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# Predictors of Violent Behavior in an Early Adolescent Cohort: Similarities and Differences Across Genders

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The authors assessed a cohort of 2,335 students from the Minneapolis, Minnesota, area to identify predictors of violent behavior and to determine whether the predictors varied by gender. The sample was 76% White; boys and girls were equally represented. The majority lived with two parents. A measure of violent behavior collected at the end of the eighth-grade year (2000) was entered into Poisson regression against baseline data collected at the beginning of the seventh-grade year (1998). Predictors of violent behavior influencing both boys and girls included depressive symptoms, perceived invulnerability to negative future events, paternal nonauthoritative behavior, and drinking alcohol. Additional predictors of violent behavior specific to girls included both risk and protective factors.

**Keywords:** *violence; adolescents; risk factors*

Physical aggression and interpersonal violence are among the most preventable causes of premature morbidity and mortality among adolescents in the United States. A recent survey of 26 industrialized nations found that the homicide rate among persons below the age of 15 living in the United States was 5 times higher than the combined homicide rate in the remaining 25 countries (Centers for Disease Control and Prevention, 1997). In addition, juveniles age 12 to 17 are as likely as young adults to be the victims of serious violence and are 3 times as likely as persons in any other age-group to be the victims of simple assault (Snyder & Sickmund, 1999). Although youth homicide and

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victimization are the most obvious consequences of violent behavior, juvenile violence also leads to psychopathology (Campbell & Schwarz, 1996; DuRant, Getts, Cadenhead, & Woods, 1995; Loeber, Green, Lahey, & Kalb, 2000) and increased anxiety about personal safety (Centers for Disease Control and Prevention, 2000; Kaufman et al., 2000) and has been associated with substance abuse (DuRant, Knight, & Goodman, 1997; Fagan, 1993; Wagner, 1996; White, Loeber, Stouthamer-Lober, & Farrington, 1999). Given the extent of violent behavior and the negative sequelae for both perpetrators and victims, increasing our understanding of the antecedents of violence represents a crucial step in the development of theory-driven intervention approaches to reduce violent behavior.

Many adolescents engage in violent behaviors. According to 1999 estimates, 35.7% of high school-age youths reported engaging in one or more physical fights during the previous 12 months and approximately one in six reported carrying a gun or other weapon in the preceding 30 days (Centers for Disease Control and Prevention, 2000). Although boys are more likely than girls to engage in violent and delinquent behaviors, the rates of these behaviors among girls are not trivial.

According to some estimates, the disparity in delinquent behavior between boys and girls is shrinking (Hoyt & Scherer, 1998; Poe-Yamagata & Butts, 1996). The ratio of boys to girls arrested for committing violent crimes fell from 7.4 to 1 in 1983 to 3.5 to 1 in 1998 (U.S. Department of Health and Human Services, 2001). Girls are now responsible for as much criminal behavior among female persons of all ages as boys are among male persons of all ages; in large part, this trend is due to increases in the rate of arrest among girls for robbery and aggravated assault (Poe-Yamagata & Butts, 1996). Although some have argued that this reflects changes in policing policies more so than changes in the rate of violent offending among girls (Chesney-Lind & Paramore, 2002), the fact remains that girls' violent behaviors are increasingly gaining the attention of policy makers and juvenile justice authorities. Equally important, current prevention programs are not equipped to meet the specific needs of violent girls (Flay, Burns, & He, 2000; Perry et al., 2003).

Adolescence is a period of heightened risk behavior, and the development of violent behavior is a complex process that is influenced by the challenges of this developmental period. Studies of delinquent boys have allowed researchers to elaborate models containing multiple pathways leading to violence and delinquency; this model emphasizes the timing of both onset and escalation in understanding the development of violent behavior (Kelley, Loeber, Keenan, & DeLamatre, 1997; Loeber & Hay, 1997; Moffitt, 1993). According to the model elaborated by Moffitt (1993), serious antisocial behavior has its roots in childhood and is characterized by a difficult temperament, a cold and callous personality, and neurocognitive deficits. It is hypothesized that these factors are exacerbated by risk factors in the child's environment such as poor parenting practices and social structure variables. This child-onset pathway is associated with increasingly antisocial behavior, multiple involvements with juvenile authorities, and a transition to adult criminality. The second pathway in this model begins during adolescence among youths with no prior history of conduct problems and is conceived of as "social mimicry" of youths with childhood onset of conduct problems. This emulation of deviance reflects the perceived adult role status associated with violent and delinquent behaviors in the youth peer structure (Moffitt, 1993).

The degree to which these pathways characterize the development of violence in girls is unclear (Dahlberg & Potter, 2001). For example, one study validated the two-path model for boys and girls, suggesting that although childhood onset was quite rare among girls, the rate of adolescent-onset delinquency was similar across genders (Moffitt &

Caspi, 2001). Others have hypothesized that girls follow a different developmental trajectory toward violence (Pepler & Slaby, 1996; Silverthorn, Frick, & Reynolds, 2001). Silverthorn and colleagues suggested a delayed-onset pathway for girls that did not correspond to either of the pathways delineated for boys (Silverthorn & Frick, 1999). According to their model, the majority of girls who engage in delinquent behavior express an adolescent onset yet display many of the characteristics of the childhood-onset youth (Silverthorn et al., 2001). Other research has identified differences between boys and girls in the taxonomy and trajectory of deviant behavior, lending support to the idea that boys and girls follow different pathways (D'Unger, Land, & McCall, 2002).

