

## Links between Pubertal Timing, Peer Influences, and Externalizing Behaviors among Urban Students Followed Through Middle School

By: Sarah D. Lynne, Julia A. Graber, [Tracy R. Nichols](#), Jeanne Brooks-Gunn, Gilbert J. Botvin

Lynne, S.D., Graber, J.A., Nichols, T.R., Brooks-Gunn, J. & Botvin, G.J. (2007). Links between pubertal timing, peer influences, and externalizing behaviors among urban students followed through middle school. *Journal of Adolescent Health*, 40(2), 181.e7-181.e13

Made available courtesy of Elsevier: <http://dx.doi.org/10.1016/j.jadohealth.2006.09.008>

\*\*\*© Elsevier. Reprinted with permission. No further reproduction is authorized without written permission from Elsevier. This version of the document is not the version of record. Figures and/or pictures may be missing from this format of the document. \*\*\*

**This is the author's version of a work that was accepted for publication in *Journal of Adolescent Health*. Changes resulting from the publishing process, such as peer review, editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. Changes may have been made to this work since it was submitted for publication. A definitive version was subsequently published in *Journal of Adolescent Health*, Volume 40, Issue 2, (2007) DOI: 10.1016/j.jadohealth.2006.09.008**

### **Abstract:**

#### Purpose

To evaluate underlying mechanisms of the association between early pubertal timing and both aggression and delinquency among a sample of minority males and females from an urban community.

#### Methods

The association between perceived early pubertal maturation and aggressive or delinquent behaviors for African American and Latino males and females (n = 1366) was examined, as well as pathways between early maturation and these negative outcomes longitudinally across 6th, 7th, and 8th grades.

#### Results

Early maturers reported higher mean levels of both aggression and delinquency at all time points regardless of gender or ethnicity. Associating with delinquent peers in 6th grade fully mediated the association between early maturation and both aggression and delinquency at all time points. Early maturers did not differentially associate with greater numbers of delinquent peers in either 7th or 8th grade.

#### Conclusions

These results provide valuable information regarding at-risk groups and inform future intervention efforts.

**Keywords:** Aggression | Delinquency | Delinquent peers | Pubertal timing | Longitudinal | Mediation | Urban | Minority | Middle school | Adolescence

### **Article:**

Both aggression and delinquency escalate during middle school (i.e., 6th-8th grade, approximately ages 11-14) and peak at age 16 for both males and females<sup>[1], [2] and [3]</sup>. To date, several risk factors for aggression and delinquency have been identified. Specifically, recent studies have demonstrated that early pubertal timing (i.e., going through puberty earlier than one's peers) is associated with higher rates of engagement in aggressive and delinquent behaviors<sup>[4], [5], [6], [7], [8] and [9]</sup>. Likewise, association with delinquent peers has been identified as not only a pathway to aggression and delinquency more generally<sup>[2]</sup>, but also as a factor that may potentially mediate the effects of pubertal timing on aggression and delinquency<sup>[5] and [10]</sup>.

Particular individual or demographic characteristics may also influence rates of adolescent delinquency and aggression. Crowded, urban, inner city environments are associated with higher exposure to violent crimes and higher rates of violent, aggressive, and delinquent behaviors<sup>[1] and [11]</sup>. However, ethnic group differences are small, such that African American and Latino adolescents report somewhat higher rates of aggressive and delinquent behaviors than their White same-gender counterparts<sup>[3]</sup>. At the same time, recent studies suggest that female delinquency and overt aggression are on the rise or, at least, that gender differences are narrowing<sup>[12]</sup>. Notably, risk factors associated with the development of aggression and delinquency do not necessarily hold across gender or ethnicity<sup>[1] and [13]</sup>. Therefore, investigation of the role of different risk factors on the development of externalizing behaviors for both genders across different ethnic/racial groups in urban areas is warranted, especially during the middle school years.

Numerous investigations have found early pubertal timing to be a risk for externalizing problems<sup>[2], [4], [5], [7], [9], [14], [15] and [16]</sup>. However, most research has examined non-Hispanic White, middle-class adolescents, with a few exceptions<sup>[4], [5] and [8]</sup>. (An extensive literature has examined the association of early maturation and age of first intercourse in females<sup>[17]</sup>; a similar association has been found among males in a few studies<sup>[18]</sup>.) One study found that early pubertal timing was associated with violent behavior among ethnically-diverse adolescent females from disadvantaged neighborhoods<sup>[8]</sup>. Another found that early pubertal timing was associated with higher rates of externalizing behaviors among African American youth<sup>[5]</sup>. While these studies support an association between early maturation and externalizing problems among minority youth, there is a need for further research with minority males and females from urban communities to clarify this association.

