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Early Menarcheal Age and Risk for Later Depressive Symptomatology: The Role of Childhood Depressive Symptoms

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Abstract

Previous research has investigated the relationship between pubertal timing and depression in girls, with most results suggesting that earlier menarche predicts more depression in adolescence. However, few studies have controlled for the potentially confounding effects of childhood depressive symptoms. The current study uses a prospective, longitudinal sample of 1,185 girls (47.8 % Caucasian) to examine the relationships between pubertal timing, childhood depressive symptoms, and adolescent depressive symptomatology. Using multiple linear regression analyses, our results suggest that higher levels of childhood depressive symptoms and earlier menarche have independent effects on adolescent depressive symptoms. Surprisingly, childhood depressive symptomatology predicted *later* age of menarche, although the magnitude of this effect was small. Taken together, the results suggest that early childhood depressive symptoms and early menarche represent independent pathways to later depressive symptoms.

Keywords

Childhood depression; Puberty; Pubertal timing; Early menarche

Introduction

Much recent work on adolescence has focused on the role of puberty in negative behavioral outcomes, highlighting the impact of early puberty in girls, as opposed to typical or late timing (Brooks-Gunn et al. 1985; Caspi and Moffitt 1991). The majority of this work has looked at heightened risk for internalizing disorders, especially depression (Conley and Rudolph 2009; Ge et al. 2001; Huerta and Brizuela-Gamino 2002; Joinson et al. 2011). Previous research has shown that girls who experience earlier pubertal development, including earlier development of breasts and onset of menarche, are more likely to experience depressive symptomatology following puberty than those girls who mature typically (Angold et al. 1998). The literature is unclear on the duration of this effect, however, as some recent work suggests that the association may dissipate within a few years following the end of puberty (Copeland et al. 2010). Regardless, investigating the effect of puberty on psychological functioning is important especially considering the fact that adolescence has been noted as a time when emotional disturbances are most likely to materialize (Angold et al. 1999; Kovacs and Devlin 1998; Spear 2000).

The sequence of biological events during puberty is well-established (Rosenfield et al. 2008). The release of gonadotropin releasing hormone (GnRH) is triggered in the

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hypothalamus, which then leads to a cascade of further hormones, including leutinizing hormone (LH), follicle-stimulating hormone (FSH), estradiol (an estrogen hormone) and testosterone. The hormonal processes that initiate puberty occur an average of 5 years before menarche, and previous research has demonstrated that secondary sex characteristics such as breast and testicular development, the major overt signs of pubertal development, typically do not emerge until approximately 2–3 years after the initial release of pubertal hormones (Marshall and Tanner 1969; Styne 2004).

Previous research has demonstrated that the development of puberty varies widely among adolescents (Styne and Grumbach 2002). Variations in physical factors such as body mass index (BMI; Kaplowitz et al. 2001) and birth weight (Delemarrevan de Wall et al. 2002; Koziel and Jankowska 2002) have been shown to affect pubertal timing, as have genetic influences (i.e., early pubertal timing in relatives; Garn and Bailey 1978) and environmental factors (Bogaert 2008; Ellis and Garber 2000; Toppari and Juul 2010). Despite the wide variation in pubertal timing, however, a recent review of the literature on pubertal timing and psychological disorders suggests that researchers tend to use similar criteria when defining “early” puberty (Negriff and Susman 2011). For studies using self-reported age of menarche as a predictor variable, early menarche in girls typically has been defined as either menarche that occurs prior to age 11 or menarche occurring one standard deviation below the sample’s average age of menarche.

