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Puberty and the Education of Girls*

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Abstract

This study extends previous research on the social psychological implications of pubertal timing to education by applying a life course framework to data from the National Longitudinal Study of Adolescent Health and from the Adolescent Health and Academic Achievement Study. Early pubertal timing, which has previously been associated with major social psychological changes in girls' lives during middle school, predicted girls' grade point average and probability of course failure at the start of high school. Because of this initial failure during the high school transition, it also predicted their probability of dropping out of high school, and, among those who graduated, their grade point average at the end of high school. Such research demonstrates one way in which the immediate social psychological risk of early pubertal timing, measured as the age at menarche, translates into long-term disadvantage for girls, thereby opening up new avenues of research for social psychologists interested in youth development, health, and education.

Puberty is a physiological event that profoundly transforms the human body. Yet, the significance of this event extends far beyond the physiological or biological into the social and psychological domains of the early life course (Stattin and Magnusson 1990). Consequently, puberty, especially its timing, is of interest to sociologists and psychologists who study adolescence (Brooks-Gunn, Peterson, and Eichorn 1985; Cavanagh 2004; Ge, Conger, and Elder 1996; Graber et al. 1997; Haynie 2003; Martin 1996). In short, this research demonstrates that how and when young people, especially girls, undergo puberty shapes their sense of self as well as their social relationships. This rich literature on the social psychological risks of puberty can and should be extended to include a careful consideration of how these immediate risks translate into long-term consequences for girls' lives. One approach to this "translation" is to investigate how these risks influence girls' pathways through major institutions of society, such as the educational system. In other words, do alterations in psychological well-being and social context during the pubertal transition direct girls' lives long after by influencing their navigation of high school?

In this study, we use the educational data recently added to the National Longitudinal Study of Adolescent Health (Add Health) to explore the connection between the pubertal transition, measured as the age at menarche, and girls' pathways into and through high school. Such research is directly relevant to three prominent areas of sociological social psychology: 1) life course research focused on the connection between the intimate aspects of individual development and larger, institutional pathways as well as on the long-term implications of discrete developmental transitions, 2) interactionist research focused on the specific mechanisms by which changes to the self translate into institutional risks and benefits, and 3) educational research focused on the ways in which school performance is as much a function of social and psychological experiences as cognitive ability.

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The general goal of this study, then, is to examine whether girls who transition to puberty earlier than their peers are likely to get a bad start in high school, entailing cumulative disadvantages for girls long after puberty (and even adolescence) is completed. Specifically, we expect that the social and psychological risks associated with early puberty will disrupt girls' academic performance in 9th grade and, through this disruption, lead to higher rates of dropout and, for those who graduate, lower rates of academic achievement by the end of high school.

BACKGROUND

The Significance of Early Pubertal Timing

This study grows out of the extensive literature on the social psychological consequences of the pubertal transition and its timing during the early life course. Puberty is one of the few universals in early development. It is a time of qualitative change in the body, and, because of the social values attached to the body, especially the female body, it also entails many other, non-physical changes in life. Although less public than breast or hip development, menarche is the primary event around which girls organize and assimilate the myriad changes that occur during puberty (Koff, Rierdan, and Silverstone 1978; Lee 1994; Martin 1996). This event signals reproductive capacity, elicits new expectations from others, and reorganizes their self-image, ushering in a more sexualized image of the self (Graber and Sontag 2006; Martin 1996). Menarche is typically the moment when adults, parents especially, begin talking to girls about sex and the dangers of sex (Martin 1995). In other words, menarche marks the time when girls “become inserted and insert themselves into the dominant pattern of sexuality” (Lee 1994: 346). For these reasons, menarche defines the pubertal transition for girls. Moreover, this transition is a *life course transition*—a physical change that also redefines social roles and brings about new expectations and obligations (Elder 1998).

According to the life course perspective, the significance of a life course transition is dependent on its timing. The consequences of the pubertal transition, then, depend on when it occurs. Indeed, ample evidence has documented that early transitions, measured as menarche before age 12, have implications for girls' lives (Caspi et al. 1993; Cavanagh 2004; Haynie 2003; Ge et al. 1996; Graber et al. 1997; Stattin and Magnusson 1990). Specifically, early pubertal timing has three main social psychological consequences in adolescence.