However, the more important question is why or how timing is linked to these problems. One theoretical explanation states that because early maturers look older or more adult-like than their same-age peers, they are likely to be treated differently by peers and adults and may initiate behaviors perceived as typical of older adolescents or engage in such behaviors at an earlier age than their peers<sup>[19]</sup>. Hence, early maturation disrupts social networks with youth associating with peers of comparable physical development rather than age<sup>[20]</sup>. Girls show outwardly physical signs of development at younger ages than do boys. Thus, early maturation may be particularly problematic for girls.

The association between peer delinquency and externalizing behaviors is well established; however, the role of peer delinquency regarding early pubertal timing effects on externalizing behaviors remains unclear. Previous research with girls found that early maturers who associated with older peers reported more engagement in behaviors like alcohol use<sup>[10]</sup>. It is important to note that mediating effects of peer delinquency have not been evaluated.

The present investigation examines the role of delinquent peers in links between pubertal timing and aggression and delinquency in a large, ethnically diverse sample of urban youth who were followed longitudinally over 6th, 7th, and 8th grades. To extend the prior literatures on pubertal timing, externalizing behaviors, and the role of delinquent peers, the present investigation examined three issues. First, we examined whether or not early pubertal maturation conferred risk for aggressive or delinquent behavior among a sample of young, urban males and females. It was hypothesized that early maturers would report significantly higher levels of aggressive and delinquent behaviors compared to on-time and late maturers for both boys and girls. The second aim was to examine whether this association was explained, or mediated, by engagement with delinquent peers. It was hypothesized that delinquent peer involvement would mediate the association between early pubertal timing, aggression, and delinquency. Finally, these effects were examined longitudinally over 6th, 7th, and 8th grades, as this is a period when these behaviors frequently increase among urban youth.

## **Methods**

### *Participants*

The current study used data collected at 6th, 7th, and 8th grades as part of a larger randomized clinical trial designed to expand and test the effectiveness of an already proven drug prevention strategy on violent and aggressive behavior. Only participants in the control condition in 6th grade (N = 2931) were used to avoid contamination with potential intervention effects. At each grade, 1.5-22.8% of students did not sufficiently complete the surveys. The maximum number of students with complete data was used in each of the following analyses. Twenty percent (n = 342) indicated an ethnic affiliation other than African American or Latino. These other subgroups were dropped because the group sizes were too small for meaningful analysis,

resulting in a final sample of 1366 students (see discussion of attrition below). Analyses conducted on the full sample controlling for ethnicity did not differ from the following results.

The mean age for the sample of 1366 youth was 11.68 years (standard deviation [SD] = .50) in the 6th grade (range 9.64-14.00). The sample included slightly more girls (54%) than boys. The majority of the students were African American (62%), with the remainder of the sample consisting of Latinos (38%). Over half of the students came from 2-parent households (55%). Youth were enrolled in public (90%) and parochial (10%) schools. Although a measure of family socioeconomic status (SES) was not available, archival public school records of participating schools showed that the majority (88%) of schools had greater than 65% student eligibility for free or reduced lunch.

### *Procedure*

A passive consent procedure approved by Weill Cornell Medical College's IRB was used to inform parents about the nature of the study and to provide them with an opportunity to disallow their child's participation. A consent form describing the focus of the larger study and the self-report survey was distributed in the schools for students to take home to their parents, as well as mailed directly to students' homes. Students whose parents indicated that they did not want them to participate in the self-report survey did not complete any of the data collection activities.

A multi-ethnic team of three to five data collectors collected the surveys. Carbon monoxide breath samples were collected at 6th, 7th, and 8th grades to enhance the validity of self-report cigarette smoking utilizing a variant of the bogus pipeline procedure<sup>[21]</sup>. Bogus pipeline procedures can also increase the validity of reporting on other problem behaviors<sup>[22]</sup>.