As noted above, the majority of research on the negative consequences of pubertal timing has suggested that earlier puberty leads to worse outcomes, at least in the short-term. In their 2006 review, however, Angold and Costello note that much of the research investigating the effects of early puberty on depression has suffered from small sample sizes and other methodological flaws. One primary flaw has been a failure to consider the role of childhood depressive symptoms in the puberty-adolescent depression relationship. This is particularly problematic considering previous research that has established that depressive symptoms are one of the most robust predictors of later depression (Costello et al. 2003; Klein et al. 2009; Luby et al. 2009). Childhood depressive symptoms could influence the association between pubertal timing and adolescent depression in a number of ways, including: (a) childhood depressive symptoms may be a third variable that predicts both early pubertal timing and later depressive symptoms; (b) childhood depressive symptoms may predict early menarche, which in turn predicts later depressive symptoms (in other words, pubertal timing may mediate the association between early and later depressive symptoms); (c) childhood depressive symptoms and early pubertal timing may each have unique and independent effects on the emergence of later depressive symptoms, and (d) early depressive symptoms and early pubertal timing may interact (e.g., girls with both may be at even greater risk for later depressive symptoms than other girls). Investigating each of these models may clarify confusion regarding how depressive symptoms and pubertal timing are related.

We are aware of only two studies that have considered the role of early depression in the relationship of pubertal timing to adolescent depression (Ge et al. 2001, 2003). Ge et al. (2001) assessed adolescents annually for 6 years, starting when the adolescents were in 7th grade, and then used the 7th grade assessment of depressive symptoms as a measure of childhood depression, controlling for this factor in their analyses of the affect of pubertal timing on adolescent depression. The authors reported an interaction between age at menarche and 7th grade depressive symptoms. Specifically, girls who had both higher levels of depressive symptomatology in grade 7 and an earlier age of menarche were likely to have higher levels of depressive symptoms in adolescence than other girls.

Ge et al. (2003) conducted a similar study with 896 African-American children who were assessed at ages 11 and 13. Depressive symptoms at age 11 were used to assess prepubertal

depression in examining the association of pubertal timing on later depressive symptoms. In contrast to their earlier study, the authors found that age 11 depression and early puberty had independent effects on later depressive symptoms. However, in both studies, although "prepubertal" depression in girls was measured prior to menarche, it did not precede the onset of pubertal development. Indeed, the mean developmental level of participants in Ge et al. (2003) was a 2.0 on the Pubertal Development Schedule (PDS), meaning that most of the sample already had started showing visible signs of puberty. Similarly, Ge et al. (2001) reported that the late maturing girls had a mean score of 2.1 on the PDS, and the early maturing girls had a mean score of 3.1 on the PDS (indicating that growth of breasts and body hair has definitely begun) at the time of the initial assessment.

To our knowledge, only one study has assessed the relationship between early depression and pubertal timing. Graber et al. (1995) found that girls who reported higher levels of depressive affect, as assessed by the Withdrawn/Depressed subscale of the youth self-report (YSR; Achenbach and Edelbrock 1986), prior to menarche were more likely to experience early menarche than girls with lower levels of depressive affect. However, this effect was qualified by an interaction with level of parental approval, such that only girls with both high levels of depressive affect *and* low levels of parental approval had earlier ages of menarche. Again, the average age at first assessment was 12.0 years, and the mean Tanner rating of breast development at that time was 2.0, indicating that depression was assessed after the process of pubertal maturation had already begun. Further research is needed to assess the relationship between truly prepubertal depressive symptoms and pubertal timing.

Childhood depressive symptoms are also important to investigate due to their association with stressful life events. As noted above, previous research has provided evidence that early psychosocial and environmental factors may impact the timing of puberty (Walvoord 2010), and past studies have found associations between pubertal timing and maternal conflict, parental marital unhappiness (Kim et al. 1996), low socioeconomic status (SES), physical and sexual abuse (Romans et al. 2003), father absence, stepfather presence (Ellis and Garber 2000), and harsh negative parenting behaviors (Belsky et al. 2007). Depressed children are typically exposed to greater stress than their non-depressed counterparts (Hammen 2002; Luby et al. 2006), and it may be that stressful life events impact early puberty via an increase in depressive symptomatology. Indeed, while earlier puberty may promote later depressive symptoms, early depressive symptoms may be promoting earlier puberty.

