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Pubertal Timing, Peer Victimization, and Body Esteem Differentially Predict Depressive Symptoms in African American and Caucasian Girls

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Abstract

This study prospectively examined pubertal timing and peer victimization as interactive predictors of depressive symptoms in a racially diverse community sample of adolescents. We also expanded on past research by assessing body esteem as a mechanism by which pubertal timing and peer victimization confer risk for depression. In all, 218 adolescents (53.4% female, 49.3% African American, 50.7% Caucasian) completed both a baseline assessment and a follow-up assessment approximately 8 months later. Early maturing Caucasian girls and late maturing African American girls experienced the greatest increases in depressive symptoms at follow-up if they experienced higher levels of peer victimization between baseline and follow-up. Furthermore, body esteem significantly mediated the relationship between pubertal timing, peer victimization, and depressive symptoms for girls of both races. The interaction of pubertal timing and peer victimization did not predict depressive symptoms for boys of either race. These results support body esteem as a mechanism that contributes to increased depression among girls in adolescence—despite a differential impact of pubertal timing for Caucasian and African American girls.

Keywords

depression; puberty/pubertal development; bullying; cross-ethnic; body image

Depression is poised to become an increasingly serious problem as the average age of first onset steadily decreases across age cohorts (Kessler et al., 2003). Depression onset at an early age increases the likelihood that an individual will have chronic episodes of depression over his or her lifetime; each successive episode increases the probability of recurrence of the disorder (Costello et al., 2002). After puberty, the prevalence of depression rises substantially and girls become much more likely to be depressed than boys (Hankin & Abramson, 2001; Hankin et al., 1998). Pubertal timing, the stage of pubertal maturation

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when compared with same-age peers, has emerged as an important vulnerability factor that may help explain why girls begin to develop higher rates of depression.

Theoretical Models of the Relationship Between Pubertal Timing and Depression

According to the stage termination model (Benoit, Lacourse, & Claes, 2013), children who physically mature earlier than normative may not have gained enough cognitive or emotional maturity to successfully navigate the psychosocial consequences of pubertal maturation. The stage termination model predicts that early maturing boys and early maturing girls will be more distressed than either on-time or late maturing children of either sex. There has been significant support for the stage termination model as earlier pubertal timing has been shown to predict increased symptoms of depression for both girls and boys (e.g., Ge, Conger, & Elder, 2001; Mendle, Harden, Brooks-Gunn, & Graber, 2010; Natsuaki et al., 2009). Additional studies of girls demonstrated that early maturers had higher levels of depressive symptoms than on-time or late maturers (Graber, Brooks-Gunn, & Warren, 2006; Joinson, Heron, Lewis, Croudace, & Araya, 2011).

In contrast, the maturational disparity or deviance model (Ge & Natsuaki, 2009) proposes that children who mature “off-time” (i.e., either earlier or later than their same-sex peers) will experience poor psychosocial adjustment. Off-time maturers may feel isolated from their peers and may be teased or victimized more often (Mendle, Turkheimer, & Emery, 2007). According to the deviance model, we would expect early and late maturers of both sexes to experience more depressive symptoms when compared to those with “on-time” pubertal development. The deviance model for depression has some empirical support as depression has been associated with early timing in girls and late timing in boys (Conley & Rudolph, 2009) or with early timing in girls and both early and late timing in boys (Kaltiala-Heino, Kosunen, & Rimpelä, 2003). However, when sociodemographic factors were controlled for in the latter study, depression was associated solely with early timing in boys and girls.

Possible Racial Differences in the Effects of Pubertal Timing on Depression

In addition to sex differences, there may be racial differences in the relationship between pubertal timing and depressive symptoms. A study of African American early maturing adolescents (Ge et al., 2003) supported the stage termination model: early maturing girls had higher levels of depressive symptoms; early maturing boys had more depressive symptoms at age 11, although this effect disappeared by age 13. Additionally, boys who experienced accelerated pubertal growth (a measure of pubertal tempo rather than pubertal timing; Mendle et al., 2010) displayed higher levels of depressive symptoms. However, a recent study of African American female adolescents did not find an association between pubertal timing and depressive symptoms (Carter, Caldwell, Matusko, Antonucci, & Jackson, 2011). Overall, few studies have included sufficient numbers of adolescents of different races or ethnicities to examine race or ethnicity as a moderator of the relationship between pubertal timing and depressive symptoms. One examination of female adolescents (DeRose, Shiyko, Foster, & Brooks-Gunn, 2011) showed that early maturing Caucasian girls were more

vulnerable to internalizing problems, but that this relationship did not hold for African American girls.

