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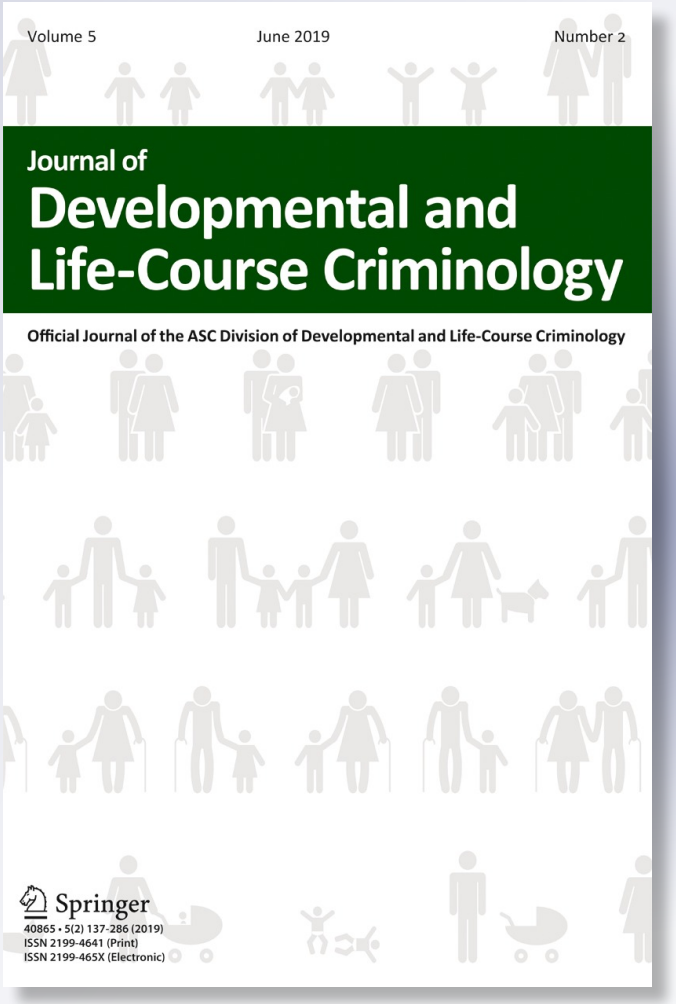

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ORIGINAL ARTICLE

Academic Achievement, School Attachment, and School Problems in the Differential Etiology of Violence

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Abstract

Purpose In the present paper, we test whether academic factors differentially predict violent offending, based on "differential etiology of violence" hypothesis as proposed by Savage and Wozniak (*Thugs and Thieves: The Differential Etiology of Violence*, [58]).
Methods We use data from the National Longitudinal Survey of Adolescent Health. We used a three-tier statistical approach to test the differential etiology of violence thesis. First, we compared the slopes of coefficients generated by ordinary least squares regression models. Second, we examined negative binomial regression partial coefficients estimating the association between academic achievement and violent offending, controlling for nonviolent offending. Finally we used binary logistic regression to compare "any violent" to "nonviolent-only" offenders.
Results The findings suggest that academic achievement, but not school attachment, is differentially associated with violent behavior in longitudinal, conservative models. Grade average is lower and several indicators of school problems are higher among violent offenders than nonviolent-only offenders, and GPA distinguishes violent from chronic, nonviolent-only offenders in models that control for a host of social factors as well as intelligence (measured with a picture vocabulary test), ADHD, alcohol, and drug use.
Conclusions The findings are consistent with the differential etiology of violence thesis, challenging the adequacy of general theories of offending and calling into question the assumption that the causes of violent offending are identical to those of nonviolent offending. Policy implications of these findings include the possibility that academic measures and programs might be used to target and address violent behavior problems; theoretical implications include a call for criminological theories specific to violence and appropriate tests of those theories.

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Keywords Violence · Violent Behavior · Academic Achievement · Differential Etiology of Violence

Introduction

Measures of academic achievement, school attachment, and school problems have been associated with delinquency in many studies across a variety of samples (e.g., [1, 8]). Some authors have emphasized the importance of school for child development. Savage and Wozniak [58] emphasize the dramatic potential impact of school, reminding us that, in developed nations like the USA, children spend a minimum of 100 days per year in formal education settings [64] and cautioning that the "... intensity of the requisite all-day attendance, grinding on for many years, enhances the potential for dramatic positive impacts for those who benefit, and dramatic adverse impacts for those whose school experience is unhappy" ([58], p. 41). As Payne and Welch [48] put it, individual development is "embedded within social institutions" (p. 94) and school is central to the lives of children around the world. Schools are not only meant to influence the development of intellectual competence but also are known to influence social competence, goals, and values (e.g., [64]). School practices and experiences are also likely to interact with the child's predispositions, enhancing or exacerbating their effects (e.g., [48]).

School factors might be important in the differential etiology of violence. Savage and Wozniak [58] propose that while causes of violent and nonviolent offending are likely to overlap, they are not identical. They supply a litany of reasons why the causes of violence must be distinguishable from the causes of nonviolent offending, such as the distribution of violent compared to nonviolent crime, the logic and language we use about violence, information derived from case studies of violent offenders, the fact that development, socialization, and learning can lead to highly specific outcomes, and so on. Modern criminological theory relies extensively on general theories predicting a unidimensional criminality, which have been tested with broad, combined measures of criminal behavior. There is a paucity of theory attempting to predict violence, per se (Felson's [21] "dual conceptualization" of violent crime, where violence is "rule breaking" but also "harm-doing" is an exception). Because violent offenses are seen as striking in their seriousness and in their effects on victims' lives, prevention of violence is an important goal. Thus, theories that help differentiate the risk factors for developing violent behavioral tendencies are needed.

Some point out that there are, in fact, thousands of published studies testing more narrow hypotheses about the etiology of violence. As Savage and Wozniak [58] have argued, using measures of violence as an outcome is helpful, but not adequate, to understand the etiology of violence. Few analyses account for the collinearity between violent and nonviolent offending, so estimates of associations between predictors and outcomes are likely to be biased, and possibly spurious. Savage and Wozniak [58] call for better theory, and for careful tests, to generate a new, carefully constructed set of risk factors specific to violent behavior.