### Measures

#### *Demographic data*

Participants reported their gender (males = 1, females = 0), age, household structure, and ethnicity on the 6th-grade survey. A single dichotomous variable was created to capture household structure, where one indicates living in a two-parent household. Students from single and no-parent households were coded as 0. Another single dichotomous variable was created to capture participants' ethnic affiliation, where 1 represented Latinos and 0 represented African Americans. A single dichotomous variable was created to indicate type of school the adolescent attended (public = 1, parochial = 0).

#### *Early pubertal timing*

This was assessed by a single subjective item, "do you think your development was any earlier, later, or about the same as other [same gender] youth your age?" This item captured individual perceptions of the timing of puberty within the normal variation in the onset/intensity/velocity of pubertal maturation among adolescents in general. Response options were: 1 (early), 2 (on-time),

and 3 (late). This item was part of a longer-term follow-up of the primary study (when youth were in 9th grade). The validity of assessing pubertal timing at a later time point is supported by previous research, which found that subjective measures of pubertal timing most accurately reflected objective measures of pubertal timing as youth progressed through puberty (i.e., in 8th vs. 6th grade)<sup>[23]</sup>. Because this investigation focused on the effects of early maturation only, a single dichotomous variable was created, where 1 represents participants who reported maturing early. All other responses were coded as 0.

#### *Aggression (past month)*

Ten items from the aggression scale of the Youth Self-Report<sup>[24]</sup> were used to assess general aggression in the 6th grade ( $\alpha = .92$ ), 7th grade ( $\alpha = .93$ ), and 8th grade ( $\alpha = .94$ ). Students were asked how many times in the past month they had engaged in each of 10 overtly aggressive behaviors (e.g., cursed at someone; tripped someone on purpose). These items do not specify the location of the aggressive act (e.g., home, school, etc.). Response options were: 1 (never), 2 (once), 3 (2-3 times), 4 (4-5 times), and 5 (more than 5 times). Items were rescored onto a scale of 0-4 and summed to create a continuous measure, where higher scores indicated a greater number of aggressive behaviors in the past month.

#### *Delinquency (past year)*

Students reported how many times in the past year they had engaged in each of 10 delinquent behaviors in 6th grade ( $\alpha = .86$ ), 7th grade ( $\alpha = .87$ ), and 8th grade ( $\alpha = .89$ ). The items were from a commonly used delinquency scale<sup>[25]</sup> that tapped behaviors such as violence, vandalism, and theft (e.g., picked a fight; purposely damaged or destroyed property; taken something from a store). These items represent legal infractions but do not indicate involvement in the court or legal system. Response options were: 1 (never), 2 (once), 3 (2-3 times), 4 (4-5 times), and 5 (more than 5 times). Items were rescored onto a scale of 0-4 and summed to create a continuous measure, where higher scores indicated a greater number of delinquent behaviors in the past year.

#### *Friends' delinquency (past year)*

Students were asked to indicate how many of their friends had engaged in each of seven delinquent behaviors in the past year<sup>[25]</sup> in the 6th grade ( $\alpha = .88$ ), 7th grade ( $\alpha = .91$ ), and 8th grade ( $\alpha = .92$ ). Response options were: 1 (none), 2 (less than half), 3 (about half), 4 (more than half), and 5 (all or almost all). Items were rescored onto a scale of 0-4 and then summed to create a continuous measure, where higher scores indicated associating with more friends who engage in a higher number of delinquent behaviors for each time point.

#### *Attrition analyses*

To test for differences between students in the current study and those who were dropped from any of the following analyses, *t* tests were run on all continuous variables and  $\chi^2$  analyses were run on all background variables from the 6<sup>th</sup> grade data. Students who were dropped from any of the current analyses were more likely to be male ( $\chi^2(1, N = 2917) = 24.64, p < .001$ ; 53% vs. 43%); more likely to attend public school ( $\chi^2(1, N = 2931) = 11.31, p = .001$ ; 91% vs. 87%); and less likely to be early maturers ( $\chi^2(1, N = 1708) = 3.74, p = .030$ ; 25% vs. 29%). The two groups did not differ on ethnicity, family structure, aggression, delinquency, or peer delinquency. Thus, the sample used in the current study had statistically-equivalent baseline rates of all outcome variables as the cross-sectional sample of participants at 6th grade. Therefore, the reduced sample does not introduce bias into the following statistical analyses.