Differences in Body Esteem During the Pubertal Transition for African American and Caucasian Girls

One mechanism that may help to explain racial differences in the effects of pubertal maturation is the likelihood of decreased body satisfaction. The pubertal transition results in increased body fat and weight gain in girls; these physical changes move girls away from the prepubescent shape currently promoted as the ideal in Western popular culture. Evidence also suggests that higher levels of depressive symptoms in early maturing postpubertal girls than in later maturing peers may be accounted for by negative perceptions of body weight and physical development (Compian, Gowen, & Hayward, 2009; Vogt Yuan, 2007). However, body dissatisfaction due to pubertal maturation may be exclusive to Caucasian adolescent girls. Caucasian girls report higher levels of body dissatisfaction than African American girls (Franko & Striegel-Moore, 2002) and African American girls have higher levels of body satisfaction than Caucasian girls during adolescence, which may contribute to different perceptions of the pubertal transition (Franko & Striegel-Moore, 2002) and result in the lack of an association between early pubertal timing and depression for African American girls. Early maturation may predict internalizing problems solely in Caucasian girls (Dorn & Biro, 2011); further research is necessary to clarify whether early pubertal timing increases vulnerability to depression for African American as well as Caucasian adolescents and if differences are mediated by body satisfaction.

Pubertal Timing May Exacerbate the Effects of Peer Victimization on Girls

The contextual amplification model (Ge & Natsuaki, 2009) proposes that it is not nonnormative pubertal timing per se that is distressing for children; however, “off-time” pubertal timing may moderate a stressful social environment to result in negative outcomes. Significant evidence suggests that early maturing adolescents with heightened levels of stressful life events involving their peers have higher rates of depression (Conley, Rudolph, & Bryant, 2012; Ge et al., 2001; Ge, Lorenz, Conger, & Elder, 1994; Nadeem & Graham, 2005). Early puberty may sensitize children to peer relationships, which may compound the distress of peer victimization for early maturers (Mendle et al., 2007). Regardless of whether the victimization centers on weight or physical development, early maturing adolescents negatively targeted by their peers may experience lower body esteem, as physical appearance is a major determinant of self-worth during the pubertal transition (Lunde & Frisén, 2011).

Girls are more likely to encounter and experience distress from peer relational victimization (Crick, 1995; Crick & Bigbee, 1998) and peer victimization has been shown to prospectively predict early adolescent girls’ body dissatisfaction (Lunde, Frisén, & Hwang, 2007). Early maturing girls victimized by their peers may be more likely to view their physical development in a negative light and consequently experience higher levels of depressive symptoms. Indeed, girls who were more physically mature reported the greatest depression symptoms in comparison with their less physically mature peers who reported the same rates

of peer relational victimization (Compian et al., 2009). However, if pubertal timing is not associated with decreased body esteem for boys or African American girls, it should not exacerbate the effects of peer victimization on the body perceptions of boys or African American girls.

The Present Study

Although previous research has examined the moderating effect of pubertal timing on the relationship between peer victimization and depressive symptoms, the present study extends the prior literature by including race as an additional moderator. Therefore, the primary goal of this study was to expand on prior research by examining race and sex differences in whether pubertal timing interacted with peer victimization to prospectively predict depression symptoms in a sample evenly divided between boys and girls and Caucasians and African Americans. In light of the importance of body satisfaction during puberty, especially for girls, we also assessed body esteem (i.e., attitudes toward one's body) as a mechanism by which pubertal timing and peer victimization confer vulnerability to depression.

Our primary hypothesis was that peer victimization would predict increases in symptoms of depression among Caucasian girls who experienced early pubertal timing. We did not expect early pubertal timing to confer increased vulnerability to depression among African American girls or boys of either race who experienced peer victimization. Our secondary hypothesis was that for Caucasian girls, there would be an indirect effect of peer victimization via body esteem in the prediction of depressive symptoms, moderated by pubertal timing. We tested this by way of a moderated-mediation model in which peer victimization predicted lower body esteem, which predicted increased symptoms of depression among those who experienced early pubertal timing. For boys and African American girls, we did not expect to find an indirect effect of peer victimization via body esteem in the prediction of depressive symptoms, moderated by pubertal timing.

Method

Participants

Participants were part of a longitudinal study of race and sex differences in the emergence of depression during adolescence. Caucasian and African American adolescents ($\bar{X}_{age}$= 12.43 years, *SD* = 0.63) were recruited through school mailings and follow-up phone calls by project staff inviting participation (approximately 68% of the sample) and through advertisements placed in Philadephia) area newspapers (approximately 32% of the sample). Eligibility criteria included being 12 or 13 years old, self- identifying as Caucasian/White or African American/Black, and having a mother/primary female caregiver willing to participate. Exclusion criteria included the absence of a mother/primary female caregiver; the mother or adolescent was psychotic, mentally retarded, or severely developmentally/ learning disabled; and the inability to complete study measures by the mother or adolescent for any other reason (e.g., due to the inability to read or speak English).[1]

[1]See Alloy et al. (2012) for further details regarding recruitment.

Eligible mothers provided written consent and adolescents provided written assent to participate in the study. The adolescent sample for the present analyses consisted of 218 adolescents (53.4% female, 49.3% African American, and 50.7% Caucasian) who completed a baseline assessment and a follow-up assessment approximately 8 months later.[2] The African American and Caucasian adolescents differed on eligibility for free school lunch ($\chi^2 = 3.74$, $df = 1$, $p < .001$), a measure of financial need that accounts for the number of dependents being supported on the family's income, and on mothers' current marital status ($\chi^2 = 2.22$, $df = 4$, $p < .001$). Specifically, 65.7% of African American adolescents and 24.3% of Caucasian adolescents were eligible for free lunch. In addition, 39.6% of the mothers of the African American adolescents were currently married, 32.3% of the mothers had never married, 17.7% were divorced, and 4.2% of the mothers were separated from a partner; whereas, 69.1% of the mothers of the Caucasian adolescents were currently married, 11.3% of the mothers had never married, 10.3% were divorced, and 7.2% of the mothers were separated from a partner. There were no differences on free lunch eligibility or mother's current marital status by sex. To control for potential confounds due to racial differences, we included free lunch status and mother's marital status as covariates in analyses.