The Current Study

The current study investigates the relationships between childhood depressive symptoms, pubertal timing, and postpubertal depressive symptoms in females using a large, nationally representative sample followed longitudinally from birth to late adolescence. We used assessments of early depressive symptoms that were conducted at least 5 years prior to menarche in order to ensure that the symptoms were truly prepubertal. Additionally, assessments of postpubertal depressive symptoms generally were conducted within the 2 years following menarche, which is important in light of recent evidence that the effects of early puberty on adolescent depression may be time-limited (Copeland et al. 2010). We tentatively hypothesized that age of menarche and childhood depressive symptoms will each have an independent effect on adolescent depressive symptoms, with earlier age of menarche and increased childhood depressive symptoms each predicting higher levels of adolescent depressive symptoms. However, we also examined the third variable, mediation and moderation hypotheses outlined above.

Method

Participants

The National Longitudinal Survey of Youth (NLSY79) is a large-scale, longitudinal study with an original sample of 12,686 American men and women. Data have been gathered regarding employment, education, health, and family experiences since 1979 (for a more complete description of the NLSY79, see Center for Human Resource Research 2005). Starting in 1986, investigators began collecting data on children who were born to women involved in the original NLSY79 cohort (known as the NLSY79 Child and Young Adult sample). Demographic, developmental, behavioral and emotional data were collected biennially from 11,469 children of NLSY79 mothers, as well as from their mothers. To date, 12 waves of data have been collected (Center for Human Resource Research 2009).

The present study utilizes data collected in the first 11 waves of the NLSY79 Child and Young Adult sample (1986–2006). 11,469 individuals were in the original data-set. Because we were interested in the effects of depressive symptoms on age of menarche, only female participants were included (48.9 % of the original sample; $N = 5,611$). Participants who had provided data on childhood *and* adolescent measures of depression, as well as age of menarche, at one or more waves were included in the analyses: 45.8 % of the female sample reported on either child or adolescent depressive symptoms, and 24.2 % of the female sample reported age of menarche. Due to our requirements that childhood depressive symptoms were assessed at least 5 years before menarche and that postpubertal depressive symptoms were assessed following menarche (mean lag of 1.23 years after menarche), much of the sample did not have depression data for both timepoints. This reduced the sample to 1428 girls. To control for non-independence of observations, if there were multiple girls from the same family in the NLSY79 database, one was randomly selected. The final dataset included 1185 girls; the racial/ethnic composition of this group was 31.3 % African-American/Black, 20.8 % Hispanic, and 47.8 % Non-Hispanic/Non-African-American/Black. Mothers of the girls in this sample had a mean of 13.01 years of education (SD = 3.74), and were approximately 26.14 years old at the birth of their child (SD = 3.09). Families were assessed for an average of 4.26 waves (SD = 1.11) over a period of 14 years (26.1 % completed only 2–3 waves, 24.7 % completed 4 waves, 38.9 % completed 5 waves, and 10.3 % completed 6 waves). The average income of our sample was $44,449; this information was averaged across waves, however, and may not account for changes in the rate of inflation from 1986 to 2006. Means, standard deviations, and *t* tests comparing participants to non-participants can be found in Table 2. Participants who were included in the current sample differed from those who were not included in the following ways: they completed significantly more assessments, mothers were significantly older at the birth of their child and were significantly more educated; participants in the current sample also had significantly higher family incomes, and there were significantly more Hispanic and Black participants in the current sample. As can be seen in Table 1 although these differences between the participant and non-participant groups are statistically significant, most are small in magnitude.

Measures

Childhood and Postpubertal Depressive Symptoms—Given the episodic nature of depressive symptomatology, if more than one childhood or postpubertal depression score was available for a given participant, the highest score was used. The same measure was employed for the childhood and postpubertal assessments.