Review of the Literature

Although many empirical studies have reported associations between school factors, especially academic achievement, and violence, few have attempted to disentangle these effects from the common association both have with nonviolent offending. In their review, Savage and Wozniak [58] select academic achievement as a "good prospect" for distinguishing violent from nonviolent offenders, but they identified only four studies that explicitly compare violent to nonviolent offenders on their overall academic achievement. While their review is also bolstered by some comparisons using more specific measures of reading and math, it is clear that the many studies providing evidence that academic achievement is negatively associated with violence ($k = 24$ at least), have not taken precautions to ensure that the relationship is not confounded. Importantly, Savage and Wozniak [58] find that a strong majority of studies of nonviolent offending *also* find significant, negative associations with grade point average (GPA). In this paper, we will provide a brief overview of the literature related to academic factors as differential predictors of violence, outline the approach for testing the differential etiology thesis, and test whether academic factors are differentially associated with violent, as opposed to nonviolent, delinquent behavior.

Intelligence is one of the best predictors of academic achievement ([61], p. 14) and intelligence deficits have been associated with violent behavior in many studies (e.g., [2, 3, 24]). Relatedly, cognitive deficits and poor executive functioning in children have been associated with physically aggressive and antisocial behavior in many studies (e.g., [3, 6, 16, 24, 59]) and there is some indication that measures of cognitive deficits might distinguish serious from nonserious offenders (e.g., [12, 15, 16]).

In addition to their association with intellectual deficits, low school achievement and school problems are likely to engender frustration and negative emotionality, enhancing any risks for violence already accruing from intellectual and executive deficits. Negative emotionality is likely to have a special relationship with physically aggressive externalizing behaviors in young children and violence in older ones as it may increase the chances of lashing out (e.g., [17–19]).

Evidence is accumulating that the association between intellectual deficits and violent behavior is stronger than its association with nonviolent antisocial behavior ([4], p. 63). Barker et al. have reported that a series of executive functions and verbal ability are negatively associated with physical aggression trajectories in their sample but not with theft trajectories. In fact, controlling for violent offending, measures of executive function, and verbal intelligence were positively associated with theft trajectories in their study [3]. Walsh [63] found a negative association between IQ and violence, but a positive association between property crime and IQ. Bernat et al. [7] report a negative correlation between WAIS-R scores and violence but not between WAIS and nonviolent offenses. A small number of studies go further to compare violent and nonviolent offenders. In several studies, violent offenders had significantly lower IQ scores than nonviolent ones, with recidivistic violent offenders having the lowest IQ of all [31]. Savage and Wozniak [58] conducted a comprehensive review of the evidence on intelligence and executive functioning and provide summary information for dozens of studies. Their tables make it clear that associations between various indicators of intelligence and nonviolent offending are less consistent than those between intelligence and violent offending. Findings from a strong majority of studies

in which intelligence levels and executive functioning are compared between violent and nonviolent offenders favor nonviolent offenders. Savage and Wozniak [58] conclude that measures of intelligence have been differential predictors of violence in past research, as have been some types of executive functioning.

Academic Achievement

In part because of its strong association with intelligence, a differential association between academic achievement and violence may exist as well. Models reported by some authors show significant associations between academic achievement and both violent and nonviolent antisocial behavior, but the authors have not compared the coefficients to see if the magnitude was different (e.g., [8, 10, 34, 44, 52]). Many small-sample studies of offenders have reported that violent offenders have lower average scores on measures of academic achievement (e.g., [28, 30, 38, 39, 62, 66]). In some cases, while the differences seem to be pronounced, they are not statistically significant because of small sample size (e.g., [30, 36, 62, 66]). There are exceptions to this pattern, however, and there are still some doubts on this point. Hollin and Wheeler [32] found that the violent offenders in their very small sample scored significantly *higher* in literacy than nonviolent offenders. In another clinical sample, Bryant et al. found that violent offenders had higher scores on writing, reading, and arithmetic [11]. Marcus and Gray [40] found that reading achievement scores were significantly lower among their violent adolescent male sample than their nonviolent offending comparison participants, but math achievement was not. Piquero [50] found that mean WRAT achievement test scores were slightly lower among violent compared to frequent, nonviolent in the Philadelphia portion of the Collaborative Perinatal Project; the difference was not statistically significant, however. In a recent meta-analysis, Savage et al. [55] report that academic achievement is negatively associated with violent behavior across many samples, the association is statistically significant, including a small number of studies where the authors controlled for other forms of general offending ($k = 5$).

School Attachment

In many studies, measures related to school bonding have been negatively associated with both violent and nonviolent offending [5, 22, 26, 34, 44, 45, 60]. The authors do not compare the size of the coefficients, so these do not provide evidence related to the differential etiology thesis. In a small number of other studies, nonsupportive evidence is presented (e.g., [23, 49]). For example, Cusick et al. [13] found that violent offending was not negatively associated with school bonding in a sample of Midwestern foster youth. Findings by Fagan et al. [20] based on data from a sample of juveniles in correctional institutions in four cities also contradict the differential etiology prediction; the association between school attachment and nonviolent offending was in the predicted direction and statistically significant, but the association with violent offending was not. Ozbay and Ozcan [46] do not report significant associations between attachment to teachers and violent or nonviolent offending in a large, Turkish sample.

In just three studies, indicators of school bonds or related constructs were compared across violent and nonviolent delinquents and the findings are mixed. In a study of juvenile offenders in Florida, violent offenders had a worse "attitude to school" among male (but not female offenders) but their attitudes toward their teachers was similar to

that among nonviolent offenders [36]. Hart et al. [28] found that violent boot camp delinquents were no less likely than nonviolent ones to say that there were caring adults at their school. In data from the Pittsburgh Youth Study, Loeber et al. [39] found that violent youths had significantly lower academic motivation than other offenders.