Procedures

At the initial assessment, adolescents completed measures of pubertal status and depressive symptoms. Mothers also completed a measure of their child's pubertal status at baseline. At a follow-up visit approximately 8 months later ($\bar{X} = 253.97$ days; $SD = 84.88$ days), adolescents completed questionnaires assessing body esteem, depressive symptoms, and peer victimization experienced since the baseline visit. Adolescents and mothers were each compensated for their participation at both time points in the study.

Measures

Pubertal timing—The Pubertal Development Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1988) is a self-report questionnaire that assesses pubertal development. The PDS rates five characteristics: growth spurt in height, body hair, skin change, breast change (girls only)/voice change (boys only), and facial hair growth (boys)/menstruation (girls). Each characteristic (except menstruation which is coded 1 = has not begun, 4 = has begun) is rated on a 4-point scale (1 = *no development*, 2 = *development has barely begun*, 3 = *development is definitely underway*, 4 = *development is complete*); higher scores indicate more mature pubertal status. The PDS has good psychometric properties and convergent validity based on self- and physician-rated Tanner stages (Petersen et al., 1988), including in multiethnic samples (J. M. Siegel, Yancey, Aneshensel, & Schuler, 1999). Adolescents' mothers also reported on their child's pubertal development via the PDS; the mother's PDS report correlated $r > .80$ with the child's PDS report. Thus, we used the child's report only in our analyses.

[2]Eight months has been shown to be an adequate time frame in which to measure changes in symptoms of depression in a community sample of this age group; studies have found significant changes in internalizing symptoms in a similar or shorter time frame (e.g., McLaughlin, Hatzenbuehler, & Hilt, 2009; Siegel, La Greca, & Harrison, 2009).

According to the PDS, 6.6% of our sample had “no development,” 39.8% had “development has barely begun,” 42.7% had “development is definitely underway,” and 10.8% had “development is complete.” When we stratified by gender: for girls, 3.8% had “no development,” 24.4% had “development has barely begun,” 52.7% had “development is definitely underway,” and 19.1% had “development is complete”; for boys, 10.0% had “no development,” 58.2% had “development has barely begun,” 30.9% had “development is definitely underway,” and 0.9% had “development is complete.” Prior to conducting analyses, the PDS total score was regressed on age separately for males and females,[3] and the residual obtained was used as a continuous measure of pubertal timing (Dorn, Susman, & Ponirakis, 2003; Susman et al., 2007). Internal consistency for the PDS in this sample was $\alpha = .70$ for girls and $\alpha = .72$ for boys at baseline.

Body esteem—The Body Esteem Scale (BES; Mendelson & White, 1982) measures beliefs about body shape, physical appearance, and weight in youth. The BES consists of 20 yes/no items, such as “I wish I were thinner”; total scores range from 0 to 20, with higher scores indicating better body esteem. The BES has been shown to have good internal consistency and concurrent validity (Mendelson & White, 1982) and has been successfully used in previous studies with youth from different ethnic backgrounds including Black adolescents (Duncan, Al-Nakeeb, & Nevill, 2004; Mendelson & White, 1985). Internal consistency in this sample was $\alpha = .89$ at follow-up.

Relational peer victimization—The Social Experience Questionnaire (SEQ; Crick & Grotpeter, 1996) measures adolescents’ reports of being the target of acts committed by their peers. The original SEQ consists of three subscales of peer acts: Peer Relational Victimization, Peer Overt Victimization, and Receipt of Prosocial Acts From Peers. In the current study, only the relational victimization subscale (e.g., others left you out) was used; during adolescence, relational victimization appears to be the most prevalent form of victimization and closely associated with vulnerability to depression (Prinstein, Boergers, & Vernberg, 2001). For each item, adolescents were asked whether or not they experienced that type of relational victimization in the period between baseline and follow-up. The SEQ has demonstrated good psychometric properties in previous studies (Crick & Grotpeter, 1996). Internal consistency in this sample was $\alpha = .69$ at follow-up.[4]

Depressive symptoms—The Children’s Depression Inventory (CDI; Kovacs, 1985) is a commonly used self-report measure that assesses affective, behavioral, cognitive, and somatic symptoms of depression in youth. Each of the 27 items is rated on a 0 to 2 scale; total scores range from 0 to 54, with higher scores indicating more depressive symptoms. The CDI has good reliability and validity as a measure of depressive symptoms in adolescents (Klein, Dougherty, & Olino, 2005). Internal consistency in this sample was $\alpha = .85$ at baseline and $\alpha = .80$ at follow-up.