Differences between boys and girls may be due to differences in socialization and learning. Violent behaviors are acquired through observational learning and reinforced performance, instigated through aversive stimulation and cognitively-based motivators, and maintained by external and internal reinforcement associated with expected consequences (Bandura, 1986). Girls develop cognitive skills at an earlier age than boys. Studies assessing the influence of cognitive factors in aggressive behavior have indicated gender-based differences related to outcome expectations (Eagly & Steffen, 1986) and empathic concern (Carlo, Raffaelli, Laible, & Meyer, 1999). Other cognitive factors associated with the development of violent behavior may differ between boys and girls as well. For example, adolescents who are generally pessimistic about their future report more weapon carrying (DuRant et al., 1995). Depression has been positively associated with the intention to use violence (Durant, Treiber, Goodman, & Woods, 1996) and reported levels of violent behavior (DuRant, Cadenhead, Pendergrast, Slavens, & Linder, 1994). In contrast, belief and commitment to a social or moral order is hypothesized to decrease the probability of violent behavior (Catalano & Hawkins, 1996). Spirituality, for example, is one belief system that may serve as a protective factor. Spirituality can afford youths a sense of identity, help them to develop personal goals, and facilitate coping (Meyer & Lausell, 1996). However, the degree to which gender modifies the influence of these factors on violent behavior is unclear.

It has also been hypothesized that girls' antisocial and aggressive behaviors may be channeled toward internalizing problems during childhood (Keenan & Shaw, 1997). This hypothesis emphasizes social control in the suppression of aggressive behavior, which is seen as inconsistent with the female gender role (Heimer, 1996). Parents are the primary agents of socialization and important sources of social control (Ary et al., 1999; Catalano & Hawkins, 1996; Heimer, 1996). Parenting practices are also known to influence the expression of high-risk behaviors through the development or hindrance of child competences (Jackson, Bee-Gates, & Henriksen, 1994). Although research on mother-child interaction dominates the field, at least one recent study has shown that mothers and fathers exert different influences on child problem behavior and these influences differ for boys and girls (Marshal & Chassin, 2000).

Research also suggests a strong association between violence and substance use (Dahlberg, 1998; Ellickson, Saner, & McGuigan, 1997; Fagan, 1993; McKeown, Jackson, & Valois, 1998; Wagner, 1996). Evidence based on adolescent boys indicates that this association is reciprocal (White et al., 1999). However, girls and boys are likely to engage in drug use for different reasons (Liu & Kaplan, 1996). Moreover, the degree to which boys and girls are likely to engage in an array of antisocial behaviors is hypothesized to differ, with girls engaging in a broader span of antisocial behaviors and boys tending to exhibit greater specialization (Marcus, 1999). Accordingly, the pattern of association between violent behavior and substance use may be very different across genders.

Unfortunately, there has been little research aimed at understanding the similarities and differences in the etiology of violent behavior between boys and girls (Hoyt & Scherer, 1998). The majority of the longitudinal research on violent behavior has been carried out on all male populations (Pepler & Slaby, 1996). Studies that have included both male and female individuals often identified gender as a main effect, concluding that "being male" is a risk factor for physical fighting, carrying a weapon, or other violent behaviors (DuRant et al., 1994; DuRant, Kahn, Beckford, & Woods, 1997; Herrenkohl et al., 2000; Kulig, Valentine, Griffith, & Ruthazer, 1998). Other studies have elaborated separate models to assess predictors and correlates of violent behavior in boys and girls (Blum, Ireland, & Blum, 2003; Valois, McKeown, Garrison, & Vincent, 1995). Studies that fail to explore gender as a potential modifier of violent behavior may be oversimplifying a complex problem.

This study prospectively assessed demographic, psychosocial, and substance use variables thought to be associated with the occurrence of violent behavior. We began with a large cohort of middle school youths in predominately urban environments. These youths were part of the TEENS study, an intervention designed to reduce future cancer risk by changing dietary choices (Lytle & Perry, 2001). The richness of the data set and the availability of measures assessing violent and antisocial behaviors provided an excellent opportunity for secondary analysis. We assessed a number of risk and protective factors that have been related to violent behavior in previous empirical work, with special consideration for the influence gender may have on the patterns of antecedents contributing to the development of the expression of violence.

## METHOD

### Design

The present study represents a secondary analysis of the baseline and follow-up surveys from TEENS, a school-based intervention to reduce cancer-related dietary risk behaviors among youths in the Minneapolis, Minnesota, area (Lytle & Perry, 2001). The goal of TEENS was to design and evaluate a multicomponent intervention to increase fruit and vegetable intake and decrease fat intake among seventh and eighth graders. TEENS targeted a moderate- to lower income population, including only schools with a minimum of 20% of students approved for a free or reduced-priced lunch. Thirty-three schools from 14 districts were eligible for participation, and 20 schools from 9 districts agreed to participate. One of the schools served as a pilot school to test the survey and intervention, and 3 were ineligible due to scheduling conflicts, leaving a total of 16 study schools. Parents received a passive informed consent letter in advance of the survey, and students gave written assent at the time of the survey; the University of Minnesota Committee on the Use of Human Subjects in Research approved these procedures.