### *Analysis plan*

The association between early pubertal timing and aggressive or delinquent behaviors over time was examined via two 2 (timing) x 2 (gender) x 2 (ethnicity) x 3 (grade) repeated measures ANCOVAs, controlling for family structure, and school type. Grade was the within-subject variable (6th, 7th, & 8th), while gender, ethnicity, and timing were the between-subjects variables. To evaluate the role of delinquent peers, mediating effects were examined for each outcome using a series of regression analyses<sup>[26]</sup> with follow-up Sobel Tests of significance of the mediation.

Initial evaluations of the data suggested that the measures of aggression were roughly univariate normal in all three grades (i.e., all with skewness less than 1 and kurtosis less than 2). The measures of delinquency were slightly skewed (i.e., skewness ranged from 1.73 to 2.65 and kurtosis ranged from 3.29 to 8.79). However, due to the large sample and the robustness of the proposed analyses, even results utilizing the most conservative estimations of the *F*-statistics were identical to uncorrected estimations. Therefore, the slight skewness of the delinquency outcome had no impact on the reliability of the analyses.

## **Results**

### *Descriptive analysis*

Initial analyses checked for pubertal timing group differences on sample characteristics. There were a higher percentage of African Americans (31%) compared to Latinos (26%) who were early maturers. Given that previous research has shown that African American females, and potentially males, tend to mature earlier on average compared to their Latino peers, this discrepancy is not unusual<sup>[27]</sup>. No other differences were found.

Means and SDs for aggression and delinquency at each grade and by timing group are shown in Table 1. Average incidents of aggressive behavior within the past month ranged from 12 to 19 across 6th, 7th, and 8th grades and average acts of delinquency in the past year was 3 in 6th grade, increasing to 6 acts in 7th grade, and just under 7 acts in 8th grade. Correlations among

aggression and delinquency at each time point were strong but decreased slightly over time, with  $r = .71$ ,  $r = .67$ , and  $r = .66$  in 6th, 7th, and 8th grade, respectively.

**Table 1.** Means and SD by pubertal timing for each grade

	6th Grade M (SD)	7th Grade M (SD)	8th Grade M (SD)
Aggression			
Early maturers	13.03 (10.50)	20.83 (11.63)	21.47 (12.46)
On-time/late maturers	11.91 (10.32)	18.77 (12.11)	19.10 (12.45)
Total sample	12.24 (10.38)	19.37 (12.01)	19.79 (12.49)
Delinquency			
Early maturers	3.97 (5.65)	6.57 (6.99)	7.39 (8.15)
On-time/late maturers	3.58 (5.30)	5.94 (7.11)	6.42 (8.06)
Total sample	3.70 (5.40)	6.12 (7.08)	6.70 (8.09)

#### Association of pubertal timing with aggression and delinquency outcomes

##### *Aggression*

Significant main effects of grade  $F(2, 1850) = 17.85, p < .001, \eta = .02$ ; pubertal timing  $F(1, 925) = 6.79, p = .009, \eta = .01$ ; and ethnicity  $F(1, 925) = 10.15, p = .001, \eta = .01$  were found after controlling for family structure and school type. Follow-up Bonferroni corrected pair-wise comparisons revealed that there were significant increases in aggression between 6th, 7th, and 8th grades and that early maturers reported significantly higher levels of aggression compared to on-time/late maturers at each grade (Table 1). African American adolescents ( $M = 18.52$ ) reported higher mean levels of aggression than Latino adolescents ( $M = 16.12$ ) overall. There were no significant interactions among grade, pubertal timing, gender, and ethnicity, and no main effect of gender.

##### *Delinquency*

Significant main effects of grade  $F(2, 1856) = 4.45, p = .012, \eta = .01$ ; pubertal timing  $F(1, 928) = 5.47, p = .020, \eta = .01$ ; and gender  $F(1, 928) = 28.22, p < .001, \eta = .03$  were found after controlling for the demographic variables. Follow-up Bonferroni corrected pair-wise comparisons revealed that there were significant increases in delinquency between 6th, 7th, and 8th grades, and early maturers reported significantly higher levels of delinquency compared to

on-time/late maturers at each grade ( Table 1). Males ( $M = 6.83$ ) reported significantly higher levels of delinquency compared to females ( $M = 4.51$ ) overall. There were no significant interactions among grade, pubertal timing, gender, and ethnicity, and no main effect of ethnicity.