[3]As there were significant sex differences, but not significant race differences, in Pubertal Development Scale (PDS) scores in our sample, we standardized scores within gender only. Analyses were rerun with PDS scores standardized within both gender and race, which did not alter findings (results available upon request).

[4]Alphas may be relatively low because the subscale items describe different types of peer relational victimization and most participants only reported one type. However, an alpha of .69 indicates adequate internal consistency similar to that found in comparable research with the Social Experience Questionnaire (SEQ; Leadbeater, Hoglund, & Woods, 2003).

Results

Descriptive Analyses

Means and standard deviations for primary variables and differences by sex and race are listed in Table 1. Forty-eight percent of the current sample reported at least one occurrence of peer relational victimization during the follow-up period, which is consistent with several studies of relational victimization among adolescents (e.g., Bond, Carlin, Thomas, Rubin, & Patton, 2001), but slightly lower than others (e.g., Ellis, Crooks, & Wolfe, 2009). In addition, means for depressive symptoms were slightly lower, but comparable with those reported in other studies conducted with community samples of early adolescents (Gibb & Alloy, 2006; Grills-Taquechel, Norton, & Ollendick, 2009; McLaughlin, Hatzenbuehler, & Hilt, 2009).

Compared with boys, girls had more advanced pubertal development, lower body esteem, and experienced more peer victimization, but did not differ on age. Girls did not differ from boys on symptoms of depression at baseline, but had significantly higher depressive symptoms at follow-up; this is consistent with the initial emergence of sex differences in depressive symptoms in adolescence (Hankin et al., 1998). Compared with Caucasian adolescents, African American adolescents were slightly older; consistent with being marginally older, African Americans showed a trend for more advanced pubertal development than Caucasians. African American adolescents did not differ from Caucasian adolescents on the number of peer victimization events experienced between baseline and follow-up, depressive symptoms at baseline or follow-up, or body esteem. Although there was a main effect of sex on depressive symptoms at follow-up, this was qualified by an interaction between sex and race: there were no differences in baseline ($F(3, 217) = 0.75$, $p = .52$) or follow-up ($F(3, 217) = 1.57$, $p = .20$) symptoms of depression between Caucasian boys, Caucasian girls, African American boys, and African American girls.

Prospective Analyses

To evaluate whether pubertal timing would moderate the relationship between peer victimization and depressive symptoms at follow-up and whether this relationship was further moderated by race and sex, we conducted a hierarchical linear regression analysis. The covariates (baseline depressive symptoms, subsidized lunch status, mother's marital status, and time elapsed between study assessments) were entered on Step 1. Pubertal timing, number of peer victimization events, race and sex were entered on Step 2. All two-way interactions were entered on Step 3, three-way interactions on Step 4, and the four-way interaction term was entered on Step 5. Continuous predictor variables were centered at their means prior to analysis, and dichotomous variables (race and sex) were dummy-coded as 0 and 1.

As hypothesized, the Pubertal Timing × Peer Victimization two-way interaction was significant in predicting depressive symptoms. However, this interaction was qualified by a significant four-way interaction between pubertal timing, peer victimization, sex, and race predicting depressive symptoms at follow-up (Table 2). A significant four-way interaction indicated that the Pubertal Timing × Peer Victimization interaction did differ by race and

sex. Higher order interactions are best interpreted by decomposition into component lower order interactions. Thus, to understand the form of the Pubertal Timing × Peer Victimization interaction for adolescents of each race and sex, we probed the lower order interactions within the significant four-way interaction. Among Caucasians, there was a significant three-way interaction between pubertal timing, peer victimization, and sex, such that the two-way interaction between pubertal timing and peer victimization was significant for girls in predicting increased depressive symptoms at follow-up ($t = 2.52$, $p = .01$), but not for boys ($t = -1.02$, $p = .31$). Among African Americans, there was a significant three-way interaction between pubertal timing, peer victimization, and sex, such that the two-way interaction between pubertal timing and peer victimization was significant for girls in predicting increased depressive symptoms at follow-up ($t = -2.12$, $p = .04$), but not for boys ($t = -0.64$, $p = .53$). There was not a significant main effect of pubertal timing ($t = -0.17$, $p = .87$) or peer victimization ($t = 1.32$, $p = .19$) on depressive symptoms for boys of either race. Also, we did not find a main effect of marital status or free lunch status on depressive symptoms.

To probe the form of the significant two-way interactions between pubertal timing and peer victimization for Caucasian and African American girls, we plotted the interaction at one standard deviation above and below the mean levels of pubertal timing (Aiken & West, 1991). For Caucasian girls (Figure 1a), consistent with our hypotheses, peer victimization predicted increases in depressive symptoms among Caucasian girls with earlier pubertal timing ($t = 4.39$, $p < .001$), but not among those with later pubertal timing ($t = 0.55$, $p = .58$). In contrast, among African American girls (Figure 1b), peer victimization predicted increases in depressive symptoms among girls with *later* pubertal timing ($t = 3.45$, $p = .001$), but not among those with earlier pubertal timing ($t = -0.27$, $p = .79$).

Does Pubertal Timing Moderate the Indirect Effect of Peer Victimization on Depressive Symptoms Through Body Esteem for Girls?