Baseline surveys occurred at the beginning of the 1998 fall semester. Variables and scales used as predictors of violent behavior came from this survey. All students in the seventh grade had the opportunity to complete a questionnaire measuring a variety of health behaviors and related factors, including measures of alcohol, tobacco, and other drug use, as well as a measure of violent behavior. Of the 4,050 eligible seventh graders, 3,878 (95.8%) completed the baseline survey, comprising the TEENS cohort. The follow-up survey occurred at the end of the 2000 spring semester; all students finishing eighth grade had the opportunity to participate. Our outcome measure came from this sur-

vey, providing an 18-month latency between assessment of potential predictors and outcome. Of the 3,878 students in the TEENS cohort, 2,923 (75%) provided information at follow-up. A small number ( $n = 34$ ) of participants reported the maximum scale score on our measure of violent behavior. As this is more likely to represent exaggerated self-reporting than valid information, we removed these participants, leaving an eligible sample of 2,889 for analysis. Another 554 (14.3%) students were omitted from the eligible sample due to missing data on one or more of the independent variables, leaving an analysis sample of 2,335, or 60.2% of the TEENS cohort.

### Variables of Interest and Their Measures

*Violent Behavior.* The outcome of interest for this study was a self-reported measure of violent behavior (Birnbaum et al., 2002). Students responded to questions asking, "During the past 12 months, how often did you <ITEM>?" The items included the following: "Carry a weapon such as a gun, knife, or club" (Kann et al., 1998); "Hit or beat up someone" (Minnesota, 1989); "Take part in a fight where a group of your friends fought another group" (Resnick et al., 1997); "Hurt someone badly enough to need bandages or a doctor" (Resnick et al., 1997); and "Use a knife, gun, or other weapon to get something from a person" (Resnick et al., 1997). Response categories included the following: *never*, *1-3 times*, *4-7 times*, *8-11 times*, and *12 or more times*. We computed a scale by assigning the midpoint value for each response category (for the highest category, we assigned the value 14) and summing the values. The scale ranged from 0 to 70; higher scores indicate more violent behavior. In a pilot test, Cronbach's alpha was .75, and the test-retest Spearman correlation was .76 (Birnbaum et al., 2002).

*Demographic Variables.* Information about sex and date of birth came from school records, and date of birth was then used to compute each respondent's age on the date of the survey administration. Students reported race/ethnicity by responding to the question "Do you think of yourself as . . . White, African American, Hispanic/Latino, Asian or Pacific Islander, Native American, Multiracial, or Other?" In addition, students reported on their family structure (the number of parents with whom they lived) and provided information on three items that have been closely linked with socioeconomic status. These included whether they participated in the Free/Reduced Price Lunch Program, the highest level of educational attainment for each parent, and the number of parents who worked full-time.

*Depressive Symptoms.* The Center for Epidemiologic Studies Depression Scale (CES-D) assessed depressive symptoms. The 20-item scale, originally developed to assess the frequency of depressive symptoms in a community-residing adult population (Radloff, 1977), has been used successfully with adolescents (Doerfler, Felner, Rowlinson, Raley, & Evans, 1988; Garrison, Addy, Jackson, McKeown, & Waller, 1991; Garrison, Schluchter, Schoenbach, & Kaplan, 1989; Roberts, Andrews, Lewinsohn, & Hops, 1990; Roberts, Lewinsohn, & Seeley, 1991; Schoenbach, Kaplan, Grimson, & Wagner, 1982). In the pilot administration, Cronbach's alpha was .84, and the test-retest Spearman correlation was .82 (Birnbaum et al., 2002). Higher scores indicate greater frequency of depressive symptoms.

*Influence of Spirituality.* An adapted scale from the Voice of Connecticut Youth Survey asked adolescents how much their spiritual beliefs influence their health-related be-

haviors (Connecticut Department of Public Health 1996). The original scale included items related to fighting, alcohol and drug use, selection of friends, and use of free time; we added items on physical activity and eating patterns. Factor analysis from the pilot study confirmed a single factor. Cronbach's alpha on the scale was .85, and the test-retest Spearman correlation was .72 (Birnbaum et al., 2002). Higher scores reflected higher reported levels of influence.

*Future Outlook.* A four-item scale, adapted from the Voice of Connecticut Youth Survey, measured adolescents' outlook for the future based on their perceived probability of experiencing a range of socially oriented life events (Connecticut Department of Public Health, 1996). The scale asked respondents to rate "on a scale from *no chance* to *it will happen*, what do you think the chances are you will <ITEM>?" The items included (a) live to age 35, (b) get HIV or AIDS, (c) be a parent by age 18, and (d) ever get in trouble with the police. Items (c) and (d) were original items written for this survey. In the pilot administration, Cronbach's alpha on the scale was .51, and the test-retest Spearman correlation was .62 (Birnbaum et al., 2002). Higher scores indicated a more positive outlook for the future.