*Role of delinquent peers: mediation effects*

The associations between pubertal timing and the outcomes of interests do not differ by gender or ethnicity, as indicated by the lack of interactions in the previous analyses. Therefore, gender and ethnicity were controlled for along with family structure and school type in subsequent analyses. To test the role of friend delinquency as a mediator, it was first necessary to test whether pubertal timing was significantly associated with friend delinquency. Timing was significantly associated with friend delinquency in the 6th grade  $F(5, 1339) = 5.11, p < .001$ , but not in the 7th or 8th grades, with early maturers reporting more friend delinquency than on-time/late maturers in the 6th grade only ( $M = 4.70$  and  $M = 3.93$ , respectively). Given this, further analyses testing the mediation model were conducted using friend delinquency in the 6th grade as the mediator on all outcomes at all time points.

As indicated previously, a significant association between pubertal timing and both aggression and delinquency was found in the 6th, 7th, and 8th grades. Therefore, the mediation model was tested on both outcomes at each point in time. Gender, ethnicity, family structure, and school type were entered in step 1, while pubertal timing and 6<sup>th</sup>-grade friend delinquency were entered simultaneously in step 2 of the regression equations. In these analyses, only 6th-grade friend delinquency predicted aggression or delinquency in 6th, 7th, and 8th grades (Table 2 and Table 3). All of the previously significant associations between pubertal timing and aggression and delinquency were nonsignificant. Sobel tests were conducted to evaluate the significance of the mediation effects <sup>[26], [28] and [29]</sup>. The resulting  $z$ -statistics for all of the mediation models evaluated ranged from 2.49 to 2.61, all  $p \leq .05$ .

**Table 2.** Mediating effects of 6th-grade friend delinquency on association between early pubertal timing and aggression

	6th Grade				7th Grade				8th Grade			
	<i>B</i>	$\beta$	<i>p</i>	$\Delta R^2$	<i>B</i>	$\beta$	<i>p</i>	$\Delta R^2$	<i>B</i>	$\beta$	<i>p</i>	$\Delta R^2$
Step 1				.04***				.02***				.03***
School type	-.35	-.01	.639		1.44	.04	.181		1.29	.03	.213	
Family structure	-.38	-.02	.404		-.57	-.02	.407		.41	-.01	.616	
Ethnicity	-2.57	-.12	< .001		-2.20	-.09	.003		-3.22	-.05	.016	
Gender	1.27	.06	.005		-.13	-.01	.854		.52	.15	< .001	

Step 2				.33***				.10***				.06***
<i>Pubertal Timing</i>	.21	.01	.674		1.23	.05	.100		1.32	—	.883	
Friend Delinquency (6th)	1.14	.58	< .001		.72	.31	< .001		.59	.57	< .001	
Model <i>R</i> <sup>2</sup>	.37				.12				.09			
Model <i>F</i>	129.83***				24.75***				16.07***			
df	6,1337				6,1110				6,1020			

Note: *B*,  $\beta$ , *p*, *R*<sup>2</sup>, *F*, and df reflect values from the final regression equation. Information in italics represents previously significant association between pubertal timing and aggression completely mediated. \*\*\**p* < .001.

**Table 3.** Mediating effects of 6th-grade friend delinquency on association between early pubertal timing and delinquency

	6th Grade				7th Grade				8th Grade			
	<i>B</i>	$\beta$	<i>p</i>	$\Delta R^2$	<i>B</i>	$\beta$	<i>p</i>	$\Delta R^2$	<i>B</i>	$\beta$	<i>p</i>	$\Delta R^2$
Step 1				.05***				.03***				.03***
School type	.48	.03	.213		.79	.04	.197		1.92	.08	.010	
Family Structure	-.12	-.01	.616		-.08	-.01	.832		-.02	—	.965	
Ethnicity	-.59	-.05	.016		-.47	-.03	.261		-1.16	-.07	.020	
Gender	1.63	.15	< .001		1.80	.13	< .001		1.67	.10	.001	
Step 2				.32***				.14***				.08***
<i>Pubertal Timing</i>	.04	—	.883		.19	.01	.661		.30	.02	.562	
Friend Delinquency (6 <sup>th</sup> )	.59	.57	< .001		.50	.37	< .001		.45	.29	< .001	
Model <i>R</i> <sup>2</sup>	.37				.17				.11			
Model <i>F</i>	129.88***				36.23***				21.40***			
df	6,1338				6,1113				6,1021			

Note: *B*,  $\beta$ , *p*, *R*<sup>2</sup>, *F*, and df reflect values from the final regression equation.