To examine the presence of an indirect effect of peer victimization via body esteem in the prediction of depressive symptoms, and to evaluate whether this indirect effect was moderated by pubertal timing (i.e., moderated mediation; Preacher, Rucker, & Hayes, 2007), we used an SPSS macro (PROCESS) to test the significance of the indirect effect with a bootstrapping approach to obtain confidence intervals (CI; Hayes, 2013). Bootstrapping is superior to other common methods of determining the significance of indirect effects as the assumption of normality for the sampling distribution is not required (Preacher & Hayes, 2004).

We constructed a conditional process model (Figure 2) that proposed that pubertal timing in girls interacted with peer victimization and race to predict body esteem and that in turn, body esteem predicted symptoms of depression. In other words, the model postulated an indirect effect of peer victimization on symptoms of depression through body esteem that was moderated by pubertal timing and race. Using the macro, we estimated the effect of peer victimization on depressive symptoms directly as well as indirectly through body esteem with direct and indirect effects moderated by pubertal timing and race. The macro generated bias-corrected 95% bootstrap CIs using 10,000 bootstrap samples for the direct and indirect

effects of peer victimization at the mean value and ± one standard deviation from the mean value of pubertal timing for Caucasian and African American girls. All analyses controlled for time to follow-up and baseline symptoms of depression; continuous predictor variables were mean-centered.

For girls, race significantly modified the interaction between pubertal timing and peer victimization in the prediction of body esteem (Table 3a). In addition, body esteem was a significant predictor of depressive symptoms at follow-up (Table 3b) and when body esteem was added to the model, the interaction between race, pubertal timing, and peer victimization no longer significantly predicted depressive symptoms; this suggested body esteem mediated the relationship between this interaction and depressive symptoms. Separately for Caucasian and African American girls, we decomposed the indirect effect of peer victimization on depressive symptoms through body esteem modified by pubertal timing (Table 3c).

Consistent with our hypothesis for Caucasian girls, we found a significant indirect effect of peer victimization on symptoms of depression through body esteem that was moderated by pubertal timing. The indirect effect of peer victimization through body esteem was nonsignificant for Caucasian girls with later pubertal timing ($B = 0.14$, 95% CI = [−0.50, 0.86]) but became significant for those with early pubertal timing ($B = 0.94$, 95% CI = [0.42, 1.99]). The model suggests that for Caucasian girls, earlier pubertal timing and greater peer victimization resulted in lower body esteem, which led to increased symptoms of depression.

Among African American girls, we also found a significant indirect effect of peer victimization on symptoms of depression through body esteem that was moderated by pubertal timing. The indirect effect of peer victimization through body esteem was nonsignificant for African American girls with early pubertal timing ($B = -0.30$, 95% CI = [−1.04, 0.20]) but became significant for those with later pubertal timing ($B = 0.90$, 95% CI = [0.27, 2.02]). The model suggests that for African American girls, later pubertal timing and greater peer victimization resulted in lower body esteem, which led to increased symptoms of depression. In addition, the mediational model was nonsignificant for boys of either race (results available upon request).

Discussion

The current study prospectively evaluated pubertal timing as a moderator of the relationship between relational peer victimization and depressive symptoms among a racially diverse sample of adolescents. Consistent with hypotheses, Caucasian girls with early pubertal timing and greater peer victimization experienced increased depressive symptoms at follow-up. Unexpectedly, among African American girls, peer victimization predicted increases in depressive symptoms, but only among those with later pubertal timing. Furthermore, body esteem significantly mediated the relationship between the interaction of pubertal timing and peer victimization and depressive symptoms for girls of both races: earlier maturing Caucasian girls and later maturing African American girls who experienced greater peer victimization had lower body esteem, which in turn predicted increased symptoms of

depression. Our results suggest that pubertal timing may moderate peer victimization to predict depressive symptoms among Caucasian and African American adolescent girls, and that body esteem may serve as a mechanism through which the risk of depressive symptoms is increased.

Our finding that earlier pubertal timing and peer victimization interact to predict depressive symptoms for Caucasian girls is consistent with past research (e.g., Compian et al., 2009); to our knowledge, this is the first study to demonstrate that African American girls who undergo puberty later than their peers and experience peer victimization are at greater risk for depressive symptoms. Findings suggest that pubertal timing may have different implications for African American and Caucasian girls and may provide insight into the mechanisms by which puberty contributes to the sex difference in depressive symptoms that emerges during this time.

One potential explanation for the divergent effects of pubertal timing for Caucasians and African Americans is that girls of each race may compare themselves primarily with other girls of the same race. Frisby (2004) found that African American women only experienced lowered body esteem when exposed to idealized images of African American models but not when exposed to idealized images of Caucasian models, suggesting that African American women may only base self-evaluation on racially similar women.