School Problems

Very few studies have provided analyses of associations between school problems and delinquent behavior that are relevant for the differential etiology thesis. Hill-Smith et al. [30] found that murderers in their sample were more often "excluded from school" than burglars, but there was no significant difference in the rate of expulsions. Loeber et al. [39] report that violent offenders had a significantly higher probability of truancy than nonviolent offenders. Piquero [50] reports that the number of school disciplinary problems did not differ between violent and nonviolent antisocial juveniles. In a recent study, using many waves of data from the National Longitudinal Study of Youth, Ramey [51] found that being suspended or expelled from school by age 14 was significantly associated with criminal justice involvement in young adulthood, controlling for a host of childhood and young adult factors reflecting antisocial behavior and attitudes, school factors, and mental health problems. At the same time, the data suggest that those who were given treatment or therapy in childhood, were more likely to be involved in the mental health system as a young adult, but not the criminal justice system.

Disentangling the Effects of Criminogenic Factors on Violent Versus Nonviolent Offending

In this paper, we test the differential etiology thesis. Disentangling the effects of school factors on violence is complicated by the fact that school factors are correlated with both violent and nonviolent antisocial behavior. Most adolescent offenders commit minor offenses and desist without intervention (e.g., [42]). Only a small subset of offenders ever commit a serious violent act. Nevertheless, because violence is highly correlated with nonviolent offending, some have assumed that no additional predictors are needed, so studies of "general offending" are the most common. Unfortunately, predictors of general offending are not going to provide the specificity necessary for an understanding of violence.

By corollary, interventions and risk assessment instruments relying on lists of risk factors derived from studies of general offending will not inform us which risks to target if we specifically want to prevent violent behavior. Even lists of risk factors derived from studies of violent behavior are likely to include risk factors whose association with violence is confounded by their common association with general offending. Ordinary delinquency is normative and lists of risk factors frequently include those with no theoretical basis for explaining serious aggressive pathology (e.g., large family size). It is no wonder, then, that risk prediction is generally thought to be poor, with many false positives. In addition, however, little research has been produced that tests whether risk factors that are logically connected with violence really are empirically connected with violence (net their common association with general deviance).

Savage and Wozniak [58] imply three ways to look for a differential association between a potential causal factor (*X*) and violence. First, *X* might be associated with violent behavior and not associated with nonviolent offending, but in many cases, it will be associated in the same direction with both. It is still possible that the factor is differentially associated with violence if it has a stronger effect on variability in violent offending, and this can be tested by comparing slopes. Second, *X* could be significantly associated with violence, holding nonviolent offending constant, suggesting an association with violence per se, over and above an association between *X* and general deviance. Finally, a differential predictor of violence should have higher levels among violent compared to nonviolent-only offenders.

Statistical Approach

In order to examine the hypothesis that violent offenders might be distinguished from nonviolent-only offenders using school-related data, we used a multi-step method. This method has been used in other tests of the differential etiology thesis (e.g., [57]). First, we ran Ordinary Least Squares(OLS) regression models and compared the coefficients to examine whether the slopes approximating the association between school factors and violent offending were steeper than those predicting nonviolent offending. Next, we ran negative binomial regression models of violent behavior, to see if indicators of academic achievement, school attachment, and school problems would be associated with violent offending, controlling for nonviolent offending. Finally, we looked at binary logistic regression models in which the outcomes were dummy codes comparing "any violent" to "nonviolent-only" offenders, and "violent" compared to "frequent nonviolent-only" offenders to see if violent offenders differ from nonviolent-only offenders on school measures.

Method

Data

We used data from waves 1 and 2 of the National Longitudinal Study of Adolescent Health (Add Health) which began with a national probability sample of adolescents. In wave 1, the participants were enrolled in grades 7 through 12 in the USA during the 1994–1995 school year ([27]–2002). Wave 2 data were collected approximately 1 year later. We limited our sample to those who were 13–18 years old in wave 2 to ensure that participants were school-aged in the previous wave. The present study uses self-report data from participants collected in their homes supplemented by the parent questionnaire (from wave 1). The use of computers for eliciting more sensitive information in the data collection for Add Health is likely to have yielded higher frequencies of self-reported crime than face-to-face methods [14].

Measures

Dependent Variables

Frequency of Violence In wave 2, participants were asked about seven violent acts including getting into a serious physical fight, taking part "in a fight where a group of your friends was against another group," using or threatening to use a weapon to get something from someone, hurting someone badly enough to need medical care, pulling a knife or gun on someone, using a weapon in a fight, and shooting or stabbing someone. The frequency values from the violence measure were summed to create this scale. Because the responses were categorized by the Add Health investigators as "never, 1–2 times, 3–4 times, 5+ times" the scale does not estimate the total number of acts, rather the resulting additive scale reflects both variety and frequency. The items are displayed in Table 1.

Frequency of Nonviolent Offending Frequency of nonviolent delinquency for wave 2 was computed by summing self-reported frequency ratings for a series of items including damaging property, painting graffiti, stealing something worth less than US$50, stealing something worth more than US$50, selling marijuana or other drugs, shoplifting, and burglary. As with the violence measure, the Add Health survey combines frequency ratings into categories and this measure dually reflects variety and frequency of nonviolent offending. The items are displayed in Table 1.

Violent Versus Nonviolent-Only Offending We constructed two dummy-coded variables for our logistic regression analyses. The first is coded 1 if the participant reported having committed any of the violent offenses and 0 if the participant reported committing nonviolent offenses only (thus, the comparison is between violent and nonviolent-only *offenders* and excludes nonoffenders).The second is coded such violent offenders (1) are compared to frequent nonviolent-only (0)

Table 1 Items used to compute dependent variables

Violent offending Wave 2	Nonviolent offending Wave 2
Got into a serious physical fight	Damaged property
Took part in a fight "where a group of your friends was against another group"	Painted graffiti
Used or threatened to use a weapon to get something from someone	Stolen something worth more than US$50
Hurt someone badly enough to need medical care	Sold marijuana or other drugs
Pulled knife or gun on someone	Stolen something worth less than US$50
Used a weapon in a fight	Taken something from a store without paying for it
Shot or stabbed someone	Went into a house to steal something

offenders. Frequent nonviolent offenders were those who reported four or more nonviolent delinquent acts in the previous year (corresponding roughly to the top 10%) but had not committed any violent acts. The cutoff is fairly arbitrary; there is no consensus about what constitutes a "chronic" offender in the literature, and authors have used as few as two offenses as a cut point, and much higher numbers as well.