Mothers were asked to rate problematic behaviors their children exhibited in the past 3 months using the Behavior Problems Index (BPI; Zill and Peterson 1986), which consists of

items from the Achenbach Behavior Problems Checklist (Achenbach and Edelbrock 1983) as well as from other rating scales (Graham and Rutter 1968; Kellam et al. 1975; Rutter et al. 1970). The BPI is divided into several subscales, including anxiousness/depression, antisocial behavior, hyperactivity, and immaturity. For the purposes of this study, seven questions relating specifically to depressive symptoms were culled from the anxiousness/depression subscale: "My child feels worthless or inferior," "My child is withdrawn," "My child is unhappy/sad/depressed," "My child has sudden changes in mood/feelings," "My child has difficulty concentrating," "My child has difficulty getting his/her mind off things," and "My child cries too much." Parents of the NLS79 children were asked to indicate how often their children experienced these symptoms on a 1–3 scale (1 = often true, 2 = sometimes true, 3 = never true), and scores were then reversed so that higher scores indicated more depressive symptoms. For childhood depressive symptoms, M = 9.21, SD = 2.01, range = 1–19, average age of childhood assessment = 5.39 years old, SD = 1.07, range = 3–9. For postpubertal depressive symptoms, M = 9.72, SD = 2.31, range = 4–21, average age of postpubertal assessment = 13.07 years old, SD = .97, range = 9–14. Alpha was calculated separately for each wave and ranged from .61 to.72 [N = 175–967]; median = .68 [N = 560]). The increase in depressive symptoms between the childhood and postpubertal assessments was statistically significant, $t(1184) = -6.94$, $p < .001$.

Age of Menarche—At each biennial assessment, mothers were asked to report whether their daughter had started to have her menstrual period, and if so, at what age her periods began. Although adolescents were also asked when they experienced menarche, maternal reports of age of menarche were used for this investigation, as adolescents were only asked about menarche if they had not yet begun menstruating by age 14, at which point all of the sample had already begun (M = 11.84, SD = .89). .3 % of the sample reached menarche at age 9, 5.6 % at age 10, 27.3 % at age 11, 45.0 % at age 12, 20.0 % at age 13, and 1.9 % at age 14.

Childhood Weight—Maternal reports of the child's weight were collected at each wave of the original study. For the purposes of the current study, the highest childhood weight reported in assessments conducted five or more years prior to menarche was used in all analyses (M = 44.43 lbs, SD = 10.44, range = 20–134 lbs, average age of childhood weight assessment = 5.26 years).

Race/Ethnicity—Race/ethnicity of the participants was based on their mother's report in the original NLS79 assessment. Participants were categorized as Hispanic, Black, or non-Hispanic/non-Black.

Procedure

Mothers and children were interviewed biennially by specially trained field staff; prior to 2000, the majority of the interviews took place in the families' homes, and in later years, most interviews were conducted over the telephone.

Results

We used multiple linear regression analysis in order to examine the associations between childhood depressive symptoms, age of menarche, and postpubertal depressive symptoms. We also used multiple linear regression analyses to examine the unique impact of childhood depressive symptoms on age of menarche, while controlling for race and childhood weight, as these variables have been previously shown to influence age of menarche (Butts and Seifer 2010; Freedman et al. 2002; Kaplowitz et al. 2001; Kaplowitz 2008). We tested all

two- and three-way interactions, and significant interactions were included in the final model (Aiken and West 1991).

Table 2 shows bivariate correlations along with proportions/means (standard deviations) for race, childhood weight, childhood and postpubertal depressive symptoms, age at childhood and postpubertal depressive symptom assessment, and age of menarche. As expected, childhood depressive symptoms and postpubertal depressive symptoms were significantly positively correlated, and age of menarche and postpubertal depressive symptoms were significantly negatively correlated. There was also a small, but significant association between childhood depressive symptoms and age of menarche. Surprisingly, however, greater childhood depressive symptoms predicted a later age of menarche. Similarly, the relationship between childhood weight and age of menarche was significant, but in the unexpected direction, with greater childhood weight predicting later age of menarche. Finally, Black (vs. Caucasian or Hispanic) race was significantly positively correlated with childhood weight and childhood depressive symptoms, and significantly negatively correlated with age of menarche; Hispanic (vs. Caucasian or Black) race was also negatively correlated with age of menarche.