*Parenting Style.* Two scales, one measuring authoritative parenting, the other measuring nonauthoritative parenting, assessed the parenting style of respondents' caregivers (Jackson et al., 1994). Authoritative parenting style was defined as balancing "responsiveness and control." Examples of items that reflect authoritative parenting include "My mother (father) gives reasons for the rules she (he) makes" and "My mother (father) praises me for doing a good job on things." Nonauthoritative parenting style was defined as "intrusive and excessively controlling." Examples of items that reflect nonauthoritative parenting include "My mother (father) wants to decide everything for me" and "My mother (father) is always telling me what to do." Nine identical questions (six measuring authoritative behavior, three measuring nonauthoritative behavior) separately assessed the mother or female caregiver and the father or male caregiver. Factor analysis confirmed the presence of the two subscales for each parent; alphas ranged from .75 to .89, and test-retest reliability ranged from .56 to .62 (Birnbaum et al., 2002). Because the two subscales had different numbers of items, they were not easily comparable in their original form. To facilitate interpretation, we transformed each subscale to a standard normal distribution, with a mean of zero and a standard deviation of one. We excluded respondents who did not answer one or more items for a parent from both subscales pertaining to that parent.

*Tobacco Use.* Current smoking behavior was measured using a standard smoking index that has been correlated with biochemical measures of smoking (Pechacek et al., 1984). The index is generated from two questions. The first asks youths to report how much they currently smoke using a 10-category response set ranging from *I don't smoke* to *A pack or more a day*. The second question asks participants to report the number of cigarettes they smoked (a) in the past 24 hours and (b) in the past 7 days. The index is scaled in terms of cigarettes per week, such that a scale score of 1 is equated with smoking one cigarette per week. Participants were dichotomized into nonsmokers and low-level smokers (index score < 1) versus weekly or greater smokers (index score  $\geq$  1).

*Substance Use.* We assessed four substance use categories using items from the Monitoring the Future questionnaire. Participants responded to the question, "During the past

30 days, how many times have you <ITEM>?” (Johnston, O’Malley, & Bachman, 1996). The items include “had alcohol to drink,” “sniffed [inhalants] to get high,” and “used marijuana.” A seven-category response set, ranging from 0 to 40 or more, allowed participants to indicate the number of times they had used each substance in the past month. Participants also indicated the number of times in the past 2 weeks they had engaged in binge drinking episodes, defined as having five or more drinks in a row (Johnston et al., 1996). This item had a six-category response set, ranging from none to 10 or more times. We dichotomized each response to indicate use (1) or nonuse (0) and entered each item as a separate predictor.

### Analysis Methods

The current study was based on the responses of adolescents nested within schools. It has been shown that observations taken from students in the same school tend to be positively correlated, reflecting an extra component of variance that is attributable to the school, above and beyond the variance attributable to the student (Murray, Clark, & Wagenaar, 2000; Murray et al., 1994; Murray & Short, 1996, 1997; Siddiqui, Hedeker, Flay, & Hu, 1996). Analyses must reflect this extra variation, or standard errors will be underestimated and the significance of findings may be overstated (Kish, 1965; Korn & Graubard, 1999; Skinner, Holt, & Smith, 1989).

We addressed this problem by using analytic methods appropriate to the cluster sampling design. We based our analyses on the Generalized Linear Mixed Model (Breslow & Clayton, 1993; Wolfinger & O’Connell, 1993). This model is appropriate when there are multiple sources of random variation and the observation level errors have a non-Gaussian distribution. In these data, we have a dependent variable that represents count information and two sources of random variation (students and schools).

We specified a Poisson error distribution with a log link to obtain a mixed-model Poisson regression analysis. Poisson regression is appropriate when the dependent variable represents count data and provides event rate ratios (ERRs). ERRs compare the incidence density of an indicated group to a reference group. In other words, ERRs compare the number of reported events between a group of interest (indicated group) and a group used as a standard (reference group). Where ERRs are greater than one, the indicated group reported higher frequency of occurrence of violent behavior than the reference group; where ERRs are less than one, the indicated group reported lower frequency of occurrence of violent behavior.

We conducted the analysis using the GLIMMIX macro from SAS version 8.02 (Littell, Milliken, Stroup, & Wolfinger, 1996; SAS Institute, 2001). The macro iteratively calls the MIXED procedure and provides results that are similar to any Poisson regression program except that the standard errors, confidence bounds, and *p* values reflect the extra variation attributable to schools. The GLIMMIX macro also accounts for the extra dispersion often found in Poisson analyses.

A preliminary analysis assessed the possibility that the dietary intervention may have unintentionally influenced violent behavior. This analysis indicated that self-reported violent behavior did not differ at follow-up by condition. Therefore, the variable representing condition was not included in the subsequent analyses.

We used a hierarchical approach to build the regression model predicting violent behavior (Cohen, Cohen, West, & Aiken, 2003). This approach recognizes the temporal priority of some variables over others in their influence on violent behavior, allowing us to explore the main effects and interactions in a given set of variables controlling for the



influence of significant terms entered in a previous set. As the primary question of this study was whether the predictors of violent behaviors differed among young adolescent boys and girls, we entered gender, baseline report of violent behavior, and their interaction as the first set. The remaining variables were grouped into three sets: demographic predictors (ethnicity, age, and family socioeconomic status [SES] characteristics), psychosocial predictors (depressive symptoms, future outlook, influence of spirituality, and parenting styles), and substance use predictors (tobacco use and substance use variables). Each set of potential predictors was added sequentially to the model, including all variables in that set as both main effects and as interactions with gender. Type III *F* tests assessed the unique contribution of each variable to the overall fit of the model. Terms that fell below the  $p < .05$  level of significance within their set were deleted; terms that fell below the  $p < .05$  level of significance as a result of the addition of variables in a subsequent set were retained in the final model to control for their effects on the remaining predictors. As a final step, we assessed the assumption of linearity for each continuous predictor by adding its quadratic form to the model. This process resulted in the development of a single model predicting violent behavior.