Information in italics represents previously significant association between pubertal timing and delinquency completely mediated. \*\*\* $p < .001$ .

## **Discussion**

The findings from the present investigation provide an important extension of previous findings for middle-class, White youth regarding the association between early pubertal timing and externalizing behaviors in a sample of largely minority, urban males and females. This study moved beyond the demonstration of effects by showing that delinquent peer association early on in adolescence was a pathway between early pubertal timing and externalizing behaviors longitudinally over the middle-school years.

As hypothesized, early maturers reported significantly higher average levels of both delinquency and aggression at all points in time, regardless of gender or ethnicity. While the negative effects of early maturation for White females is well documented in the literature for externalizing symptoms and behaviors<sup>[7], [15] and [30]</sup>, the current study extended these findings to urban minority males and females. Additionally, the effects of early maturation did not differ significantly by gender. Previous research reported that early maturation was associated with adjustment and health in adulthood among males<sup>[31]</sup>. Future research should attempt to replicate this finding by evaluating adjustment outcomes into young adulthood.

The current study moved beyond the demonstration of main effects by investigating the role of delinquent friends as a pathway underlying the association between early pubertal maturation, aggression, and delinquency in adolescence. Prior studies have found that associating with older male peers is related to negative outcomes for early maturing White females compared to other girls<sup>[10]</sup>; however, the delinquent behavior of these peers was not evaluated. One study evaluated neighborhood conditions and parenting factors as moderators of pubertal timing effects on externalizing outcomes controlling for the effects of peer delinquency in a cross-sectional sample of 10-12-year-olds but peer delinquency was not evaluated as a moderator or mediator of pubertal timing effects in this study<sup>[5]</sup>. The current study expanded upon previous findings by being the first to examine the mediating effect of associating with delinquent friends in a large, ethnically diverse, urban sample of both males and females that were followed longitudinally across middle school.

Mediating effects of friend delinquency in the 6th grade were found for aggression and delinquency at all points in time. Differential association with delinquent peers early on appears to place young adolescents on a negative trajectory, which results in higher average levels of problematic outcomes at later points in time compared to their on-time or late maturing counterparts, even if these peers subsequently associate with deviant peers. One previous study of 10-12-year-old African Americans found that early maturers were significantly more likely to affiliate with delinquent peers<sup>[5]</sup>. This age range roughly corresponds with the 6th grade sample

studied here. No other research has examined the association between pubertal timing and friend delinquency in an older sample for these constructs.

Recent studies have linked romantic involvement with delinquent peers and early maturation with problem behaviors and sexual risk among girls in mid and late adolescence<sup>[32] and [33]</sup>. Our investigation demonstrated that delinquent peer involvement is salient to externalizing behaviors at younger ages. Perhaps these early links to externalizing behaviors during middle school establish trajectories for subsequent behavior and relationships.

The current study found the largest increases in rates of aggression and delinquency between 6th and 7th grades. Future research should attempt to elucidate the factors that contribute to this increase at this point in time. Future prevention programs attempting to reduce the rates of these problematic behaviors should ideally begin before the transition into 7th grade, or consider factors salient to this year in school. Note that all youth in the current study were enrolled in middle schools and did not change schools between 6th and 7th grades.