First, we examined the unique impact of childhood depressive symptoms on age of menarche (see Table 3). After controlling for race, childhood weight, and age of childhood assessment, childhood depressive symptoms significantly predicted age of menarche, B = .03, SE = .01, $t(1173) = 2.37$, $p < .05$, with higher levels of depressive symptoms predicting later menarche. There were no significant two-way interactions between any predictor variables.

We next determined the unique associations of childhood depressive symptoms and age of menarche on post-pubertal depressive symptoms, controlling for race, childhood weight, and age at childhood and postpubertal assessment (see Table 4). Both childhood depressive symptoms and age of menarche independently predicted later depressive symptoms, such that higher levels of childhood depressive symptoms (B = .38, SE = .03, $t(1171) = 11.88$, $p < .001$) and earlier menarche (B = −.37, SE = .09, $t(1171) = -3.88$, $p < .001$) were each associated with higher levels of postpubertal depressive symptoms. The interaction between childhood depressive symptoms and age of menarche was not significant.

Discussion

The current study used a large longitudinal database to examine the relationship between childhood depressive symptoms, age of menarche, and postpubertal depressive symptoms in a nationally-representative sample of girls. While many previous studies have investigated the impact of pubertal timing on psychological outcomes, especially depression, few have considered the role of childhood depressive symptoms in predicting age of menarche and later depressive symptomatology. This study is the first to assess depressive symptoms prior to the onset of pubertal development and to investigate the impact of these early depressive symptoms on age of menarche and postpubertal depressive symptomatology.

We considered a number of potential relationships between the study variables. First, we tested an additive model in which early depressive symptoms and early pubertal timing have unique effects on postpubertal depressive symptoms. Second, we considered a third variable model, wherein childhood depressive symptoms predict both early pubertal timing and postpubertal depressive symptoms. Third, we considered a mediation model, wherein childhood depressive symptoms predict early menarche, which in turn predicts an increase in postpubertal depressive symptoms. Finally, we tested a moderation model, wherein early depressive symptoms and early puberty interact to predict postpubertal depressive

symptoms. Consistent with an independent effects model, we found that greater childhood depressive symptoms and earlier age of menarche each had small but significant unique effects on levels of postpubertal depressive symptoms. These findings are inconsistent with the third variable and mediation models, and in our test of the moderation model the interaction of child depressive symptoms and age of menarche on postpubertal depressive symptoms did not approach statistical significance.

We also examined the relationship between childhood depressive symptoms and age of menarche, and found that higher levels of depressive symptoms predicted a *later* age of menarche. This finding is also inconsistent with the third variable and mediation models, and is contrary to the results of the only prior study addressing this issue (Graber et al. 1995). Although the magnitude of the effect was quite small and therefore should be interpreted cautiously, it is worth considering possible explanations for this unexpected finding. As noted above, Graber et al. reported that the association between depressive affect and an earlier age of menarche was moderated by perceived family approval, reflecting the fact that girls with both high levels of depressive affect *and* low levels of perceived approval had the earliest age of menarche. It is possible that the inconsistent findings could be due to differences in the nature and level of parental approval in this sample. Graber et al.'s sample was drawn from middle- to upper-class families in an urban Northeastern area, and most participants attended private school. Thus, it is conceivable that the standards for achievement and the concern regarding parental disappointment were greater than in the present sample. Additionally, in the Graber et al. sample, the "intermediate" age of menarche (13.56 years old) was almost 2 full standard deviations above our sample's average age of menarche (11.89 years old). Thus, "early menarche" in Graber et al.'s affluent, mostly Caucasian sample, may reflect different processes than early menarche in more representative samples (Anderson and Must 2005).