*Propensity Analysis.* A propensity analysis of the complete TEENS cohort ( $N = 3,878$ ) assessed differences between the 2,889 participants available for the analysis sample and the 989 nonparticipants who did not provide outcome information. The propensity analysis excluded 138 participants and 241 nonparticipants due to missing data. This analysis included all variables with less than 2.5% missing data. The propensity analysis was fit using logistic regression procedures as implemented in SAS PROC LOGISTIC, version 8.02 (SAS Institute, 2001). The results of the propensity analysis provide odds ratios comparing nonparticipants with participants on each variable, highlighting any association between a variable of interest and participants who did not provide outcome information.

## RESULTS

### Sample Characteristics and Propensity Analysis

Descriptive characteristics of the TEENS cohort and the analysis sample appear in Table 1, presented separately for boys and girls. Overall, the mean age of the sample was 12.7, with a range of 11.8 to 14.5 years. The sample was primarily White (75.9%), Asian Americans constituted the largest identified minority group (6.9%), and 8.2% identified themselves as belonging to an ethnic group not listed. Approximately 80% reported living with two parents, and nearly one quarter participated in the free and reduced-price lunch program. Substantially more boys than girls reported any violent behavior in the past 12 months, in both the TEENS cohort (53.8% vs. 33.1%) and the analysis sample (48.0% vs. 27.9%). From the beginning of seventh grade to the end of eighth grade, the mean number of violent behaviors reported among the analysis sample increased both for boys (+1.26) and for girls (+0.30).

Table 2 presents the results of the propensity analysis identifying predictor variables associated with systematic differences between the TEENS cohort and the analysis sample. For example, minority status was related to nonparticipation. Among all cohort members, African Americans and Native Americans were about 3 times as likely as Whites to be nonparticipants, whereas Hispanics or Asian Americans were about 1.5

Table 1. Characteristics of TEENS Cohort and the Analysis Sample at Baseline

Variable	TEENS Cohort		Analysis Sample	
	Boys ( <i>n</i> = 1,983)	Girls ( <i>n</i> = 1,895)	Boys ( <i>n</i> = 1,150)	Girls ( <i>n</i> = 1,185)
Baseline violence (mean)	4.58	2.08	3.18	1.47
Any violent behavior (%)	53.81	33.12	48.00	27.93
Age (mean)	12.79	12.72	12.78	12.70
Race/ethnicity (%)				
White	66.36	66.83	75.48	76.37
African American	11.72	10.94	5.30	5.82
Asian American	6.72	7.29	6.70	7.09
Hispanic	2.78	2.75	2.70	2.03
Native American	1.72	1.74	1.13	0.93
Other	10.71	10.46	8.70	7.76
Household structure (%)				
Lives with two parents	72.79	69.95	80.52	79.07
Single parent—father	4.92	4.30	3.65	3.46
Single parent—mother	22.29	25.75	15.83	17.47
Parents' work status (%)				
One parent works full-time	36.66	37.40	34.26	36.37
Both parents work full-time	46.55	45.07	53.22	51.73
Other	16.79	17.89	12.52	11.90
Parents' education (%)				
Both completed college	21.18	19.31	26.61	22.87
One completed college	19.31	19.16	20.17	20.93
One completed high school	4.08	5.91	2.61	3.63
Neither completed high school	12.96	13.51	12.00	13.25
Other	15.83	17.84	15.83	18.40
Don't know	26.63	24.27	22.78	20.93
Free/reduced-price lunch (%)				
Yes	23.40	23.85	18.35	18.40
No	76.60	76.15	81.65	81.60

NOTE: TEEN = an intervention designed to reduce future cancer risk by changing dietary choices (Lytle & Perry, 2001).

times as likely to be nonparticipants. Nonparticipants were more likely to be older and report family characteristics indicating lower socioeconomic standing. They were more likely to receive a free or reduced-price lunch, to report lower parental education, and were less likely to come from homes where both parents work full-time. Those who reported drinking alcohol in the past month or smoking at least weekly were less likely to provide follow-up information and be included in the analysis sample than youths who did not engage in these behaviors.

### Violent Behavior

Table 3 reports ERRs and 95% confidence intervals for terms in the final model predicting violent behavior. For some terms, a single ERR is provided, indicating a main effect applicable to boys and girls. For other terms, ERRs are provided separately, indicating that the ERR was significantly different for boys and girls. To aid in the interpreta-

Table 2. Propensity Analysis Identifying Variables Associated With Nonparticipation in the Follow-up Survey

Variable	Odds Ratio Estimate	95% Wald Confidence Limits	
Ethnicity			
White	1.00 <sup>a</sup>	—	—
African American	3.04	2.35	3.93
Hispanic	1.72	1.08	2.75
Asian American	1.52	1.09	2.11
Native American	2.86	1.62	5.04
Other	2.17	1.67	2.81
Age	1.46	1.18	1.82
Parents' education			
Both parents completed college	1.00 <sup>a</sup>	—	—
At least one parent completed college	1.42	1.05	1.91
At least one parent completed high school	2.43	1.61	3.65
Neither parent graduated high school	1.80	1.31	2.47
Other	1.47	1.08	1.99
Don't know	1.78	1.34	2.36
Receives free/reduced-priced lunch			
No	1.00 <sup>a</sup>	—	—
Yes	1.49	1.23	1.82
Parents' working status			
Both parents work full-time	1.00 <sup>a</sup>	—	—
One parent works full-time	1.52	1.25	1.85
Neither parent works full-time	1.64	1.28	2.11
Recent use of alcohol (reference group = no use)			
No	1.00 <sup>a</sup>	—	—
Yes	1.69	1.33	2.14
Weekly smoking (reference group = nonsmoking)			
No	1.00 <sup>a</sup>	—	—
Yes	2.34	1.60	3.42

a. Reference group.

tion of continuous variables, we computed ERRs at the 10th, 25th, 75th, and 90th percentiles, referenced against the 50th percentile.