First, early pubertal timing affects girls' perceptions of self. By virtue of their earlier transition to adolescence, early maturing girls are more likely to be physically out-of-step (i.e., greater breast development and curviness) with agemates at a developmental moment when both the body and social comparison increase in significance. Thus, early maturing girls maintain a negative self-appraisal, and this, in turn, can heighten their risk for psychological distress and depression (Ge et al. 1996; Graber and Sontag 2006).

Second, early pubertal timing is linked with girls' peer relationships. Because early maturing girls and their peers attribute greater maturity to them than is warranted by their age, early maturing girls are more likely to select and/or be drawn into less normative friendship groups, ones that include older boys and girls and are characterized by riskier behavior and lower academic achievement (Cavanagh 2004; Haynie 2003).

Finally, as a consequence of its effects on girls' psychological well-being and relationships with peers, early pubertal timing is associated with higher levels of problem behaviors, such as drinking, smoking, and sexual activity. That is, early maturing girls are more likely to be embedded in social contexts that offer them opportunities to engage in riskier behaviors. Because these girls had less time to integrate the coping skills needed to manage the new tasks in adolescence, they negotiate these opportunities often without the socio-emotional resources they need to make healthier choices (Cavanagh 2004; Haynie 2003; Jessor and Jessor 1979).

Two additional factors are worth noting. To the extent that researchers have recorded both hormone readings and self-reports of physical development for girls, the risks associated with early puberty timing do not appear to be a function of hormones driving both girls' pubertal timing and behavior (Udry 1988; Udry, Talbert, and Morris 1986). Rather, these risks come about through the social psychological interpretation of this transition. Second, the risks associated with early puberty do not occur as soon as menarche begins, at age 11, for instance. Rather, risks emerge as adolescent girls are granted more autonomy and independence from parents, establish more intense and intimate peer relationships, and explore both platonic and romantic relationships with boys. In other words, the disruptive social psychological consequences of early puberty become most pronounced between 8th through 10th grades (Stattin and Magnusson 1990).

Early Pubertal Timing and Girls' Academic Careers

Past evidence, therefore, confirms that early pubertal timing is a major developmental disruption for girls. Yet, its effect on social psychological functioning in early adolescence is not the end of the story. Just because the disruption goes away does not mean that its consequences do. Because this period of disruption overlaps with an important institutional transition—the transition to high school—early pubertal timing can impact girls' lives long after the physical markers that indicate advanced development have faded.

In this study, we consider how the long-term consequences of early puberty play out academically, across the high school years. This focus is motivated by two common themes in the adolescent literature. First, self-perceptions and peer associations are the two main conduits by which early puberty affects well-being. The former are crucial to how young people, especially girls, function in school, and the latter are typically embedded in school contexts (Correll 2001; Crosnoe 2000). Second, high school is the foundation for subsequent stages of the life course, affecting the likelihood and timing of college enrollment, marriage, childbearing, income security, good health, and mortality (Kingston et al. 2003; Kerckhoff 1993). Bringing these themes together, the school is a setting for the social psychological disruption of early puberty and a vehicle through which this disruption has long term consequences. By assessing how early puberty affects schooling outcomes, we demonstrate how physical maturation, not just intellectual maturation, influences academic progress in ways that may ultimately have as much or even greater impact on post-adolescent life than many of the risk behaviors typically studied in relation to the timing of this biological transition.

The first goal of this study is to investigate whether early maturing girls have a more difficult transition into high school. We expect this to occur precisely because the social psychological risks of early puberty described above are also academically consequential. Specifically, early maturing girls are more depressed, overestimate their maturity, engage in riskier behavior, and have older, male-dominated peer groups that engage in non-normative behaviors than other girls (Cavanagh 2004; Graber et al. 1997; Haynie 2003). These social psychological consequences of early puberty, in turn, are powerful distractions to girls' academic achievement.

Beginning with depression, internalizing problems such as depression or anxiety are a long-acknowledged influence on school achievement (Roeser, Eccles, and Strobel 1998; Feshbach and Feshbach 1987). For instance, depressed youth tend to receive lower grades and perform lower on standardized tests. This comes about, in part, because these youth have more difficulty concentrating in school and are more likely to skip classes and, when they do attend, engage in avoidance behaviors that keep them from fully engaging in the learning process (Roeser et al. 1998).