Our findings are consistent with previous research suggesting that depressive symptoms in youth are predictive of later depression (Costello et al. 2003; Klein et al. 2009; Luby et al. 2009). It is important to note that childhood depressive symptoms in our sample was measured at a mean age of 5 years old, which is long before depressive symptoms traditionally have been thought to emerge. Our results therefore support previous findings from a small but growing literature on the continuity between depressive symptoms in early childhood and later childhood/adolescent depression (Luby et al. 2009). Previous research has found that some of the risk factors for later depressive symptomatology, including difficult temperament and lifetime maternal depression, also are associated with depressive symptoms in children as young as age 18 months of age (Cote et al. 2009). Assessing early childhood depressive symptomatology, therefore, may be useful in identifying children who will experience later, possibly more severe, depression, and intervening early to minimize long-term morbidity.

It is puzzling that childhood depressive symptoms were associated with both later puberty and depressive symptoms, but earlier puberty was associated with later depressive symptoms. While these effects were quite small, some insight into the findings may be found in the literature on extreme and chronic stress. There is evidence suggesting that depression in early childhood is associated with high levels of acute and chronic stress (Luby et al. 2006). Stress-suppression (Cameron 1997; MacDonald 1999) and energetics (Ellison 2001) theories propose that extreme and chronic stressors result in diminished availability of resources and cause animals to delay pubertal development until the environment is more agreeable. These theories are supported by evidence that inadequate nourishment (Bosch et al. 2008), war-time psychological trauma (Prebeg and Bralic 2000; Tahirović 1998), and low socioeconomic status (for a review, see Ellis 2004) all are associated significantly with later ages of menarche. Research from the animal literature

provides evidence for a potential mechanism of action, as exposure to stress has been shown to suppress the release of GnRH in rats (Dobson et al. 2003); GnRH, in turn, is necessary for the initiation of puberty (Plant and Barker-Gibb 2004). Therefore, early depressive symptoms may be but one of the many consequences of extreme and/or chronic stress, all of which contribute to a later age of menarche, as well as a predictor of later depressive symptoms. Given the small magnitude of these effects, however, further research is needed to investigate possible explanations for these results.

The current study had a number of strengths. First, we measured depressive symptoms at least 5 years prior to the onset of menarche, hence probably before the onset of the earliest stages of pubertal development. As noted above, most previous studies of the relationship between early puberty and later depression have not addressed the role of early depressive symptoms, and the few that have did not assess childhood depressive symptoms prior to the onset of puberty, but rather, before the onset of menarche, which occurs, on average, 5 years after the beginning of pubertal development. We also assessed postpubertal depressive symptoms in early adolescence, which is important given evidence that the effects of early menarche on later depressive symptoms may dissipate within several years (Copeland et al. 2010). Finally, we assessed childhood depressive symptoms prospectively, and used a large, nationally-representative sample to increase the generalizability of the findings.

Despite its strengths, the current study also had several weaknesses. First, pubertal development was based solely on age of menarche, rather than using alternative measures such as the PDS or Tanner scales. Although we conservatively approximated onset of puberty by looking at assessments measured at least 5 years before menarche, we could not take individual variations in pubertal tempo into account. Similarly, measurement of stress and pubertal hormones (such as cortisol, estradiol, and testosterone) may shed additional light on the relationship between depression and puberty, especially considering existing research implicating endocrine dysfunction in depression (Goodyer et al. 1998; Goodyer et al. 2003; Juruena et al. 2009; Young et al. 2000). Second, the main variables of interest in this study, depressive symptoms and age of menarche, were collected from maternal reports rather than self-reports or semi-structured interviews. Previous research has suggested that children under the age of 8 are often *unreliable* reporters of their symptoms (Edelbrock et al. 1985), which necessitated the use of maternal reports of depressive symptoms for our childhood assessment. By age 13, however, using both maternal and child reports may have provided more accurate measures of child depressive symptoms. Unfortunately, postpubertal self-reports of depressive symptoms were not available for the entire sample, while maternal reports were. Third, as discussed above, assessment of life stressors during the pre- and midpubertal years may have helped clarify the relationship between depressive symptoms and pubertal timing. Finally, there were a number of statistically significant demographic differences between the study sample and the original sample. Given that the magnitude of these differences were relatively small, however, this is unlikely to have had a substantial influence on the results. While it is important to note these limitations, many of them will provide valuable starting points for further research in this area.