Independent Variables

GPA Wave 1 GPA was estimated by using self-reported recent grades in math, English/language arts, history/social studies, and science. If data were missing for a particular class, this was seen as an indication that the participant did not take that course in the previous year, so the average for the three remaining courses, or two remaining courses was used. Note that the original variables in the Add Health data set are coded such that $A = 1$ and $D = 4$. We reverse coded these so that our measure corresponds to the traditional GPA; a higher value indicates higher grades. Wave 1 data were used for the academic measures to ensure temporal order.

School Attachment Subjects were asked three questions related to their attachment to school including how close they feel to people at their school, the extent to which they feel that they are a part of their school, and the extent to which they are happy to be at their school. Five response categories varied from "Strongly agree" to "Strongly disagree." The values were summed to create the school attachment index. All variables loaded on one factor in a confirmatory principal components analysis using varimax rotation. We used wave 1 data.

School Problems Subjects were asked four questions about problems in school since the start of school this year. These included the frequency with which participants had trouble getting along with teachers, paying attention in school, getting their homework done, and getting along with other students. Five response categories ranged from "Never" to "Every Day." The ratings were summed to create the school problems index. We used wave 1 data.

We also use two other indicators of school problems, both of which are dichotomously coded. Students were asked: "Have you ever been suspended?" and "Have you ever been expelled?" These were coded 1 if the participant answered in the affirmative and 0 otherwise.

Control Variables

Demographic Characteristics Demographic controls included *age*, and *gender* (1 = male, 2 = female as it was coded by the Add Health investigators). We also

controlled for *disadvantaged minority status* (coded 1 if the participant reported being Black or Hispanic, otherwise 0).

Intact Family If the participant reported that he or she was living with both biological mother and biological father in wave 2, this variable was coded 1 and 0 otherwise.

Neighborhood Disorder Community disorganization can have a powerful effect on criminal behavior and may be associated with academic achievement and school problems. Items related to community disorder were rated on a scale of 1 = no problem, 2 = small problem, and 3 = big problem by parents in wave 1. One item was rated only as "Yes or No." So we dummy-coded each item such that "1" reflects any sign of a neighborhood problem and 0 otherwise. The items were related to whether or not the participant knew his or her neighbors (reverse coded), if the neighborhood was safe (reverse coded), and if there were problems with trash or drugs. These were added together to create the scale; scores range from 0 to 4. Questions about neighborhood disorder were not asked in wave 2.

Parent Education Because a child's academic achievement and experiences may be related to parent education, and parent education has been consistently associated with violent behavior in children (e.g., [58]), we employed a control for parent education. We used the self-reported education (last grade completed) of the responding parent from the parent questionnaire collected in wave 1. The responses were categorized from "8th grade or less" to "Professional training beyond 4-year college/university."

Peer Delinquency This measure is comprised of a summated scale including three items: "Of your three best friends, how many ..." smoke at least one cigarette a day and drink alcohol or use marijuana at least once a month. Because substance use is associated with delinquency, we believe this variable can be used as a proxy for peer deviance, albeit an imperfect one. These were the only peer delinquency data collected in wave 2 of Add Health.

Intelligence Person factors, such as intelligence, may confound the association between academics and offending. We used the Add Health Picture Vocabulary Test score, administered in wave 1. This test is a modified version of the Peabody Picture Vocabulary Test which has moderate correlations with measures of intelligence such as the Stanford-Binet Intelligence Scale and the Wechsler Intelligence Scale for Children [29].

Attention Deficits To control for another person factor that is associated with offending, we used a self-report indicator of attention deficit hyperactivity disorder (ADHD). In wave 3 of Add Health, the participants answered a series of questions related to their ability to pay attention and sit still. Unfortunately, because of sample attrition, there are

substantially fewer respondents for these items. We applied a factor analysis to achieve a one-factor solution which included five items, and participants were asked to rate their agreement:

When you were between 5 and 12, you failed to pay close attention to details or made careless mistakes in your work

… you had difficulty organizing tasks and activities

… you avoided, disliked, or were reluctant to engage in work requiring sustained mental effort

… you were easily distracted

… you were forgetful

The items were coded such that greater agreement indicated greater attention problems and were summed to calculate the scale.

Alcohol Use Subjects were asked in wave 2, "During the past 12 months, on how many days did you drink alcohol?" The responses varied on a 6-point scale from "never" (0) to "every day/almost every day" (6). The vast majority of these teenagers reported never drinking alcohol; several hundred reported drinking at least once a week.

Drug Use Subjects were asked in wave 2 whether or not they had used marijuana, cocaine, inhalants, or "other" illegal drugs since their last interview, approximately 1 year before. We created a 4-point scale, 1 point for each of these categories. Thus a score of 4 indicates the participant had used all four types of drugs in the past year.

Missing Data

As is common in analyses of large data sets, not all participants provided data for all of the constructs we use in our analysis. If we omit cases where we do not have data for all cases, we lose a substantial portion of the sample, leading to concerns about sampling bias if the cases are not missing at random (see [9]). Instead, we opted to use multiple imputation as provided by SPSS. We constrained the imputation so that no imputed values were generated for our dependent variables (indicators of violent and nonviolent offending) or for our principal independent variables of interest (indicators of academic achievement, school attachment, or school problems). SPSS does this using regression models with variables selected by the analyst. Brame et al. [9] argue that there is little computational advantage in producing more than five imputations, so we set the number to 5 and display results based on the "pooled" data. Table 2 displays descriptive data for the original sample and the imputed data. As the reader can see, the highest proportion of imputed data was needed to supplement the data for ADHD (which were collected in wave 3), the measures of community disorder, parent education, and the picture vocabulary test.

