

Pubertal Timing, Racial Identity, Neighborhood, and School Context Among Black Adolescent Females

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Objectives: This study bridges the empirical research on pubertal timing effects, racial identity, and school and neighborhood context to understand the pubertal development and depression link among Black adolescent females. We examined whether racial identity content dimensions moderated the relation between pubertal timing and depressive symptoms among Black adolescent females and the moderating capacity of school and neighborhood racial composition. **Method:** We administered measures of pubertal development, racial identity, and depressive symptoms to a sample of 217 Black adolescent females, aged 14 to 18. We assessed racial centrality, private regard, and public regard and used archival data to obtain the racial composition of participants' neighborhoods and schools. **Results:** The results indicated that high racial centrality levels were linked to depressive symptoms for adolescent girls with late pubertal timing relative to their early counterparts, which was stronger for girls attending not majority Black schools. The results also indicated that low public regard levels were linked to depressive symptoms among adolescent girls with early pubertal timing relative to their late counterparts, which was stronger for girls attending not majority Black schools. **Conclusions:** The current study provides evidence that racial identity and school racial context moderate the effects of pubertal timing differentially for early and late maturing Black girls. The results support the notion that the psychological effects of pubertal timing on internalizing symptoms are context dependent.

Keywords: pubertal timing, racial identity, adolescents, Black, girls

Research findings illustrate that girls who develop early relative to their same-sex and age counterparts are at greater risk for depression (see Mendle, Turkheimer, & Emery, 2007; Negri & Susman, 2011). The timing of pubertal processes varies considerably by race/ethnicity, with African American girls experiencing pubertal changes such as breast growth, pubic hair development, and menarche earlier than non-Black girls (Biro et al., 2010; Herman-Giddens et al., 1997). Yet, research examining early pubertal timing and depressive symptoms among African American girls yield inconsistent findings. Some studies reported similar findings as those obtained with White girls such that early pubertal timing was linked to depressive symptoms (Ge, Brody, Conger, & Simons, 2006; Ge et al., 2003; Keenan, Culbert, Grimm, Hipwell, & Stepp, 2014; Nadeem & Graham, 2005). Other research has not indicated a link between early pubertal timing and depressive symptoms among African American and Caribbean Black girls (Carter, Caldwell, Matusko, Antonucci, & Jackson, 2011; Hamlat

et al., 2015; Hayward, Gotlib, Schraedley, & Litt, 1999; Michael & Eccles, 2003) or that both early and late pubertal timing were related to depressive symptoms among African American girls (Carter, Jaccard, Silverman, & Pina, 2009; Michael & Eccles, 2003).

Because the physical changes associated with puberty tend to occur earlier in African American girls (Biro et al., 2010), improved understanding of the link between early pubertal timing and depressive symptoms is needed. This study examined the racial identity and context (neighborhood and school racial composition) of African American girls to clarify the nature of the relationship between early pubertal timing and depressive symptoms. Through processes involving social comparison and exposure to group norms, contextual experiences linked to social group membership (e.g., female, African American) can provide critical information for how Black girls adapt to pubertal changes. Adolescence is an important developmental period to examine these variables because depressive affect increases with the pubertal transition (Angold & Costello, 2006).

Guiding Theoretical Frameworks

We used the contextual amplification hypothesis (see Ge & Natsuaki, 2009) to examine pubertal timing, racial identity, racial context (e.g., school and neighborhood racial composition), and depressive symptoms. This theory emphasizes the interaction between pubertal processes and psychosocial contexts (e.g., family conflict, neighborhood, interpersonal experiences). According to this theory, psychosocial contexts moderate the effects of early puberty on outcomes through the implicit reward, punishment

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structures and norms and expectations provided by contexts (Ge & Natsuaki, 2009). Adaptation is expected to be particularly difficult for girls in adverse social contexts such as those living in disadvantaged neighborhoods or who experience harsh parenting (e.g., Deardorff et al., 2013; Ge, Brody, Conger, Simons, & Murry, 2002; Obeidallah, Brennan, Brooks-Gunn, & Earls, 2004). It is reasoned that the contextual circumstances (e.g., stress) can overtax the undeveloped coping resources of early developers. For early developing girls in supportive environments, however, the risk of negative outcomes is decreased.

Theoretical support for the current study is also drawn from the Phenomenological Variant of Ecological Systems Theory (PVEST; Spencer, 2006; Spencer, Dupree, & Hartmann, 1997). This theory considers the unique and cumulative individual-context interactions that stem from being a member of a social group such as dealing with disseminated stereotypes (e.g., body type, skin color, and racial categorization) and stereotypic definitions of physical attractiveness. PVEST also argues that emergent identities arise out of coping with stressors linked to social group membership as individuals appraise their role in specific individual-context situations (Spencer, 2006). These individual-context interactions are hypothesized to shape individual experiences and influence individual behaviors over time. This is particularly relevant for racially and ethnically diverse youth given the significance of self-identification, exploration and learning about social group norms and behaviors during adolescence.