### *Strengths and limitations*

This study is limited in that adolescents were from urban communities only. Thus, findings cannot be generalized to suburban or rural contexts. However, this is also a strength of the study, given the dearth of research on all but suburban middle-class communities. Another limitation is that the measures included in the present study were obtained via a self-report survey format. While steps were taken to increase the validity of these reports, some reporting bias may have occurred. Similarly, the current study used a perceived measure of early pubertal timing collected after puberty would have been completed or in advanced stages for many participants. Perceptions of pubertal timing are most highly correlated with objective measures when assessed after puberty<sup>[23]</sup> and it has been argued that perceptions of pubertal timing may be most relevant when comparing adolescents within diverse racial/ethnic groups<sup>[34]</sup>. Despite this, the limitations associated with this measure of pubertal timing are noteworthy and replication of these results with an objective measure of timing would be prudent. Recent research that has examined aggression in adolescence has distinguished between overt forms of aggression (e.g., fighting) and relational forms of aggression (e.g., rumor spreading)<sup>[35] and [36]</sup>. Moreover, other types of aggression (e.g., relational) may be more common among girls<sup>[37]</sup>. This study is limited in that we are unable to evaluate relational aggression as the larger prevention study did not include this information. In addition, we were unable to disentangle peer delinquency from age or gender in this study. Hence we were unable to determine if the delinquent peers were also older and male. Finally, the amount of variance explained in this study is low to moderate, indicating that future studies should evaluate other potential mediators of the association between early pubertal timing and externalizing outcomes. This includes evaluations of specific skill deficits such as communication, assertiveness, and decision-making skills, as well as aspects of the early childhood environment such as family cohesion, presence of nonbiological adult males in the home, and other stressful life events.

## *Implications*

This study indicated that early maturation was a risk factor for aggressive and delinquent behaviors among both males and females from urban communities. Early maturation placed individuals on a negative trajectory early on, resulting in higher levels of problematic behaviors in later years; this was attributable to affiliation with delinquent friends in the 6th grade. By targeting prevention efforts to focus on developing nondelinquent peer friendships early on, it may be possible to attenuate some of the negative outcomes associated with early maturation in later years. The practical significance of even a slight reduction in rates of aggression and delinquency among adolescents would prove to be of great value socially. Further investigation of the specific risks, skill deficits, or social contexts that place early maturers at risk is warranted to better inform, parents, practitioners, and prevention programming.

## **References**

- [1] Coie JD, Dodge KA. Aggression and antisocial behavior. In: Damon W, Eisenberg N (eds). *Handbook of Child Psychology*, vol. 3. Social, Emotional, and Personality Development, 5th edition. New York: John Wiley & Sons, 1998:779 – 862.
- [2] Moffitt TE, Caspi A, Rutter M, et al. *Sex Differences in Antisocial Behavior: Conduct Disorder, Delinquency, and Violence in the Dunedin Longitudinal Study*. New York: Cambridge University Press, 2001.
- [3] Centers for Disease Control and Prevention. *Surveillance Summaries*. YRBS 2004.
- [4] Cota-Robles S, Neiss M, Rowe DC. The role of puberty in violent and nonviolent delinquency among Anglo American, Mexican American, and African American boys. *J Adolesc Res* 2002;17:364 –7.
- [5] Ge X, Brody GH, Conger RD, et al. Contextual amplification of pubertal transition effects on delinquent peer affiliation and externalizing behavior among African American children. *Develop Psychol* 2002;38:42–54.
- [6] Ge X, Conger RD, Elder GH. Pubertal transition, stressful life events, and the emergence of gender differences in adolescent depressive symptoms. *Develop Psychol* 2001;37:404 –17.
- [7] Graber JA, Lewinsohn PM, Seeley JR, et al. Is psychopathology associated with the timing of pubertal development? *J Am Acad Child Adolesc Psychiatry* 1997;36:1768 –76.
- [8] Obeidallah D, Brennan RT, Brooks-Gunn J, et al. Links between pubertal timing and neighborhood contexts: Implications for girls' violent behavior. *J Am Acad Child Adolesc Psychiatry* 2004;43: 1460 – 8.