Table 2 Descriptive data for the analytic sample aged 13–18 in wave 2

	Original data		Imputed data[a]		Number of cases imputed
	Percentage (%)	Mean	Percentage (%)	Mean	
Age		15.8		15.8	0
Male	46.5		46.5		0
Peer delinquency		1.82		1.83	99
Community disorder		1.20		1.21	579
Parent education		5.65		5.62	547
Disadvantaged minority	33.9		34.4		65
Intact family wave 2	52.5		52.5		0
ADHD		3.92		3.93	1188
Picture vocabulary test		101.3		101.3	232
Any alcohol use wave 2		1.06		1.06	10
Any drug use wave 2		0.356		0.355	43
Frequency of violence wave 2		0.781		0.781	0
Any violence wave 2	30.1		30.1		0
Frequency of nonviolent offending wave 2		1.11		1.11	0
Any nonviolent offending wave 2	31.9		31.9		0

[a] Pooled from five imputations

Results

We assessed the reliability of the model estimations using collinearity diagnostics and examined residual plots to determine goodness of fit. We generated correlation matrices, scatter plots, and tolerance values, eigenvalues, and condition indices for all of the models. Furthermore, we replicated our binary logistic regression models using OLS regression diagnostics because many of the collinearity diagnostics are not available for logistic regression models. This approach allowed us to examine tolerance values, eigenvalues, and condition indices, which provide the most precise information on potential collinearity problems. Collinearity can inflate the standard errors of the collinear variables and "... while this does not bias the coefficient estimates, the inflated standard errors mean that the estimated coefficients may not be very close to the population coefficients and their size, sign, and significance tests may not be accurate" ([65], p. 257).

We found a weak positive correlation between age and several of our independent variables (school problems, expulsion, suspension, and school attachment). We also found a weak positive relationship between gender, parent education, and school attachment. We removed age from the models and reran all of the collinearity diagnostics and found that this resolved the collinearity problem. However, we also noted that in every case, the direction and the statistical significance of the estimated effects of school factors did not change, so we opted to report our tables as originally designed.

Table 2 displays descriptive statistics for the analytic sample. Many of the participants reported committing at least one violent act (30.1%) or nonviolent criminal act (31.9%). Approximately 34% of the sample reported being in one of the disadvantaged minority groups, and 52.5% of the sample were living with both biological parents in wave 2.

Comparing the Strength of the Relationship

Table 3 displays a summary of ten OLS regression models. For each coefficient displayed, a regression model, including controls for age, sex, disadvantaged minority status, intact family, peer delinquency, community disorder, parent education, picture vocabulary score, ADHD, and participant alcohol and drug use were applied. GPA was significantly, negatively associated with both violent and nonviolent criminal behavior as was school attachment. The index of school problems, suspension, and expulsion were all positively and significantly associated with both violent and nonviolent criminal behavior. As expected, academic indicators were consistently associated with both forms of offending.

For the first prong of the evaluation of the differential etiology thesis, we compared those coefficients to see if the associations between education factors and violence were stronger in magnitude than those between education factors and

Table 3 Summary of OLS regression findings: comparisons of coefficients representing the relationship between school factors and violent versus nonviolent delinquency

	Nonviolent offending (standardized)		Violent offending (standardized)			
	b (SE)	Partial *r*	*b* (SE)	Partial *r*	Z_1	Z_2
GPA	−0.060** (0.020)	−0.046	−0.090** (0.020)	−0.067	−1.35+	−1.05
School attachment	−0.023** (0.005)	−0.065	−0.015** (0.006)	−0.042	1.48+	1.00
School problems index	0.044** (0.005)	0.135	0.040** (0.005)	0.121	−0.923	−0.493
Suspension	0.160** (0.034)	0.071	0.257** (0.035)	0.111	2.60**	1.98**
Expulsion	0.247** (0.073)	0.052	0.491** (0.074)	0.100	3.12**	2.35**
N	4348		4348			

The table summarizes findings from 10 models, each including controls for age, sex, minority status, intact family, peer delinquency, community disorder, parent education, the picture vocabulary test, ADHD, alcohol use, and drug use. The education measures were added one at a time

Z_1 *Z* score estimated using formula by [41]; Z_2 *Z* score estimated using formula by [47]

+ p#0.10

* p#0.05

** p#0.01

nonviolent offending. A cursory view of the coefficients, which are estimated using standardized dependent variables, makes it clear that the magnitude of the association between violence and school attachment and school problems cannot be larger in magnitude than the associations with nonviolent offending because the absolute values of the unstandardized coefficients are not larger in magnitude. For the remaining three variables, a formal test of the equivalence of coefficients can be used. Two formulae for Z were used to compare coefficients. The first is favored by Paternoster et al. [47] (p. 862) and does not make any correction for dependence of the sample. This estimate provides a test regarding whether or not the slope is steeper for violence than nonviolence:

$$Z = \frac{b_1 - b_2}{\sqrt{\mathrm{SE}b_1{}^2 + \mathrm{SEB}_2{}^2}}$$

For dependent samples, Meng et al. [41] recommend the following formula to compare the correlations, where r_x is the correlation between the two correlated variables and the formula includes an adjustment for that association:

$$Z = (z_{r1} - z_{r2})\sqrt{\frac{N-3}{2(1-r_x)h}}$$

N is the number of cases, z_{r1} and z_{r2} are the Fisher z-transformed correlation coefficients.

$$h = \frac{1 - f\overline{r^2}}{1 - \overline{r^2}} = 1 + \frac{\overline{r^2}}{1 - r^2}(1 - f)$$
$$f = \frac{1 - r_x}{2\left(1 - \overline{r^2}\right)}$$

$\overline{r^2}$ is the mean of $r_1{}^2$ (the squared correlation between X and violence) and $r_2{}^2$ (the squared correlation between X and nonviolent offending).