The normative change in self-concept towards a more adult-oriented perspective, although not necessarily a negative psychological development in all instances, can be detrimental to academic achievement when it occurs at too early a stage, resulting in adolescents rejecting conventional notions of school and parental authority (Billy et al. 1988). A hallmark of middle adolescence is a declining interest in school and in doing well in school. This trend appears to be a reflection of adolescents' need to reject—at least nominally—many conventional goals and rules as well as their growing dissatisfaction with obvious signs of conformity (Eccles et al. 1993; Johnson, Crosnoe, and Thaden 2006). In some sense, premature self-perceptions of maturity and being “all grown up” might facilitate this trend among girls, encouraging them to downplay academic pursuits as they are entering high school, a period with incredible power to direct subsequent high school trajectories.

The inverse association between risky behavior and academic achievement is well-known (Jensen 1976; Maguin and Loeber 1986; Monk-Turner 1989). Although young people who engage in delinquency and other behaviors have already disengaged from school to some degree, their delinquency is typically followed by subsequent academic decline (Crosnoe 2002). Furthermore, risky behavior is most common in male-dominated groups. To the extent that early-maturing girls are pulled into such groups, their exposure to academic risks is higher (McCarthy, Felmlee, and Hagan 2004).

Finally, along the same lines, peer groups dominated by older boys and girls have normative systems more detrimental to academic pursuits. For example, such groups exacerbate social pressures that engender depression (Joyner and Udry 2000). Groups dominated by older boys and girls also increase opportunities for early sexual activity (Cavanagh 2004). Although sexual activity clearly has negative academic consequences for girls when it results in pregnancy, it also predicts lower school performance and expectations for college among girls even in the absence of pregnancy (Billy et al. 1988). Moreover, such peer groups hasten the trend in academic disengagement described earlier at a critical period for establishing academic credentials. Thus, early puberty tends to select girls into peer contexts that are less conducive to long-term academic progress.

Ample evidence documents that depression, adult-like self-concepts, and certain risky peer associations distract from academic pursuits. Consequently, we expect that early maturing girls will have lower grades and more course failures when they enter into high school in 9th grade.

The second goal of this study is to assess whether early maturing girls have a more difficult transition throughout high school. Educational careers are cumulative, with earlier experiences—good or bad—often presaging later performance (Entwisle and Alexander 1999). If students struggle with courses early in high school, they may have difficulty meeting prerequisites and mastering the curriculum later in high school, become discouraged and invest less effort in school, and receive less attention and encouragement from teachers and counselors who have identified them as poor students. Thus, given early maturing girls' greater likelihood of academic problems in 9th grade, we expect that they will be more likely to drop out of school before graduating and, if they persist to graduation, that they will earn lower grades.

Together, these two aims capture how the pubertal transition may affect the high school transition, one that lays the foundation for the transition into young adulthood and beyond. In this way, this paper pieces together a chain of events in which a temporary developmental disruption can have cascading effects in girls' lives.

METHODS

Source of Data

The data for this study came from Add Health, a nationally representative sample of adolescents who were in grades 7–12 in 1995, and the Adolescent Health and Academic Achievement (AHAA) transcript study. Add Health used a multistage, stratified, school-based sampling design (see Bearman, Jones, and Udry 1997). For each school, Add Health collected an in-school survey from every student (approximately 90,000 young people) who attended on the day of administration. About one year later, Add Health selected a nationally representative sample from this pool, plus other students listed on the school roster, to participate in in-home interviews. A random sample of about 200 students from each school pair—a high school and its feeder middle school—was selected and then supplemented with targeted oversamples to produce the sample of 20,745 adolescents for the Wave I In-Home Interview, administered between April and December 1995. Additional in-home interviews were conducted between April and September 1996 (Wave II) and between August 2001 and April 2002 (Wave III). Approximately 74% of the original Wave I sample participated in Wave III.

The AHAA transcript study links these Add Health data to equally rich educational data (Muller 2005). All Wave III respondents were asked to complete a high school Transcript Release Form that authorized study personnel to collect transcripts from the last school they attended. Approximately 91% of the Add Health Wave III respondents signed a Transcript Release Form and had transcript data collected. These data provide official grades as well as indicators of course-taking patterns at the student-level and school-level that can be linked to the general Add Health survey data.