Gender modified the effect of baseline reports of violent behavior. Compared with adolescents reporting the median level of violent behavior at baseline, those who reported higher levels also reported higher levels of violent behavior at follow-up, and this effect was stronger among girls than among boys. Ethnicity was associated with predicted violent behavior, and gender modified this association as well. Among boys, rates of violent behavior did not differ significantly between Whites (the reference group) and any other ethnic group. However, African American girls reported about twice as many incidents of violent behavior as White girls. No other differences between Whites and other ethnic groups were significant. Household structure is presented in Table 3 even though it did not remain significant in the final model. Following our modeling strategy, this term was retained due to its initial significant association with violent behavior. Table 3 indicates that parents' level of education predicted violent behavior. Youths who reported one parent with less than a high school education or reported "other" also reported higher rates of

Table 3. Hierarchical Regression Model of Predictors of Violent Behaviors

Variable	Boys ERR <sup>a</sup> (95% CI) <sup>b</sup>	Girls ERR <sup>a</sup> (95% CI) <sup>b</sup>
Baseline violence <sup>c</sup>		
50 percentile	1.00 <sup>d</sup>	1.00 <sup>d</sup>
75 percentile	1.09 (1.07, 1.11)	1.13 (1.10, 1.17)
90 percentile	1.28 (1.22, 1.36)	1.46 (1.32, 1.61)
Demographic predictors		
Ethnicity		
African American	1.30 (0.93, 1.82)	1.94 (1.28, 2.93)
Hispanic	0.88 (0.50, 1.56)	1.58 (0.71, 3.52)
Asian American	0.88 (0.61, 1.27)	1.09 (0.63, 1.89)
Native American	1.09 (0.49, 2.41)	1.44 (0.59, 3.50)
Other	1.04 (0.78, 1.38)	1.38 (0.88, 2.17)
White	1.00 <sup>d</sup>	1.00 <sup>d</sup>
Household structure		
Single parent—mother		1.18 (0.85, 1.64)
Single parent—father		1.13 (0.94, 1.36)
Living with two parents		1.00 <sup>d</sup>
Parents' education		
Both completed college		1.00 <sup>d</sup>
At least one completed college		1.04 (0.82, 1.33)
At least one completed high school		1.70 (1.18, 2.45)
Neither completed high school		1.05 (0.81, 1.37)
Other		1.43 (1.13, 1.81)
Don't know		1.24 (1.00, 1.56)
Psychosocial predictors		
Authoritative parenting (mother)		
10 percentile	1.02 (0.92, 1.15)	1.42 (1.23, 1.64)
25 percentile	1.01 (0.96, 1.07)	1.19 (1.11, 1.28)
50 percentile	1.00 <sup>d</sup>	1.00 <sup>d</sup>
75 percentile	0.99 (0.93, 1.05)	0.70 (0.66, 0.76)
90 percentile	0.98 (0.87, 1.09)	0.83 (0.73, 0.97)
Nonauthoritative parenting (father)		
10 percentile		0.89 (0.81, 0.97)
25 percentile		0.96 (0.93, 0.99)
50 percentile		1.00 <sup>d</sup>
75 percentile		1.07 (1.02, 1.15)
90 percentile		1.12 (1.03, 1.23)
Depressive symptoms		
10 percentile		0.93 (0.88, 0.98)
25 percentile		0.96 (0.93, 0.99)
50 percentile		1.00 <sup>d</sup>
75 percentile		1.07 (1.01, 1.13)
90 percentile		1.16 (1.03, 1.31)
Future outlook		
10 percentile		0.22 (0.09, 0.50)
25 percentile		0.62 (0.48, 0.81)
50 percentile		1.00 <sup>d</sup>
75 percentile		1.56 (1.22, 1.99)
90 percentile		2.35 (1.46, 3.77)

(continued)

Table 3 (continued)

Variable	Boys ERR <sup>a</sup> (95% CI) <sup>b</sup>	Girls ERR <sup>a</sup> (95% CI) <sup>b</sup>
Substance use predictors		
Alcohol use		
Yes	1.46 (1.21, 1.77)	
No	1.00 <sup>d</sup>	
Binge drinking		
Yes	1.13 (0.78, 1.64)	0.49 (0.41, 0.95)
No	1.00 <sup>d</sup>	1.00 <sup>d</sup>
Marijuana use		
Yes	0.61 (0.41, 0.90)	2.09 (1.23, 3.52)
No	1.00 <sup>d</sup>	1.00 <sup>d</sup>

a. Event rate ratio.

b. 95% confidence interval.

c. 10th and 25th percentiles are not shown because 62% of the participants reported no violent behaviors at baseline.

d. Reference group.

violent behavior than those who reported both parents had a college education; this pattern applied equally to boys and girls.