Table 3 shows that the slope of the association between GPA and violent behavior is steeper (more negative) than that between GPA and nonviolent offending by more than one standard deviation, though that difference is only marginally statistically significant for one estimate ($Z_1 = -1.35$) and not statistically significant for the other ($Z_2 = -1.04$). The magnitude of the association between suspension and expulsion and violent behavior is significantly steeper in both estimates ($Z_1 = 2.6$ and $Z_2 = 1.98$, respectively, for suspension; $Z_1 = 3.12$ and $Z_2 = 2.35$ for expulsion). Thus, this prong of the analysis provides no firm support for the differential etiology hypothesis—the only sound support coming from the measures of suspension and expulsion, which may have problems with temporal order (antisocial behavior may have caused the suspension or expulsion). We report the finding because it is consistent with the differential etiology thesis and because readers may be concerned about the role of suspension and expulsion in the school-to-prison pipeline.

Controlling for Variability in Nonviolent Offending

Table 4 displays the second prong of the analysis. In this table, we estimate the associations between the indicators of school factors and variability in violent behavior,

Table 4 Negative binomial regression models of violent offending, controlling for frequency of nonviolent offending: unstandardized beta coefficients (standard error) are displayed

	GPA	School attachment	School problems	Suspension	Expulsion
Age	−0.122** (0.019)	−0.116** (0.019)	−0.107** (0.019)	−0.122** (0.019)	−0.112** (0.019)
Sex (1 = male, 2 = female)	−0.619** (0.054)	−0.690** (0.054)	−0.640** (0.054)	−0.594** (0.055)	−0.673** (0.054)
Minority status (0 = minority; 1 = White)	0.382** (0.057)	0.393** (0.047)	0.405** (0.058)	0.341** (0.060)	0.372** (0.058)
Intact family (1 = yes)	−0.164** (0.054)	−0.196** (0.054)	−0.184** (0.054)	−0.130* (0.055)	−0.190** (0.054)
Peer delinquency (wave 2)	0.129** (0.017)	0.140** (0.017)	0.129** (0.017)	0.133** (0.017)	0.139** (0.017)
Community disorder	0.042 (0.030)	0.043 (0.030)	0.033 (0.030)	0.035 (0.030)	0.048 (0.030)
Parent education	−0.029* (0.013)	−0.036** (0.013)	−0.037** (0.012)	−0.028* (0.012)	−0.035** (0.012)
Picture vocabulary	−0.009** (0.002)	−0.012** (0.002)	−0.012** (0.002)	−0.101** (0.002)	−0.012** (0.002)
ADHD	−0.007 (0.010)	−0.006 (0.010)	−0.007 (0.010)	−0.008 (0.010)	−0.006 (0.010)
Alcohol use (wave 2)	0.134** (0.019)	0.133** (0.019)	0.123** (0.019)	0.130** (0.019)	0.132** (0.019)
Drug use (wave 2)	0.096* (0.042)	0.097* (0.043)	0.096* (0.042)	0.081+ (0.043)	0.105** (0.03)
Frequency of nonviolent offending	0.154** (0.010)	0.155** (0.010)	0.146** (0.010)	0.154** (0.010)	0.155** (0.010)
GPA	−0.259** (0.037)				
School attachment		−0.027** (0.010)			
School problems index			0.073** (0.009)		
Suspension				0.489** (0.059)	
Expulsion					0.362** (0.111)
N	4348				

+ p#0.10

* p#0.05

** p#0.01

controlling for frequency of nonviolent offending. Negative binomial regression is used because the distribution of the dependent variable violates assumptions of ordinary least squares regression such as the assumption of homogeneity in error variance and the assumption of a normal error distribution (see [43]). This analysis is designed to answer the question, "Is there still an association between school factors and violent offending, above and beyond their common association with nonviolent forms of criminality?" The models are very similar to those in Table 3, except for the added control variable for frequency of nonviolent offending.

First, we comment on the control variables because they may not operate as predicted when nonviolent offending is included as a control. In this sample, age is negatively associated with violent offending, thus those in our sample who are 17 or 18 are less likely to report violent behavior than those aged 13 or 14. Males and those belonging to disadvantaged minority groups report a greater frequency of violence as do those children from nonintact families, with friends who drink and use drugs, those whose parents have less education, and those who drink alcohol. Community disorder (measured in wave 1) was not significantly associated with violent behavior, controlling for nonviolent criminal behavior, nor was the retrospective indicator of ADHD.

GPA is negatively and significantly associated with violence in this conservative model controlling for frequency of nonviolent offending, person factors, and myriad social factors. The same is true for the index of attachment to school. The index of school problems and indicators of suspension and expulsion are also all significantly and positively associated with violence, controlling for frequency of nonviolent offending. This provides strong support for academic indicators as being useful in the differential prediction of violent compared to nonviolent-only offending.

Logistic Regression Analyses

Tables 5 and 6 display binary logistic regression models. In Table 5, the dependent variable is a dichotomous variable coded 1 = any violence and 0 = nonviolent-only offending. Thus, only offenders are being compared to one another (the sample size is now $n = 1988$) and the model is designed to answer the question, "Do violent offenders differ from nonviolent offenders on dimensions related to school?" We report the odds ratio (OR), displayed as Exp(B). The reader is reminded that an odds ratio less than 1.0 indicates a *negative* relationship between the independent and dependent variables. The table also displays the semi-standardized binary logistic regression coefficient favored by Kaufman [35] featured in King's [37] "best practices" chapter about binary logistic regression. Because the coefficient reflects the change in predicted probability of the outcome corresponding to a one standard deviation difference in an independent variable, it can be used as one way to compare the magnitude of effects across variables. We use the reference point around the mean:

$$\mathrm{SS}_{\mathrm{j}}^{\Delta \mathrm{P}} = \frac{1}{1 + e^{-\left(\ln\left(\frac{P_{\mathrm{ref}}}{1-P_{\mathrm{ref}}}\right) + \frac{1}{2} b_j s_j\right)}} - \frac{1}{1 + e^{-\left(\ln\left(\frac{P_{\mathrm{ref}}}{1-P_{\mathrm{ref}}}\right) - \frac{1}{2} b_j s_j\right)}}$$

where P_{ref} is the probability of Y at the reference point (the mean of the dichotomized dependent variable), b_j is the unstandardized binary logistic regression coefficient for