Analytical Sample

Four selection criteria resulted in the analytical sample for this study. To begin, the sample was restricted to girls who completed the Wave I interview ($N = 10,480$) and then to those who also completed the Wave III survey ($N = 8,005$). Next, we kept only those girls whose high school transcripts were collected at Wave III ($N = 6,430$). Finally, the sample included only girls who had valid sampling weights,¹ leaving 4,653 girls for whom longitudinal interview and transcript data were collected.

Obviously, this analytical sample is smaller than the full Wave I sample. The important question is whether the exclusions that led to this subsample introduced bias. To examine this possibility, we performed t -tests comparing key variables in the Wave I sample of girls to the analytical sample. The results indicate that these selection filters did introduce some attrition bias (results available upon request). Although there is no difference in the proportion of sample members who were early maturing, the analytical sample included girls with higher self-reported grade point averages (GPAs) and higher Picture Vocabulary Test scores (PVTs). These girls were more likely to live in two-biological parent families marked by higher levels of parental education.

The girls in the analytical sample, then, were less likely to be academically at risk in 9th grade or the end of high school, which means that estimates of the negative effects of pubertal timing on academic achievement are conservative. These biases must be kept in mind when interpreting results, although they are arguably offset by the many benefits of Add Health and AHAA, such as the large sample size and longitudinal educational data.

¹About 1,800 adolescents in the Wave I sample did not have sampling weights because they were either picked up in the field or did not have a sample flag. They are excluded from the analytic sample.

Measures

Student performance was identified with data collected from official high school transcripts (Riegle-Crumb et al. 2005). Overall grade point average (GPA) in both 9th and 12th grade was the average of all courses for which a student got a grade (0 = F; 1 = D; 2 = C; 3 = B; 4 = A). A separate binary indicator measured whether a student failed any course in 9th grade. An additional binary indicator was drawn from the Wave III in-home survey to capture graduation status. Respondents who completed less than 12 years of school, were not currently enrolled in high school at Wave III, and did not have a GED at Wave III were considered high school dropouts. Another important performance indicator, math course-taking in 9th grade, was created to be a covariate. Controlling for math course-taking allowed us to account for girls' general academic track. A ten-point scale measured math location in 9th grade, where 0 = no math, 1 = basic/remedial math, 2 = general/applied math, 3 = pre-algebra, 4 = algebra, 5 = geometry, 6 = algebra II, 7 = advanced math, 8 = pre-calculus and trigonometry, and 9 = calculus.

Self-reported age at menarche, measured in whole years at Wave I, served as a proxy for early pubertal timing. Although this event typically occurs later in the pubertal process, age at menarche, unlike more public displays of pubertal development such as breast development or general physical curviness, is a fixed event anchored in time, not a gradual set of body changes that emerge over time. As such, young women themselves use this event to organize the full set of pubertal changes. Moreover, the properties of this indicator allow for the determination of relative pubertal timing in a sample of girls between the ages of 12–18. Early maturing girls who reached menarche before age 12 accounted for 26% of sample, the balance, on-time and later maturing girls, reached menarche at or after age 12.

Three individual controls were measured at Wave I: self-reported age, race/ethnicity (dummy variables for Latina, non-Latina Black, non-Latina White, Asian, and other), and cognitive ability (score on the Add Health Picture Vocabulary Test or PVT, a computerized, abridged version of the Peabody Picture Vocabulary Test). A squared version of this PVT score was also included to account for the curvilinear relationship between cognitive ability and risk behaviors (Halpern et al. 2000).

We also measured three family controls: family structure (dummy variables for two biological parent family, single parent family, stepparent family, and other family forms), number of teenaged sisters, and parents' educational attainment. We controlled for the number of older sisters because we expect that girls can make important connections to older friends through older sisters, who are more likely to share intimate details about boys and sex and be more meaningful role models (Hogan and Kitagawa 1985). Parents' educational attainment was based on youth reports of the highest number of years of schooling completed by parent(s). Responses were recoded into four dummy variables: college graduation or more, some post high school education, a high school graduation or GED (reference category), or less than high school graduation. Those who did not know their parents' level of education were included in the reference category, with a binary variable indicating missing data included in the analysis (Astone and McLanahan 1991).