- [9] Williams JM, Dunlop LC. Pubertal timing and self-reported delinquency among male adolescents. *J Adolesc* 1999;22:157–71.
- [10] Stattin H, Magnusson D. *Paths Through Life*, vol. 2. Pubertal Maturation in Female Development. Hillsdale, New Jersey: Erlbaum, 1990.
- [11] Farrington DP. Conduct disorder, aggression, and delinquency. In: Lerner RM, Steinberg L (eds). *Handbook of Adolescent Psychology*, 2nd edition. 2004:627– 64.
- [12] Odgers CL, Moretti MM. Aggressive and antisocial girls: Research update and challenges. *Int J Forensic Mental Health* 2002;1:103–19.
- [13] Nichols TR, Graber JA, Brooks-Gunn J, et al. Sex differences in overt aggression and delinquency among urban minority middle school students. *J Appl Develop Psychol* 2006;27:78–91.
- [14] Andersson T, Magnusson D. Biological maturation in adolescence and the development of drinking habits and alcohol abuse among young males: A prospective longitudinal study. *J Youth Adolesc* 1990;19:33– 41.
- [15] Graber JA, Seeley JR, Brooks-Gunn J, et al. Is pubertal timing associated with psychopathology in young adulthood? *J Am Acad Child Adolesc Psychiatry* 2004;43:718 –26.
- [16] Lanza ST, Collins LM. Pubertal timing and the onset of substance use in females during early adolescence. *Prev Sci* 2002;3:69 – 82.
- [17] Ellis BJ. Timing of pubertal maturation in girls: An integrated life history approach. *Psychol Bull* 2004;130:920 –58.
- [18] Crockett LJ, Bingham R, Chopak JS, et al. Timing of first intercourse: The role of social control, social learning, and problem behavior. *J Youth Adolesc* 1996;25:89 –111.
- [19] Brooks-Gunn J, Petersen AC, Eichorn D. The study of maturational timing effects in adolescence. *J Youth Adolesc* 1985;14:149 – 61.
- [20] Silbereisen RK, Petersen AC, Albrecht HT, et al. Maturational timing and the development of problem behavior: Longitudinal studies in adolescence. *J Early Adolesc* 1989;9:247– 68.
- [21] Evans RI, Hansen WB, Mittlemark MB. Increasing the validity of self-reports of smoking behavior in children. *J Appl Psychol* 1977; 62:521–3.
- [22] Tourangeau R, Smith TW, Rasinski KA. Motivation to report sensitive behaviors on surveys: Evidence from a bogus pipeline experiment. *J Appl Soc Psychol* 1997;27:209 –22.
- [23] Dubas JS, Graber JA, Petersen AC. A longitudinal investigation of adolescents' changing perceptions of pubertal timing. *Develop Psychol* 1991;27:580 – 6.

- [24] Achenbach TM, Edelbrock CS. Manual for the Teacher's Report Form and Teacher Version of the Child Behavior Profile. Burlington, University of Vermont, 1986.
- [25] Elliot D, Huizinga D, Menard S. Multiple Problem Youth: Delinquency, Substance Use, and Mental Health Problems. New York: Springer-Verlag, 1989.
- [26] Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* 1986;51:1173–81.
- [27] Herman-Giddens ME, Slora EJ, Wasserman RC, et al. Secondary sexual characteristics and menses in young girls seen in office practice: A study of pediatric research in office settings network. *Pediatrics* 1997;99:505–12.
- [28] Preacher KJ, Leonardelli GJ. Calculation for the Sobel Test: An interactive calculation tool for mediation tests. Available at: <http://www.unc.edu/~preacher/sobel/sobel.htm>. Accessed March 10, 2006.
- [29] MacKinnon DP, Lockwood CM, Hoffman JM, et al. A comparison of methods to test mediation and other intervening variable effects. *Psychol Meth* 2002;7:83–104.
- [30] Hayward C (ed). *Gender Differences at Puberty*. New York: Cambridge University Press, 2003.
- [31] Huddleston J, Ge X. Boys at puberty: Psychosocial implications. In: Hayward C (ed). *Gender Differences at Puberty*. New York: Cambridge University Press, 2003:113–34.
- [32] Cavanagh SE. The sexual debut of girls in early adolescence: The intersection of race, pubertal timing, and friendship group characteristics. *J Res Adolesc* 2004;14:285–312.
- [33] Young AM, d'Arcy H. Older boyfriends of adolescent girls: The cause or a sign of the problem? *J Adolesc Health* 2005;36:410–9.
- [34] Obeidallah D, Brennan RT, Brooks-Gunn J, et al. Socioeconomic status, race, and girls' pubertal maturation: Results from the project on human development in Chicago neighborhoods. *J Res Adolesc* 2000;10:443–64.
- [35] Crick NR. Engagement in gender normative versus nonnormative forms of aggression: Links to social-psychological adjustment. *Develop Psychol* 1997;33:610–7.
- [36] Crick NR, Grotpeter JK. Relational aggression, gender, and socialpsychological adjustment. *Child Develop* 1995;66:710–22.
- [37] Underwood MK. *Social Aggression Among Girls*. New York: Guilford Press, 2003.