Table 5 Binary logistic regression models of comparing violent to nonviolent-only offenders

	GPA		School Attachment		School Problems		Suspension		Expulsion	
	Exp [B]	$SS^{\spadesuit P}$	Exp[B]	$SS^{\spadesuit P}$	Exp[B]	$SS^{\spadesuit P}$	Exp[B]	$SS^{\spadesuit P}$	Exp[B]	$SS^{\spadesuit P}$
Age	0.921*	−0.027	0.931*	−0.024	0.934*	−0.022	0.919*	−0.028	0.932*	−0.023
Sex (1 = female)	0.592**	−0.059	0.553**	−0.066	0.571**	−0.063	0.605**	−0.056	0.567**	−0.063
Minority status	1.38**	0.035	1.41**	0.037	1.41**	0.037	1.32**	0.030	1.37**	0.034
Intact family	0.847+	−0.019	0.817*	−0.002	0.824+	−0.022	0.865	−0.016	0.831+	−0.021
Peer delinquency	1.05	0.023	1.07*	0.029	1.06+	0.026	1.06+	0.026	1.06+	0.027
Comm disorder	1.06	0.013	1.07	0.014	1.06	0.013	1.05	0.010	1.06	0.013
Parent education	0.949*	−0.027	0.939**	−0.032	0.939**	−0.032	0.946*	−0.028	0.941**	−0.031
Picture vocabulary	0.984**	−0.052	0.981**	−0.062	0.981**	−0.061	0.983**	−0.054	0.981**	−0.059
ADHD	0.991	−0.006	0.993	−0.005	0.992	−0.005	0.991	−0.006	0.992	−0.005
Alcohol use	1.08*	0.029	1.08+	0.027	1.07+	0.026	1.07+	0.025	1.07+	0.027
Drug use	0.868*	−0.026	0.884+	−0.022	0.875+	−0.024	0.860*	−0.027	0.883+	−0.023
GPA	0.752**	−0.049								
School attach			0.990	−0.006						
School problems					1.04*	0.027				
Suspension							1.65**	0.054		
Expulsion									1.99*	0.034
N	1988		1988		1988		1988		1988	
Cox and Snell R^2	0.068		0.061		0.063		0.069		0.064	
−2 Log likelihood	2415		2431		2426		2413		2425	

+ p#0.10

*p#0.05

**p#0.01

the independent variable, and s_j is the standard deviation of the independent variable.

Table 5 shows that controlling for age, sex, disadvantaged minority status, intact family, peer drug and alcohol use, community disorder, parent education, picture vocabulary score, ADHD, and participant alcohol and drug use, violent delinquents (those who reported one or more violent acts) in wave 2 had significantly lower GPA than nonviolent-only offenders in wave 1 (OR = .752). School attachment was not different between the two groups. The violent group had higher scores on the school problems index, and was significantly more likely to have been suspended in wave 1 (OR = 1.65), and expelled (OR = 1.99). In a simple comparison of means, we see that 42% of those in the violent group in wave 2 had been suspended in wave 1, while 25% of those in the nonviolent-only group had been suspended. It may be worth noting that a comparison of the semi-standardized binary logistic regression coefficients suggests that GPA is second in magnitude only to minority status in distinguishing violent from nonviolent-only offenders. The standardized coefficient for suspension is also among the largest in the model. Thus, this set of analyses also provides evidence that academic indicators may be differential predictors of violence.

Control variables performed largely as expected, though coefficients were weak and inconsistent for several. The average score on the picture vocabulary test was lower among violent than nonviolent-only offenders, but ADHD was not different across the two groups. Alcohol use was consistently higher among violent than nonviolent-only offenders, but the association was only marginally significant in most cases; violent offenders used a smaller variety of drugs than nonviolent-only offenders.

Table 6 shows the same logistic regression analysis, using a binary variable coded 1 for violent offenders and 0 for those who reported four or more nonviolent offenses and no violent offenses. This analysis is designed to answer the question, "Are violent offenders different from chronic, nonviolent offenders on school dimensions?" The pattern of findings is similar to that from the previous comparison, with some attenuations in effect sizes. The sample size is considerably smaller because the cases include only violent and chronic, nonviolent offenders. The data suggest that violent offenders have significantly lower grades than chronic, nonviolent-only offenders and they are 39% more likely to report having been suspended in the previous wave, but this association is only marginally significant. Although the odds of committing an act of violence in wave 2, relative to committing multiple acts of nonviolent offending, is 52% higher for those who were expelled in wave 1, this association is not statistically significant.

Note that in this most conservative test, violent offenders did not differ from chronic nonviolent offenders on other factors in the model, either. They were more likely to be male and to be from a disadvantaged minority group, to have a lower picture vocabulary score, and to use illegal drugs in less variety than nonviolent chronic offenders.

Discussion

In this paper, we have examined the relationships between a series of school-related factors and violent compared to nonviolent offending. The pattern of findings is supportive of Savage and Wozniak's [58] differential etiology of violence thesis, for some but not all measures. Most consistently and importantly, the findings suggest that low academic

Table 6 Binary logistic regression models of comparing violent to chronic nonviolent-only offenders