RESULTS

Overview of Early Puberty and Girls' Academic Careers

Table 2 presents the mean differences in key study variables by pubertal timing status. At the beginning of high school, early maturing girls had lower overall GPAs and were more likely to have failed a course. Although these outcomes are related, with course failures reflected in the overall GPA, students' GPAs can mask course failure. Moreover, course failure has direct

consequences for girls' course-taking in the following school year (i.e., they may have to retake the course), as well as the number of accrued credits needed for graduation. Thus, examining both outcomes provides a fuller picture of girls' academic standing in 9th grade.

Early maturing girls were also much less likely to graduate from high school. Moreover, even those early maturing girls who did graduate reported significantly lower grades by the end of high school. Together, these analyses suggest that pubertal timing was associated with girls' academic careers at the start of high school in ways that carried through to the end of high school. The following analyses explored these associations in a multivariate context.

Early Puberty and Girls' Performance at the Start of High School

Does early puberty affect the transition to high school? Table 3 contains results from models that answer this question. Model 1 regressed overall GPA in 9th grade on pubertal timing, girls' academic status in math in 9th grade, and individual and family characteristics. Early maturing girls had lower GPAs than other girls, net of their location in the academic curriculum and other key factors. This difference, however, was only marginally significant ($p < .07$). Beyond this focal association between pubertal timing and GPA, girls in more advanced math courses, Asians, Whites, those in two-biological parent families, and those with more educated parents earned better grades in 9th grade than other girls.

The results of Model 2 in Table 3, which estimated the likelihood of course failure in 9th grade using the same set of independent variables and covariates, were similar. Early maturing girls were more likely to fail a course net of other key factors, and this coefficient was statistically significant at conventional levels. Specifically, early maturing girls experienced a 34% increase in the odds of course failure in 9th grade, even after accounting for other predictors of academic performance (e.g., location in the math sequence, race/ethnicity, family structure, and parent education).

Early Puberty and Girls' Performance at the End of High School

Does the academic disadvantage associated with early pubertal timing in 9th grade extend to the end of high school, and, if so, is this cumulative disadvantage a function of their academic status in 9th grade? Tables 4a and 4b present results that address these questions. For each academic outcome, two models were estimated. The first established the direct link between early pubertal timing and academic risk at the end of high school. The second included our indicator of 9th grade course failure in order to determine the extent to which early failure explained any observed links between early puberty and girls' end-of-school outcomes.

Early maturing girls were more likely to drop out of high school before graduating (see Table 4a). The association, however, narrowly missed statistical significance at conventional levels ($p < 0.06$). Model 2 included an indicator of 9th grade course failure. Although this measure was associated with the likelihood of dropping out, it had little effect on the size of the coefficient associated with pubertal timing. Among those who graduated, early maturing girls had lower cumulative GPAs by the end of their high school careers (see Table 4b), net of their level of math course-taking in 9th grade and other key factors. Comparing the results of Model 1 to those of Model 2 indicated that the inclusion of the measure of course failure in 9th grade attenuated the observed associations between early pubertal timing and cumulative GPA. This attenuation indicates that academic failure at the beginning of high school helped to explain early maturing girls' lower academic success at the end of high school.

CONCLUSION

With this study, we sought to extend a popular area of inquiry among developmental psychologists in psychology and social psychologists in sociology: research on the consequences of the timing of puberty. Drawing on the life course perspective as well as a new, unique data source, we tracked the academic pathways of early maturing girls through high school. We found that girls who went through puberty early (typically in late elementary school or at the start of middle school) had more difficult transitions into high school and, because of this disrupted transition, more problematic journeys through high school. The findings of this study naturally lead to questions about why this happens, why this matters, and what can be done. The answers to these three questions can, in turn, be found in the three areas of sociological social psychology mentioned in the introduction.

Why this happens can be addressed by researchers working from an interactionist perspective, those exploring how young people come together to create their own micro-cultures and, in the process, develop their sense of self. These social psychologists (e.g., Martin 1996) have done a good deal to illuminate the ways in which the non-physiological dimensions of puberty rival the physiological ones in shaping girls' lives, and they can now extend their inquiry to a new question: why does pubertal timing affect schooling? Earlier, we put forward four mechanisms by which this effect may come to be: depression, prematurely adult self-concepts, risky behavior, and problematic peer group associations. These hypothesized mechanisms need to be tested. One way to do so is to triangulate the rich behavioral, peer network, and school-level data in Add Health. Because of the differences in the timing of Add Health and Adolescent Health and Academic Achievement study, this can only be done for a small subset of the sample (e.g., the 1454 7th and 8th graders in Wave I), but that would at least be a good start. Another way is through intensive, qualitative interviews with girls that can enhance our theoretical understanding of what puberty is and how it is experienced specifically in relation to academic status, not just in relation to the usual suspects (e.g., sex).