The effect of pubertal timing on Caucasian and African American girls may also be influenced by different racial perceptions of the ideal body type. Although Caucasian girls tend to idealize a figure resembling the prepubescent female body (Rucker & Cash, 1992), the body type and size preferred by African American girls may be more congruent with the physical changes that occur during puberty (Halpern, Udry, Campbell, & Suchindran, 1999; Hayward, Gotlib, Schraedley, & Litt, 1999). Physical changes during the pubertal transition move Caucasian girls away from their ideal body shape; whereas, African American girls tend to idealize a fuller figure and be less averse to the increasing body fat and weight gain that accompany pubertal development (Franko & Striegel-Moore, 2002; Rucker & Cash, 1992). In fact, some research suggests that African American girls undergoing puberty experience positive feelings about their physically maturing bodies (O'Sullivan, Meyer-Balhburg, & Watkins, 2000; Parker et al., 1995; J. M. Siegel et al., 1999). Different views of the physical changes that accompany puberty may help to explain why early maturing Caucasian girls and later maturing African American girls who are victimized by their peers experience lower body esteem, which leaves them more vulnerable to depression.

Our results appear to support a sex *and* race specific maturational deviance model of pubertal timing; girls who matured "off-time" (i.e., either earlier or later than their same-sex *same-race* peers) experienced higher levels of depressive symptoms. There are several reasons why "off-time" maturing adolescent girls of either race may be more vulnerable to the effects of peer victimization. Research suggests that girls develop a heightened sensitivity to interpersonal relationships in adolescence (Natsuaki et al., 2009). As a result of this sensitivity, girls tend to have more social-evaluative concerns than boys and to base self-evaluations on comparisons with their peers (Jones, 2001). As girls have a tendency to derive self-esteem from their level of acceptance by peers and the quality of their peer

relationships (Compian et al., 2009; Jones, 2001; Rudolph, Caldwell, & Conley, 2005; Rudolph & Conley, 2005), they may be more likely than boys to experience depressive symptoms after being victimized by their peers (Crick, 1995; Prinstein et al., 2001).

As expected, we did not find a significant main effect of pubertal timing or peer victimization on depressive symptoms for boys of either race. In addition, none of the tested interactions with pubertal timing or peer victimization were significant for boys. Boys had higher body esteem and experienced fewer peer victimization events than girls, so they may experience these vulnerability factors less often or may not find them as distressing or depressogenic as do girls. Consistent with the initial emergence of sex differences in depressive symptoms in adolescence, girls did not differ from boys on symptoms of depression at baseline but had significantly higher depressive symptoms at follow-up. However, boys also had less advanced pubertal development than girls at baseline; if boys compare themselves physically primarily with other boys and most boys in our study had not experienced much pubertal maturation at baseline, this may account for the lack of pubertal timing effects in our study. If we had conducted a later follow-up after more boys experienced physical pubertal changes, we might have found significant effects of pubertal timing on depressive symptoms for boys.

The current study has a number of strengths, including the use of a prospective design and a large, community-based sample of adolescents equally divided between males and females, and between African Americans and Caucasians. We were able to examine pubertal timing, peer victimization, and body esteem at an age just prior to the average age of the first onset of depression, a time when sex differences in depressive symptoms begin to emerge (Hankin & Abramson, 2001). In addition, the current study adds to the limited body of research examining the effects of pubertal timing on African Americans (Carter et al., 2011). Finally, the present study extends past research by examining body esteem as a potential mechanism linking pubertal timing, peer victimization, and depressive symptoms.

Several limitations of the study should be addressed. First, we assessed only depressive symptoms and did not examine diagnoses of depressive disorders. However, subclinical depressive symptoms during adolescence have been found to predict first onset of major depressive disorder during adulthood (van Lang, Ferdinand, & Verhulst, 2007); consequently, adolescent vulnerability to subclinical depressive symptoms warrants examination. Another limitation to the current study is that symptoms of depression, peer relational victimization, and body esteem were measured by self-report concurrently at the follow-up assessment; thus, it is possible that measures of peer victimization were biased by current symptoms of depression (De Los Reyes & Prinstein, 2004). Evidence suggests that the perception of peer victimization may be just as important as the actual occurrence of the event in contributing to depressive symptoms (Paul & Cillessen, 2003); however, a multi-informant approach to the assessment of peer victimization would be beneficial for future studies. In addition, gender measurement bias has been a concern with self-report of depressive symptoms and peer victimization in children; however, recent research did not find evidence of gender differences in measurement as long as overt and relational victimization were measured on separate subscales (Bevans, Bradshaw, & Waasdorp, 2013). Similarly, examination of the CDI has supported validity across gender (Carle, Millsap, &

Cole, 2008). To our knowledge, the BES has not been assessed for gender measurement bias; it is possible that gender differences in the BES may reflect item content.

The current study found that for adolescent girls, pubertal timing exacerbated the depressogenic effects of relational peer victimization through the mechanism of lowered body esteem. More specifically, Caucasian girls who experienced earlier pubertal timing and African American girls who experienced later pubertal timing were more likely to have poor body esteem if they experienced peer victimization, which then resulted in increased depressive symptoms. These findings demonstrate the importance of pubertal timing and relational victimization as vulnerability factors for lower body esteem and higher levels of depressive symptoms. Results suggest that body esteem may be a promising target of treatment and prevention programs for adolescent girls, and highlight the damaging nature of peer victimization, which should continue to be a focus of intervention for depression. Furthermore, findings suggest that pubertal timing may have different social and psychological consequences that are dependent on race and sex. Consequently, assessment and interventions for adolescents may need to account for this variability in order to improve efficacy for more individuals.