	GPA		School attachment		School problems		Suspension		Expulsion	
	Exp [B]	$SS^{\spadesuit P}$	Exp [B]	$SS^{\spadesuit P}$	Exp [B]	$SS^{\spadesuit P}$	Exp [B]	$SS^{\spadesuit P}$	Exp [B]	$SS^{\spadesuit P}$
Age	0.923	−0.012	0.941	−0.009	0.941	−0.009	0.931	−0.010	0.941	−0.009
Sex (1 = female)	0.734+	−0.015	0.691*	−0.019	0.690*	−0.019	0.734+	−0.016	0.702*	−0.018
Minority status	1.53*	0.021	1.56*	0.022	1.56*	0.022	1.52*	0.021	1.53*	0.021
Intact family	0.776	−0.013	0.750+	−0.015	0.751*	−0.015	0.782	−0.001	0.761	−0.014
Peer delinquency	0.994	−0.001	1.01	0.001	1.01	0.001	1.00	0.013	1.00	0.001
Community disorder	1.06	0.006	1.07	0.007	1.07	0.007	1.06	0.006	1.06	0.006
Parent education	0.970	−0.007	0.958	−0.010	0.958	−0.010	0.963	−0.009	0.958	−0.010
Picture vocabulary	0.975**	−0.036	0.972**	−0.040	0.972**	−0.040	0.974**	−0.038	0.973**	−0.040
ADHD	0.995	−0.001	0.998	−0.001	0.998	−0.001	0.998	−0.001	0.996	−0.001
Alcohol use (wave 2)	0.978	−0.004	0.975	−0.004	0.975	−0.004	0.973	−0.005	0.974	−0.005
Drug use (wave 2)	0.640**	−0.038	0.654**	−0.036	0.653**	−0.036	0.638**	−0.038	0.650**	−0.037
GPA	0.732**	−0.024								
School attachment			1.00	0.001						
School problems					0.999	−0.000				
Suspension							1.39+	0.017		
Expulsion									1.52	0.011
N	1476		1476		1476		1476		1476	
Cox and Snell R^2	0.058		0.054		0.054		0.055		0.054	
−2 Log likelihood	963		969		969		966		968	

+ p#0.10

*p#0.05

**p#0.01

achievement is differentially associated with violent, criminal behavior. The negative association between academic achievement and violence was marginally steeper than the association with nonviolent offending; GPA was significantly associated with violent behavior in a model controlling for person factors and variability in nonviolent offending, and violent offenders had significantly lower grades than nonviolent-only offenders and chronic nonviolent-only offenders. The consistency of these findings is not ambiguous, particularly given the conservative nature of the statistical tests. The findings build on the growing body of research providing tests of the differential etiology of violence and good prospects including academic achievement [55], physical child abuse victimization [54, 57], neglect [56], and attachment [53].

Although Savage and Wozniak [58] report that school attachment has also been more consistently associated with violent than with nonviolent offending, our direct test does not support a differential relationship between school attachment and violence. The measure of school problems, operationalized as frequency with which participants had trouble getting along with teachers, paying attention in school, getting their homework done, and getting along with other students, was significantly associated with variability in both nonviolent and violent offending. It was associated with violent offending, even controlling for frequency of nonviolent offending, and the average score was higher among violent compared to nonviolent-only offenders, consistent with the differential etiology hypothesis. Interpretation of the school problems analyses deserves caution; we recommend future research to distinguish the measure more clearly from attention deficit and other "person factors."

The associations between suspension and expulsion in wave 1 and offending in wave 2 were significantly stronger when violent offending was used as the outcome rather than nonviolent-only offending. Also, those who were suspended or expelled in wave 1 reported a higher frequency of violence in wave 2 and were more likely to end up in the violent group than the nonviolent-only group. Interpreting this finding as "causal" is ill-advised because violent behavior is more likely than nonviolent antisocial behavior to result in suspension or expulsion, and though our models are longitudinal, it is possible that prior propensities caused differences in suspension and expulsion. We elaborate this finding because suspension and expulsion are easily identified markers than could be used to help target intervention. In addition, while the finding does not test the causal association, if suspension and expulsion do lead to an increase in violent offending, this may have consequences for the school-to-prison pipeline; more research is needed.

While these findings advance the propositions made by Savage and Wozniak [58], who include academic factors, particularly academic achievement, as a good prospect in the differential etiology of violence, they also bolster support for the idea that specific theories of violence should be developed. Most theories of crime are general in scope and do not predict different types of crime. If violence has a differential etiology, those who are interested in violence need specific theories of violent behavior and careful tests to ensure their findings are not spurious.

Distilling factors that contribute to violence, above and beyond their influence on this "underlying general deviance" is difficult, but has practical importance as well. Violent crime exacts human and social costs greater than nonviolent crime and is seen as an important target for intervention. If we rely on all the risk factors found in studies using the usual methods, we might mis-allocate resources to address risk factors that are

not really associated with violent behavior. Current lists of risk factors for violence include a host of factors, many of which do not seem like good targets for intervention. In order to eliminate those, and focus on the most promising risks, empirical research is needed. Savage and Wozniak [58] also examine other "good prospects" (intelligence and executive functions, attachment to parents, parental warmth and rejection, abuse victimization, poverty, neighborhoods, and substance use) and not all of their findings are consistent with "common sense" expectations.

The practical import of these findings is that school factors might be used to identify youngsters at high risk for violence to target prevention programs more efficiently. Further work would be needed to optimize the predictive utility of these measures. According to the literature, most violence prevention programs in schools focus on classroom curricula about drug use or violence, using interactive exercises and teaching social skills (e.g., [33]). Gottfredson [25] points out that school-based prevention programs do not work as well as we might expect them to, given their advantage of having access to a near-universe of potential offenders. Though our findings do not establish cause, they do beg the question whether programs that support academic achievement could be used to prevent violence.

The interpretation and generalizability of these findings are limited by a number of factors. The sample is a national probability sample, and we do not know how much of the self-reported offending is very serious. The fact that 30% of the sample reported at least one violent act suggests that this study is not tapping into serious violent behavior in its coefficient estimates. It is unclear whether the relationships seen here would be replicated in a study designed to predict violence among a set of serious juvenile offenders, for example. Nevertheless, the national probability sample does provide statistical power to uncover small effects that might not be observed in small offender samples. This analysis is longitudinal, but predicts just 1 year forward. Therefore, it cannot provide evidence of long-term effects. Self-report data may suffer from social desirability and other biases. It is possible that the willingness to admit violence is associated with school performance and that our coefficients are biased because "smarter" participants or those most committed to school did not admit their violent behavior. Finally, the indicator of ADHD was a retrospective, self-report measure and may not be adequate to fully control the effects of low self-control. In addition, the measure of school problems may not have included the problems most likely to engender violence; a better measure may have performed differently in our models.

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