Next, why this matters can be addressed by life-course researchers, who tend to be interested in the connection between the different trajectories of human development and their larger institutional and structural contexts. Building on past work demonstrating how girls' pubertal transition represents the interlocking biological, psychological, and social trajectories of the life course (Cavanagh 2004; Ge et al. 1996), this study has added institutional trajectories to the tapestry. In short, the social psychological circumstances of a biological event disrupt an institutional transition. The critical nature of this transition raises the possibility that this relatively short-lived experience will have long-term consequences on socioeconomic attainment, family formation, and health. These potential consequences of early puberty—through truncated educational trajectories—need to be documented, with a special eye towards variability by race and class. Life-course social psychologists, with their interest in linking life stages, connecting transitions to trajectories, and assessing contextual variability (Elder 1998), can take up this challenge. In doing so, they can determine whether the disruption of early pubertal timing is merely an adolescent phase or, as this study suggests, an event with power to affect the life course long after adolescence has concluded.

As for the question of what should be done, social psychologists of education have a prominent role to play. These researchers are most interested in how social interaction and psychological development add to or counteract cognitive abilities in determining academic progress, usually with the intent of informing policy intervention (Correll 2001). The potential applications of this research take the form of large-scale school redesign and smaller-scale group intervention. First, some evidence indicates that the social psychological consequences of early puberty that we have hypothesized to be academically disruptive can be blunted by limiting girls' exposure to older adolescents and, especially, to boys (Caspi et al. 1993). This pattern seems to lend

credence to movements advocating junior highs and/or single-sex public schools; in other words, this separation keeps pubescent girls away from potentially damaging messages, influences, and opportunities until they have transitioned into the secondary school curriculum. Importantly, these movements also have critics who point out some of the dangers and pitfalls of these school designs. Educational researchers, then, need to accrue sound empirical evidence about the pros and cons of such designs and make recommendations based on it. Reflecting the intimacy of the phenomenon, this policy approach should be coupled with more micro-level action. For example, some in-school programs—e.g., sports teams, media clubs, leadership classes (Kearney 2006)—aim to foster the psychological well-being of girls. They could be important during this vulnerable time, but, again, we need scientific evidence to move forward.

Such future research that could come out of this preliminary study has the potential to make a difference in girls' lives. It will do so by identifying, unpacking, and addressing a vulnerability that, although dismissed by adults as simply part of growing up, as a phase can effectively derail girls' futures if not taken seriously. Tying together theory, empirical analyses, and policy action in this way embodies what public sociology is all about.

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Table 1Descriptive Statistics for Study Variables ($N = 4,653$)

	Percent	Mean	SE
<i>Outcomes</i>			
Start of high school measures			
Overall GPA	—	2.71	(0.04)
Any course failure	22.93		
End of high school measures			
Overall GPA	—	2.93	(0.03)
High school dropout	9.56	—	—
<i>Individual characteristics</i>			
Early pubertal timing	26.31	—	—
Race and ethnicity			
White	68.21	—	—
African American	15.72	—	—
Latina	11.06	—	—
Asian	1.11	—	—
Other	3.51	—	—
Age	—	15.46	(0.11)
Picture Vocabulary Test (PVT) score	—	101.29	(0.63)
Missing PVT score	4.44	—	—
<i>Family characteristics</i>			
Family structure at Wave I			
Two-biological parent families	57.88	—	—
Stepparent family	15.89	—	—
Single parent family	22.15	—	—
Other parent family	4.08	—	—
Number of older sisters in home	18.96	—	—
Parents' educational attainment		—	—
Less than high school education	11.81	—	—
High school education	30.41	—	—
Some college education	19.68	—	—
College graduation or more	35.13	—	—
Missing education	4.97	—	—

