR	95% CI	OR	95% CI	OR	95% CI
African American						
Community-level						
Alcohol outlet density	0.82	0.23–2.96	2.03	0.80–5.18	1.49	0.53–4.16
Adults in neighborhood drink	1.35	0.87–2.09	1.36	0.82–2.24	1.75**	1.16–2.64
Parental and Peer Influences						
Parental involvement	0.99	0.95–1.03	1.03	0.97–1.09	0.99	0.96–1.04
Peer alcohol use	1.44	0.78–2.63	1.22	0.57–2.58	1.86	0.95–3.63
Individual-level Risk Factors						
Alcohol use	1.62	0.42–6.24	2.09	0.44–9.85	1.34	0.38–4.76
Marijuana use	0.40	0.09–1.70	0.37	0.18–0.76	1.16	0.23–5.81
Low academic achievement	1.04	0.64–1.71	0.86	0.52–1.41	1.04	0.23–5.81
Unsupervised time	0.94	0.62–1.42	1.19	0.76–1.84	1.20	0.80–1.82
Depression	1.23	0.73–2.05	1.38	0.80–2.38	1.63*	1.61–5.39
Aggression						
Group fighting	1.42	0.73–2.75	1.23	0.63–2.39	2.94**	1.61–5.39
Baseline aggression	2.64***	1.79–3.91	1.84**	1.21–2.81	5.67***	4.01–8.02
Hispanics						
Community-level						
Adults in neighborhood drink	0.81	0.49–1.35	1.03	0.67–1.58	1.55*	1.03–2.32
Parental and Peer Influences						
Parental involvement	0.98	0.94–1.02	0.99	0.96–1.03	0.95*	0.91–0.99
Home access to alcohol	0.65*	0.46–0.92	0.81	0.55–1.20	1.26	0.98–1.64
Peer alcohol use	2.57**	1.46–4.55	1.76	0.95–3.24	2.28**	1.35–3.88
Individual-level Risk Factors						

	Trajectory Group					
	Desistors		Escalators		Consistent aggression	
	OR	95% CI	OR	95% CI	OR	95% CI
Alcohol use	1.31	0.38–4.53	1.60	0.50–5.13	1.40	0.41–4.73
Low academic achievement	1.82*	1.08–3.06	1.60	0.95–2.69	1.59*	1.02–2.47
Unsupervised time	1.69**	1.20–2.38	1.04	0.74–1.44	1.39	0.86–2.25
Depression	1.10	0.70–1.73	1.07	0.69–1.65	1.26	0.85–1.89
Spanish at home	0.54**	0.35–0.83	0.71	0.47–1.08	0.56*	0.34–0.90
Aggression						
Group fighting	1.20	0.60–2.40	0.79	0.45–1.39	2.00*	1.13–3.55
Baseline aggression	3.28***	2.09–5.13	2.38**	1.49–3.80	8.23***	5.67–11.94

Note: The “Non-Aggression” trajectory group serves as the reference category. All analyses are controlling for demographics and treatment. Clustered robust standard errors were calculated to account for the clustered sampling design. Only predictors that were significant in the bivariate models were included in the multivariate analysis.

* p<0.05

** p<0.01

*** p<0.001

J Adolesc Health. Author manuscript; available in PMC 2013 July 01.

Table 3

Mediated effects of contextual variables through individual variables on aggression trajectories.

	Mediator	Indirect Effect (ab)	z	SE	Percent Mediated
African Americans					
Parental involvement	Alcohol use	0.255	1.60	0.16	9.7
	Marijuana use	0.176	1.19	0.15	6.7
	Unsupervised time	0.138	5.80***	0.02	5.2
	Depression	0.183	5.06***	0.04	6.9
	Academic achievement	0.139	4.61***	0.03	5.3
	Group fighting	0.416	3.65***	0.11	15.7
	Baseline aggression	0.414	6.05***	0.07	15.7
	Total				65.2
Adults in neighborhood use alcohol	Alcohol use	0.398	1.55	0.26	18.2
	Marijuana use	0.195	1.19	0.16	8.9
	Unsupervised time	0.109	5.03***	0.02	4.9
	Depression	0.141	4.49***	0.03	6.4
	Academic achievement	0.101	4.17***	0.02	4.6
	Group fighting	0.345	3.58***	0.09	15.8
	Baseline aggression	0.347	4.32***	0.08	15.9
	Total				74.9
Peer alcohol use	Alcohol use	0.283	1.39	0.20	12.1
	Marijuana use	0.146	0.94	0.15	6.3
	Unsupervised time	0.088	4.41***	0.02	3.7
	Depression	0.118	4.14***	0.03	5.1
	Academic achievement	0.079	4.13***	0.02	3.4
	Group fighting	0.411	3.31***	0.12	17.6
	Baseline aggression	0.492	3.18**	0.15	21.1
	Total				69.4

	Mediator	Indirect Effect (ab)	z	SE	Percent Mediated
Hispanics					
Parental involvement	Alcohol use	0.337	1.69	0.20	12.5
	Marijuana use[1]				
	Unsupervised time	0.153	6.31***	0.02	5.6
	Depression	0.187	6.48***	0.03	6.9
	Academic achievement	0.239	5.94***	0.04	8.9
	Acculturation	0.059	4.95***	0.01	2.2
	Group fighting	0.274	3.96***	0.07	10.1
	Baseline aggression	0.053	6.80***	0.08	19.8
	Total				65.9
Adults in neighborhood use alcohol	Alcohol use	0.219	2.39*	0.09	11.9
	Marijuana use[1]				
	Unsupervised time	0.143	5.03***	0.03	7.8
	Depression	0.070	2.76**	0.03	3.8
	Academic achievement	0.191	5.00***	0.04	10.3
	Acculturation	0.026	4.51***	0.006	1.5
	Group fighting	0.209	3.68***	0.06	11.4
	Baseline aggression	0.458	5.22***	0.09	24.9
	Total				71.7
Home access to alcohol	Alcohol use	0.311	2.32*	0.13	16.7
	Marijuana use[1]				
	Unsupervised time	0.140	5.02***	0.03	7.6
	Depression	0.123	4.29***	0.03	6.6
	Academic achievement	0.217	5.05***	0.04	11.7
	Acculturation	0.030	4.06***	0.007	1.6
	Group fighting	0.227	3.50***	0.06	12.2
	Baseline aggression	0.397	4.84***	0.08	21.4

	Mediator	Indirect Effect (ab)	z	SE	Percent Mediated
	Total				77.9
Peer alcohol use	Alcohol use	0.209	2.12*	0.09	9.8
	Marijuana use[1]				
	Unsupervised time	0.099	4.57***	0.02	4.6
	Depression	0.160	5.03***	0.03	7.5
	Academic achievement	0.187	4.49***	0.04	8.8
	Acculturation	0.021	4.24***	0.005	0.9
	Group fighting	0.266	3.45***	0.08	12.5
	Baseline aggression	0.479	4.57***	0.10	22.5
	Total				66.7

Notes: All models are adjusted for demographics and treatment. Clustered robust standard errors were calculated to account for the clustered sampling design.

(a) These mediated effects were generated in accordance with MacKinnon[34] and Komro, Perry, Williams, Stigler, Farbakhsh, & Veblen-Mortenson.[35] The percent mediation was generated using the formula: [(a*b/(a*b + c)] [34].

(b) Indirect effects are not directly comparable across variables. Percent mediation is comparable across variables and groups of variables.

[1] Because marijuana use was perfectly correlated with aggression (no Hispanics who were aggressive reported using marijuana), a mediated effect could not be estimated.

** p<0.01

*** p<0.001