Table 3 also contains the psychosocial and substance use predictors of violent behavior. The parenting style of both mothers and fathers predicted violent behavior in this sample. For girls, perceived authoritative parenting by mothers was negatively associated with violent behavior. Compared with girls who reported median levels of maternal authoritative behavior, those who perceived their mother as more authoritative (90th percentile) reported 17% lower rates of violent behavior, whereas those who perceived their mother as less authoritative (10th percentile) reported 42% higher rates of violent behavior. For fathers, a positive linear trend was found between paternal nonauthoritative behavior and predicted levels of violent behavior among both boys and girls. Adolescents who rated their father at the low end of the nonauthoritative scale (10th percentile) reported 11% less violent behavior than those at the median; those who perceived their father as more nonauthoritative reported higher rates of violent behavior.

Reported frequency of depressive symptoms was related to violent behavior, with greater frequency predicting higher rates of violent behavior for both boys and girls. Future outlook had a nonlinear effect on violent behavior, characterized by a positive but decelerating slope. Youths who indicated a poorer future outlook (10th percentile) reported 0.22 times the rate of violent behavior as those at the median, whereas those who indicated a very positive future outlook (90th percentile) reported 2.35 times the rate of violent behavior as those at the median.

Baseline substance use behavior also predicted later violence. The main effect for alcohol indicated that youths who reported any drinking in the past 30 days reported 1.46 times as many violent behaviors as those who reported no alcohol consumption. Binge drinking also predicted violent behavior, and gender modified the association. Girls who reported binge drinking reported fewer violent behaviors than girls who did not report binge drinking; binge drinking was not associated with violent behavior among boys. A similar pattern emerged in reverse for marijuana use. Boys who reported smoking mari-

juana in the past 30 days reported fewer violent behaviors than those who reported not smoking marijuana, whereas girls who smoked marijuana in the past 30 days reported more violent behaviors than girls reporting no use.

## DISCUSSION

As youths progress through adolescence, they become more likely to engage in a number of violent behaviors. It is currently unknown whether the factors that predict violence are similar for boys and girls. Although we did not directly address the trajectories of violent behavior in boys and girls, our findings add to the growing evidence that there are both similarities and differences in the factors that influence these trajectories.

Overall, we see more predictors of violent behavior for girls and that protective factors appear to be more important for girls than for boys. In each of the three categories of predictors, we find both main effects and gender-modified predictors influencing violent behavior. Boys in our sample reported more violent behaviors than girls at each measurement time, but the increase in violent behavior over time was steeper in girls than boys. This is consistent with previous reports that girls tend to close the “gender gap” in delinquent behavior during early adolescence (Keenan & Shaw, 1997; Silverthorn et al., 2001).

Demographic variables are better conceived of as markers of risk than as true risk factors (Kaplan & Bennett, 2003). In our study, ethnicity was the only demographic variable that demonstrated gender-modified effects, predicting more violent behaviors among African American girls than among White girls, but not predicting violent behavior in boys. This leads us to wonder why ethnicity was associated with the expression of violent behavior. We know, for example, that minority ethnic status is generally confounded with factors such as economic disadvantage and neighborhood disorganization (Currie, 2000; Guerra, Huesmann, Tolan, & Van Aker, 1995), and it is likely that factors such as these play a role in the association between ethnicity and violence in young girls.

Parental education, a proxy of socioeconomic standing, was associated with violent behavior among both boys and girls. Compared with children who come from homes where both parents graduated from college, those who reported coming from homes where at least one parent graduated high school or had some college or vocational training reported more violent behaviors in the past 12 months. Youths coming from households characterized by the lowest levels of educational attainment (neither parent graduated from high school) and youths who reported that only one parent graduated from college did not differ from those who reported that both parents had completed college. We retained household structure in the final to control for the influence of the number of parents living in the home.

We also assessed the influence of parenting styles on the expression of violent behavior. Although authoritative parenting by fathers was not related to violent behavior, children who perceived their fathers as more demanding and controlling (i.e., nonauthoritative) reported higher rates of violent behavior. Previous research has suggested an association between overcontrolling parental behavior and patterns of aggression in children (Ruchkin, 2002). Our findings agree with this position as well as with research suggesting that violent behavior may be influenced through the social modeling of power assertive behavior (Coie & Dodge, 1998; Ruchkin, 2002). The presence of a nonauthoritative father may also weaken or eliminate important social control mechanisms (Catalano & Hawkins, 1996; Reppucci, Fried, & Schmidt, 2002).

Our findings also suggest that violent behavior among girls may be buffered by the presence of a warm, responsive (i.e., authoritative) mother; this variable did not influence violent behavior in boys. Klein, O'Bryant, and Hopkins (1996) have pointed to the importance of maternal authoritative in the development of personal competencies in young women, suggesting that identification with the strength and rationality of an authoritative mother bolsters girls' self-perceptions. Our research supports this finding and is consistent with other research indicating that protective factors are more important determinants of behavioral outcomes for girls than for boys (Hollister-Wagner, Foshee, & Jackson, 2001; Marshal & Chassin, 2000).