Table 2

Comparison of Girls by Pubertal Timing

	On-Time or Later Maturing Girls (N = 3367)		Early Maturing Girls (N = 1286)	
	Percent	M	Percent	M
<i>Outcomes</i>				
Start of high school measures				
Overall GPA	—	2.74	(0.04)**	2.61 (0.05)
Any course failure	21.7	—	**	27.6 —
End of high school measures				
Overall GPA		2.98	(0.03)**	2.84 (0.04)
High school dropout	8.7	—	—*	—
<i>Individual characteristics</i>				
Race and ethnicity				
White	69.7	—	—	—
African American	14.7	—	—	—
Latina	10.4	—	—	—
Asian	0.9	—	—	—
Other	3.8	—	—	—
Age		15.51	(0.12)	15.35 (0.12)
Picture Vocabulary Test (PVT) score		101.45	(0.66)	100.85 (0.77)
Missing PVT score	4.9	—	—	—
<i>Family characteristics</i>				
Family structure at Wave I				
Two-biological parent families	59.4	—	—	—
Stepparent family	15.3	—	—	—
Single parent family	21.3	—	—	—
Other parent family	4.0	—	—	—
Number of older sisters in home	20.1	—	—	—
Parents' educational attainment				
Less than high school education	11.3	—	—	—

	On-Time or Later Maturing Girls (N = 3367)		Early Maturing Girls (N = 1286)		SE
	Percent	M	Percent	M	
High school education	29.8	—	32.0	—	—
Some college education	18.5		20.1		
College graduation or more	36.3		29.5		
Missing education	4.1	—	5.1		

* $p < 0.01$;
 ** $p < 0.05$;
 *** $p < 0.001$.

Table 3

Regression Estimates of Academic Experiences at the Start of High School

	Overall GPA in 9th Grade		Any Failures in 9th Grade		Odds Ratio
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	
Early pubertal timing	-0.07 [†]	(0.04)	0.29 ^{**}	(0.16)	1.34
Location in math sequence in 9th grade	0.18 ^{***}	(0.02)	-0.25 ^{***}	(0.04)	0.78
<i>Individual characteristics</i>					
Race and ethnicity					
African American	-0.26 ^{***}	(0.07)	0.45 [*]	(0.29)	1.56
Latina	-0.13 [*]	(0.06)	0.42 [*]	(0.28)	1.52
Asian	0.38 ^{***}	(0.10)	-0.69 [†]	(0.20)	0.50
Other	-0.33 [*]	(0.14)	1.10 [*]	(1.48)	3.00
Age	-0.03 [*]	(0.01)	0.04	(0.05)	1.04
Picture Vocabulary Test (PVT) score	0.01	(0.02)	0.01	(0.05)	1.01
PVT squared	0.00	(0.00)	0.00	(0.00)	1.00
Missing PVT score	0.06	(0.08)	0.22	(0.30)	1.25
<i>Family characteristics</i>					
Family structure at Wave I					
Stepparent family	-0.11 ^{**}	(0.04)	0.38 ^{**}	(0.18)	1.46
Single parent family	-0.17 ^{***}	(0.05)	0.42 ^{**}	(0.23)	1.52
Other parent family	-0.09	(0.07)	0.17	(0.33)	1.18
Number of older sisters in home	0.01	(0.03)	0.10	(0.10)	1.11
Parents' educational attainment					
Less than high school education	-0.09	(0.07)	0.38 [*]	(0.21)	1.46
Some college education	0.11 [*]	(0.04)	-0.02	(0.14)	0.98
College graduation or more	0.29 ^{***}	(0.04)	-0.50 ^{***}	(0.08)	0.61
Missing education	0.08	(0.10)	0.44	(0.43)	1.56
Intercept	1.40	(0.86)			

	Overall GPA in 9th Grade		Any Failures in 9th Grade		<i>Odds Ratio</i>
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>	
R-squared	0.31		—		
−2 log likelihood	—		−2183.2		
<i>N</i>	4600		4625		

[†] $p < .07$;
* $p < .05$;
** $p < 0.01$;
*** $p < 0.001$.