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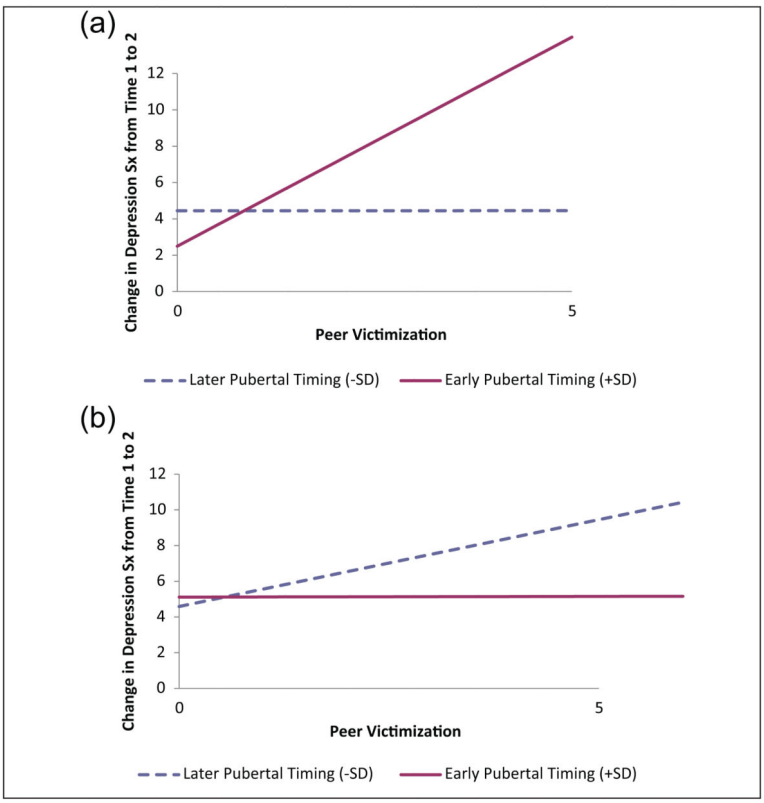

Figure 1.

Depressive symptoms at follow-up as a function of pubertal timing and peer victimization for (a) Caucasian girls and (b) African American girls.

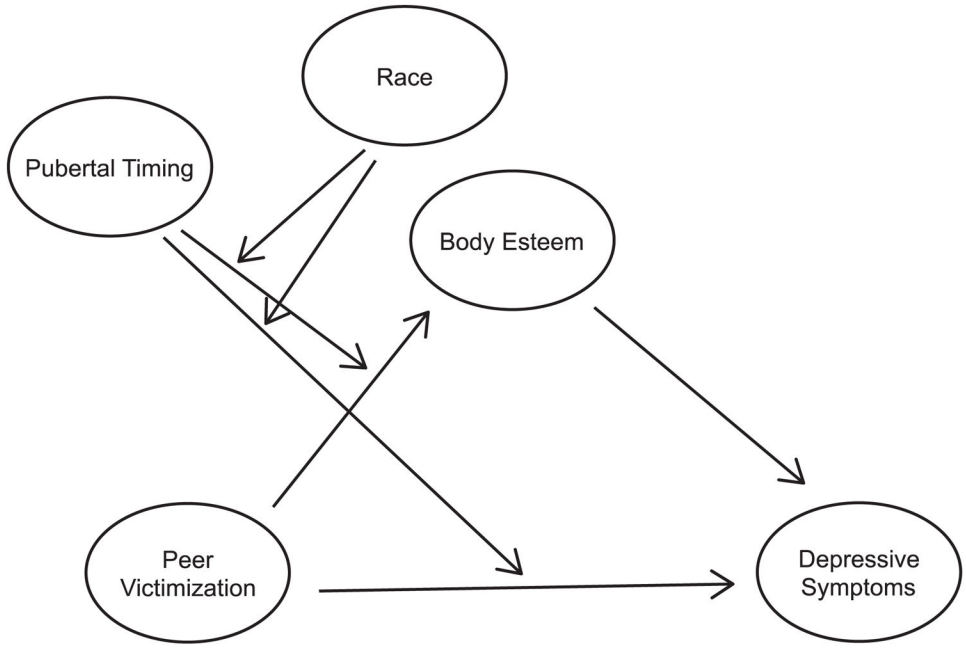

Figure 2.
Model for the indirect effect of peer victimization on depressive symptoms through body esteem moderated by pubertal timing.