Two other psychosocial variables predicted violent behavior in boys and girls: depressive symptoms and future outlook. There was a positive, linear association between depressive symptoms and the violent behaviors. One possibility may be that previous exposure to violence led to the depressive symptoms that predict future violent behavior, suggesting a complex and reciprocal relationship. Others, however, have suggested that the covariation between aggression and depression may reflect a broadband underlying dysfunction relating multiple manifestations of internalizing and externalizing behaviors (Weiss & Catron, 1994).

Our findings on future outlook are perplexing as they suggest that those adolescents with the most optimistic view of their future engage in more violence as youths. Previous studies have found the opposite pattern (Birbaum, Lytle, Hannan, Murray, & Perry, 2003; DuRant et al., 1995). One artifactual explanation for our findings could be that we failed to include life events that were proximally realistic enough to allow for sufficient heterogeneity in responses. Examination of the responses for future outlook indicated a median response of 18, showing a generally optimistic outlook, with an interquartile range that was severely restricted. This association may also be the product of a cognitive orientation that promotes risk taking. Youths who deny the likelihood of negative events and persistently engage in violent behaviors without experiencing negative consequences may further reduce their assessment of the likelihood of encountering negative events, leading to an increasing spiral of risk-taking behaviors. More work is needed in examining these relationships.

Substance use is another form of deviant behavior that has been associated with violence (Ellickson et al., 1997). Of the five substance use variables we assessed, only alcohol predicted violent behavior equally for girls and boys; this relationship has been reported in other research (Bachman & Peralta, 2002; DuRant, Kahn, et al., 1997; DuRant, Knight, et al., 1997; Valois et al., 1995).

Previous research has suggested that male and female adolescents engage in substance use behavior for different reasons (Lex, 1991; Liu & Kaplan, 1996). Our data indicate that marijuana use among girls was associated with more than twice the rate of violent behavior compared to girls who had not used marijuana. Boys who used marijuana, however, reported much lower rates of violent behavior than boys who had not used marijuana. Our study also indicates that binge drinking suppressed the reported rate of violent behavior among girls and was not associated with violent behavior among boys. The reason why marijuana use drives girls' behavior in one direction and binge drinking drives it in the other direction is indeed puzzling. So, too, is the association between marijuana use in boys and violent behavior. More research on these relationships is called for.

These findings need to be considered in light of several limitations. First, ours is a secondary analysis from a study designed to evaluate a dietary change intervention. As such, a number of critical variables were unavailable. For example, we had no measure of com-

munity violence or victimization. This information could have helped us understand the influence of demographic factors and depressive symptoms. Other family-related measures, such as family management practices, would have also been of interest. In addition, our measure of parenting style was based on a scale that emphasized the influence of authoritative parenting, hence we cannot address how permissive, or uninvolved, parenting may have influenced violent behavior. Second, the propensity analysis indicates a number of limitations on our ability to generalize these findings. The propensity analysis suggests that minority cohort members and youths from homes of lower SES were less likely to be included in our analysis. Moreover, although our data are derived from a study of urban youths, the sample had a relatively low mean level of violent behavior and a low proportion of children eligible for the free or reduced-price lunch program. As such, it is not clear whether our findings would generalize to settings characterized by higher levels of community violence and poverty. Third, a significant proportion of the youths in our analysis did not provide any information of parental education. Previous studies have shown that youths from more deprived backgrounds are less competent reporters of parental education and occupation (Wardle, Robb, & Johnson, 2002). Fourth, although our measure is very similar to the measure used in many other studies (Blum et al., 2003; DuRant et al., 1994; Herrenkohl et al., 2000; Kosterman, Graham, Hawkins, Catalano, & Herrenkohl, 2001), we did not differentiate between mild and severe violent behavior; this is both a limitation and a strength. On one hand, our global measure of violent behavior precludes us from offering suggestions aimed at the development of targeted interventions for serious or chronically violent youths. On the other hand, this allows us to make several recommendations aimed at population-based assessment and intervention development.

### **Implications for Practice**

These findings hold a number of implications for reducing violent behavior in the general population. Our data confirm that children who employ violence as an interpersonal strategy are likely to continue doing so if left unchecked. Our data also suggest a positive dose-response relationship between depressive symptoms and violent behavior. The lesson for educators is clear: Children should be exposed to universal prevention programs that identify constructive, nonviolent methods of dealing with interpersonal conflict and depressive symptoms.

Our data also identify several important factors that may help reduce violent behavior among girls. First, our data suggest that early drug and alcohol use among girls is associated with later violent behavior. Although such behaviors should be discouraged among all children, it appears that early deviance among girls places them at even greater risk for later violence than it does for boys. These data could be used in an alcohol, tobacco, and other drug (ATOD) prevention program to provide yet another reason to avoid alcohol and other drugs at this age. Second, our data suggest that the absence of authoritative parenting by mothers is associated with greater violence among girls. Some of the most effective violence intervention programs are those that aim at creating change not only in the child but in the family as well (Molgaard, Spoth, & Redmond, 2000). Our findings support this approach and suggest that teachers should attempt to engage both child and parent in violence prevention. In family studies lessons, the teacher could use this information to open discussion of parenting styles, to identify the risks, and to generate discussion among the students about more constructive ways of responding to the parenting styles of their parents. Through parent-teacher contact, parents should be educated on



how their behaviors may be increasing the risk of violent behavior in their children. Facilitating appropriately responsive and involved mothering may help reduce violence among girls, and facilitating similar parenting by fathers may reduce violence among boys and girls.

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