Table 4a

Estimates of Academic Status at the End of High School

High School Drop Out						
	Model 1			Model 2		
	<i>b</i>	<i>SE</i>	<i>Odds Ratio</i>	<i>b</i>	<i>SE</i>	<i>Odds Ratio</i>
Early pubertal timing	0.22 [†]	(0.21)	1.25	0.22	(0.20)	1.24
Math sequence in 9th grade	−0.29 ^{***}	(0.05)	0.75	−0.25 ^{***}	(0.05)	0.78
Any failure in 9th grade	—	—	—	1.49 ^{***}	(0.59)	4.43
<i>Individual characteristics</i>						
Race and ethnicity						
African American	−0.65 [*]	(0.14)	0.52	−0.84 ^{***}	(0.11)	0.43
Latina	−0.30	(0.17)	0.74	−0.42 [*]	(0.15)	0.66
Asian	−0.71	(0.27)	0.49	−0.45 [†]	(0.31)	0.64
Other	−0.21	(0.37)	0.81	−0.56	(0.26)	0.57
Age	−0.04	(0.06)	0.96	−0.07	(0.05)	0.93
Picture Vocabulary Test (PVT) score	−0.07	(0.05)	0.93	−0.08 [*]	(0.05)	0.92
PVT squared	0.00	(0.00)	1.00	0.00	(0.00)	1.00
Missing PVT score	0.00	(0.39)	1.00	−0.08	(0.35)	0.92
<i>Family characteristics</i>						
Family structure at Wave I						
Stepparent family	0.66 ^{**}	(0.41)	1.94	0.59 [*]	(0.44)	1.81
Single parent family	2.77 [*]	(0.32)	15.90	0.38	(0.30)	1.46
Other parent family	1.10 ^{***}	(0.93)	3.01	1.11 ^{***}	(1.01)	3.04
Number of older sisters	0.29 [*]	(0.20)	1.34	0.29 [*]	(0.20)	1.34
Parents' educational attainment						
Less than high school	0.69 ^{***}	(0.37)	2.00	0.60 ^{**}	(0.38)	1.83
Some college education	−0.19	(0.17)	0.83	−0.17	(0.17)	0.84
College graduation or more	−1.24 ^{***}	(0.08)	0.29	−1.17 ^{***}	(0.09)	0.31

High School Drop Out					
	Model 1			Model 2	
	<i>b</i>	<i>SE</i>	<i>Odds Ratio</i>	<i>b</i>	<i>SE</i>
Missing education	0.45	(0.52)	1.57	0.39	(0.53)
Intercept					
–2 log likelihood	–1183			–1101	
<i>N</i>	4607			4607	

[†] $p < .06$;
* $p < .05$;
** $p < 0.01$;
*** $p < 0.001$.

Table 4b

Estimates of Academic Status at the End of High School (n = 4029)

	Overall GPA at End of High School Among Graduates			
	Model 1		Model 2	
	<i>b</i>	<i>SE</i>	<i>b</i>	<i>SE</i>
Early pubertal timing	−0.07*	(0.03)	−0.05	(0.03)
Math sequence in 9th grade	0.14***	(0.02)	0.13***	(0.02)
Any failure in 9th grade	—	—	−0.49***	(0.05)
<i>Individual characteristics</i>				
Race and ethnicity				
African American	−0.29***	(0.05)	−0.26***	(0.05)
Latina	−0.21***	(0.07)	−0.19**	(0.06)
Asian	0.03	(0.07)	−0.01	(0.06)
Other	−0.37*	(0.15)	−0.28*	(0.14)
Age	−0.04***	(0.01)	−0.04***	(0.01)
Picture Vocabulary Test (PVT) score	0.01	(0.02)	0.00	(0.01)
PVT squared	0.00	(0.00)	0.00	(0.00)
Missing PVT score	0.15	(0.08)	0.16*	(0.08)
<i>Family characteristics</i>				
Family structure at Wave I				
Stepparent family	−0.09*	(0.04)	−0.06	(0.04)
Single parent family	−0.20***	(0.04)	−0.17***	(0.04)
Other parent family	−0.03	(0.08)	−0.04	(0.08)
Number of older sisters	0.01	(0.04)	0.02	(0.04)
Parents' educational attainment				
Less than high school	−0.07	(0.05)	−0.03	(0.06)
Some college education	−0.05	(0.04)	0.06	(0.03)
College graduation or more	0.19***	(0.04)	0.18***	(0.04)
Missing education	0.02	(0.11)	0.07	(0.08)
Intercept	2.08	(0.85)	2.72	(0.78)
R-squared	0.24		0.28	
<i>N</i>	4029		4029	

†
 $p < .06$;*
 $p < .05$;**
 $p < 0.01$;***
 $p < 0.001$.