In sum, the results of the current study suggest that there are multiple pathways to postpubertal depressive symptoms in adolescent females, including childhood depressive symptoms and earlier pubertal timing. These findings add to our understanding of the relationship between pubertal timing and depression, as this study confirms that the effect of early puberty on later depression in girls cannot be explained by childhood depression. Future research should be conducted to further unpack these relationships, especially investigating the role of prepubertal stress on adolescent depression, and how this effect could be mediated by pubertal timing. By obtaining a more thorough understanding of the risk factors for adolescent depression, intervention efforts could be targeted to more

vulnerable populations, thereby reducing the negative impact of depression during this high risk developmental period.

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Table 1

Means and standard deviations of demographic variables for participants and non-participants

Variable	Participants	Non-participants	*t*
Race (percentage non-black, non-Hispanic)	47.8	54.5	3.98***
Total number of assessments	4.26 (1.11)	2.13 (1.87)	−33.37***
Maternal highest level of education	13.01 (3.74)	12.65 (4.09)	2.52*
Maternal age at birth of child	26.14 (3.09)	24.91 (6.32)	−5.78***
Family income	$44,499 (39,213)	$39,938 (52,925)	−2.38*

* $p < .05$,

*** $p < .001$

Table 2

Bivariate correlations among major study variables

Variable	1	2	3	4	5	6	7	8
Black (vs. Caucasian or Hispanic) race		−	.06*	.09**	−.12***	−.13***	−.02	−.06*
Hispanic (vs. Caucasian or Black) race			−.04	−.001	−.05	−.06*	.01	−.02
Childhood weight				−.05	.21***	.35***	−.03	.14***
Childhood depressive symptoms					.00	.06*	.32***	−.07*
Age at childhood assessment						.46***	−.05	.22***
Age of menarche onset							−.14***	.50***
Postpubertal depressive symptoms								−.71
Age at postpubertal assessment								
N/Mean	371	247	44.43	9.21	5.39	11.84	9.72	13.07
%/SD	31.3 %	20.8 %	10.44	2.01	1.07	.88	2.30	.97

* $p < .05$,

** $p < .01$,

*** $p < .001$

Table 3

Betas, standard errors, and standardized coefficients for regression model predicting age of menarche

	B	SE	β
Step 1			
Childhood weight	.02	.002	.27***
Black race (vs. Caucasian)	−.21	.05	−.11***
Hispanic race (vs. Caucasian)	−.16	.06	−.07***
Age at childhood assessment	.31	.02	.38***
Step 2			
Childhood depressive symptoms	.03	.01	.06*

R^2 = .28 for Step 1 (p <.001); ΔR^2 = .003 for Step 2 (p <.05).

* p <.05,

*** p <.001

Table 4

Betas, standard errors, and standardized coefficients for regression model predicting postpubertal depressive symptoms

	B	SE	β
Step 1			
Childhood weight	−.01	.01	−.01
Black race (vs. Caucasian)	−.18	.16	−.04
Hispanic race (vs. Caucasian)	−.06	.17	−.01
Age at childhood assessment	−.04	.07	−.02
Age at postpubertal assessment	−.40	.07	−.17***
Step 2			
Childhood depressive symptoms	.38	.03	.33***
Age of menarche onset	−.37	.09	−.14***

R^2 = .17 for Step 1 (p <.001); ΔR^2 = .20 for Step 2 (p <.001).

*** p <.001