Table 1

Participant Characteristics by Sex and Race.

	etjSex				Race			
	Female	Male			Caucasian	African American		
Variables	*X̄ (SD)*	*X̄ (SD)*	*t*	*d*	*X̄ (SD)*	*X̄ (SD)*	*t*	*d*
PDS T1	14.50 (3.32)	11.29 (2.96)	7.50***	1.02	12.56 (3.75)	13.46 (3.25)	1.90†	0.26
Age T1	12.44 (0.66)	12.40 (0.58)	0.50	0.07	12.31 (0.60)	12.55 (0.63)	2.88**	0.39
SEQ PV T2	1.19 (1.56)	0.80 (1.23)	2.04*	0.28	1.07 (1.31)	0.94 (1.54)	0.66	0.09
CDI T1	6.84 (6.90)	5.77 (5.00)	1.33	0.18	6.09 (5.89)	6.59 (6.32)	0.61	0.08
CDI T2	5.57 (5.58)	4.25 (3.97)	2.03*	0.27	5.07 (4.78)	4.85 (5.11)	0.32	0.04
BES T2	15.87 (4.80)	17.12 (3.43)	2.23*	0.30	15.99 (4.68)	16.91 (3.75)	1.61	0.22

Note.

PDS = Pubertal Development Scale; T1 = baseline; SEQ PV = Social Experiences Questionnaire Peer Victimization; T2 = follow-up; CDI = Children's Depression Inventory; BES = Body Esteem Scale.

† $p < .10$.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

Table 2

Interaction Between Pubertal Timing, Peer Victimization, Sex, and Race Predicting Depressive Symptoms at Follow-Up.

	B	*SE B*	β	f^2	ΔR^2
Step 1				.56	.36***
CDI T1	.37	.05	.46***		
Days since T1	<.01	<.01	−.04		
Lunch status	.28	.61	.03		
Marital status	.40	.56	.04		
Step 2				.22	.12***
PT	.92	.44	.19*		
SEQ PV	1.17	.37	.34**		
Sex	−1.63	.75	−.17*		
Race	−.82	.80	−.08		
Step 3				.02	.01
PT × SEQ PV	.83	.33	.21*		
Race × SEQ PV	−.29	.47	−.06		
Race × PT	−.90	.74	−.12		
Sex × SEQ PV	−.50	.59	−.09		
Sex × PT	−1.05	.68	−.15		
Sex × Race	1.70	1.07	.15		
Step 4				.07	.03*
Sex × Race × SEQ PV	1.32	.80	.17		
Sex × PT × SEQ PV	−1.35	.61	−.19*		
Race × PT × SEQ PV	−1.87	.56	−.28**		
Sex × Race × PT	1.15	1.08	.11		
Step 5				.04	.02*
Sex × Race × PT × SEQ PV	2.16	1.03	.19*		

Note.

B = unstandardized coefficients; CDI = Children's Depression Inventory; T1 = Time 1 (baseline); PT = Pubertal Timing (standardized residual of Pubertal Development Scale regressed on age); SEQ PV = Social Experiences Questionnaire Peer Victimization.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

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Table 3

Body Esteem as a Mediator of the Interaction Between Pubertal Timing, Peer Victimization, and Race, and Depressive Symptoms (10,000 Bootstrap Samples).

a.) Pubertal Timing, Peer Victimization, and Race as Predictors of Body Esteem at Follow-Up for Girls.

Predictor	*B*	*t*
PT	−0.81	$-1.72^{\dagger}$
SEQ PV	−1.33	-3.34^{**}
PT × SEQ PV	−0.60	$-1.70^{\dagger}$
Race	1.18	1.48
PT × Race	1.80	2.35^{*}
SEQ PV × Race	0.72	1.39
PT × SEQ PV × Race	1.73	2.93^{**}
CDI T1	−0.12	-2.09^{*}
Days between T1 and T2	0.01	1.02
Model R^2 = .34, F = 5.99. p < .001		

b.) Pubertal Timing, Peer Victimization, Race, and Body Esteem as Predictors of Depressive Symptoms at Follow-Up for Girls.

Predictor	*B*	*t*
BES	−0.43	-5.41^{***}
PT	0.47	1.19
SEQ PV	0.40	1.14
PT × SEQ PV	0.35	1.17
Race	−0.26	−0.39
PT × Race	−0.27	−0.42
SEQ PV × Race	0.03	0.08
PT × SEQ PV × Race	−0.53	−1.04
CDI T1	0.40	8.00^{***}
Days between T1 and T2	<0.01	0.41
Model R^2 = .66, F = 20.96. p < .001		

c.) Indirect Effect of Peer Victimization on Depressive Symptoms at Follow-Up Through Body Esteem at Early (+1 *SD*) and Late (−1 *SD*) Pubertal Timing for Caucasian and African American Girls.

	Effect	*SE*	CI (lower)	CI (upper)
Caucasian girls				
Late pubertal timing	0.14	0.34	−0.50	0.86
Early pubertal timing	0.94	0.38	0.42	1.99
African American girls				
Late pubertal timing	0.90	0.41	0.27	2.02
Early pubertal timing	−0.30	0.29	−1.04	0.20

Note. Confidence intervals that do not contain 0 are statistically significant, implying mediation.

B = unstandardized coefficients; PT = pubertal timing (standardized residual of Pubertal Development Scale regressed on age); SEQ PV = Social Experiences Questionnaire Peer Victimization; CDI = total score on Children's Depression Inventory; T1 = baseline; T2 = follow-up; BES = Body Esteem Scale; CI = confidence interval.

$^{\dagger}p < .10$.

$^{*}p < .05$.

$^{**}p < .01$.

$^{***}p < .001$.