Boundaries and Self-Perceptions of Puberty

Puberty is not a discrete event, but a process of sequential events that has variable onset and tempo (Hayward, 2003). The growth spurt and early signs of breast development (breast buds) may begin between 9 and 11 for the majority of girls. Additionally, the rate of change for breast development may take between 2 and 5 years, extending into late adolescence. There are also racial/ethnic differences regarding the onset and tempo of puberty, as well as individual differences within groups (Biro et al., 2010; Herman-Giddens et al., 1997). Previous work indicated that although African American girls evidenced earlier pubertal timing compared with White girls, they did not evidence faster *pubertal tempo*, or the speed at which individuals pass through various stages of physical development (Mendle, Harden, Brooks-Gunn, & Graber, 2010). Thus, pubertal development among African American girls may occur from ages 9 through 17. Because pubertal onset and tempo vary dramatically across individuals, the meaning of what is normative for an individual girl changes depending on age and context.

The precise onset of changes or the rate of change for an African American girl is unpredictable given that pubertal development boundaries may vary from age 9 to age 17. Further, self-perception of puberty rather than physician ratings of puberty may provide important insight as to why early developing girls display emotional adjustment problems when considering the individual-context interactions of an individual girl. Girls' self-perception of pubertal development is subjective and thus reflect social experiences that stem from observing outwardly signs of puberty in their same-sex and age peers who serve as a comparison group, feedback from interactions with adults and peers, "actual" pubertal timing, or individual differences in sensitivity to these biological

and social experiences. Person-in-context theory suggests that girls' perceptions of pubertal development is based not solely on biological development, but also on an understanding of how their development matches with norms established by distal and proximal contexts (Adams & Marshall, 1996). As girls adapt to the hormonal and physical changes associated with puberty, they may assimilate salient puberty-related social experiences into their self-concept and interpret these experiences consistent with their contextual circumstances. Several factors such as social identities related to racial/ethnic membership point to middle and late adolescence (when pubertal development is slowing down for girls) as a period for understanding how individual qualities and contextual circumstances may moderate associations between pubertal development and depressive symptomatology.

Racial Identity and Depression

Racial identity is a central part of the self-concept and a key developmental task for racially and ethnically diverse children and youth (see Umaña-Taylor et al., 2014). *Racial identity* is defined as the significance and meaning that individuals ascribe to being a member of their racial group (Sellers, Smith, Shelton, Rowley, & Chavous, 1998). A recent meta-analysis indicated that racial identity content and developmental dimensions were positively linked to developmental outcomes among African American, Latino, and Asian American youth (see Rivas-Drake, Syed, et al., 2014). Similarly, a recent empirical review examined the relation between racial identity dimensions, mental health, academic and risk indicators among African American, Latino, and Asian American children and adolescents (Rivas-Drake, Seaton, et al., 2014). The results indicated that racial identity content and developmental dimensions were generally linked to positive mental health indicators among African American youth (see Rivas-Drake, Seaton, et al., 2014). Thus, racial identity is linked to positive mental health outcomes among African American adolescents.

In the current study, racial identity content dimensions were assessed using the Multidimensional Model of Racial Identity (MMRI; Sellers, Rowley, Chavous, Shelton, & Smith, 1997). The MMRI proposed that racial identity comprises interrelated dimensions, and only racial centrality and racial regard were assessed. Racial centrality is the significance that individuals ascribe to race and racial regard includes individuals' affective attitudes toward African Americans with a private and public component (Sellers et al., 1997). Private regard is the extent to which an individual feels positively or negatively about being African American and public regard is the extent to which an individual feels that the broader society views African Americans positively or negatively (Sellers et al., 1997). Burgeoning research indicates that specific racial identity content dimensions are linked to improved mental health. Prior work conducted among African American women indicated that those with high private regard levels (e.g., felt positively about being African American) reported less depression (Settles, Navarrete, Pagano, Abdou, & Sidanius, 2010). Similarly, previous research conducted among African American emerging adults indicated that those with high private regard and low public regard levels (e.g., felt that the broader society viewed Blacks negatively) reported fewer depressive symptoms (Hurd, Sellers, Cogburn, Butler-Barnes, & Zimmerman, 2013).

Though racial identity has not been studied in conjunction with pubertal timing, racial centrality, and racial regard assess contextual experiences related to being a member of a social group that may interact with self-perceptions of pubertal timing to mitigate the risk for negative outcomes (Sellers et al., 1997). Racial identity content dimensions may be linked to pubertal development because they provide critical information for how African American girls adapt to pubertal changes and capture the unique individual-context interactions that stem from being a member of a marginalized racial group. Similarly, racial identity may be linked to pubertal development because of body image concerns, particularly among girls, because of the additional weight and body fat associated with puberty (Rogol, Clark, & Roemmich, 2000). Given ethnic/racial variations in standards of physical attractiveness, being a member of a racial group can influence body image norms. African American girls tend to describe their beauty ideals in terms of personality characteristics such as style, attitude, pride, and confidence; whereas White girls tend to describe their beauty ideal in terms of fixed physical attributes such as tall, thin, and high cheekbones (Cotter, Kelly, Mitchell, & Mazzeo, 2013; Webb, Warren-Findlow, Chou, & Adams, 2013). Researchers have speculated that adolescent girls who adopt body ideals in terms of personality characteristics are less vulnerable to the distress generated by puberty (Thompson & Stice, 2001). Thus, early developing African American girls with specific racial identity beliefs may have different thoughts, feelings, perceptions, and attitudes regarding their changing bodies and self-concepts.

Because prior research has indicated that specific racial identity dimensions (e.g., low public regard and high private regard levels) have been linked to less depressive symptoms, we expect these dimensions to moderate the effects of early pubertal timing among African American girls. It is important to highlight that the MMRI does not assume that race is the central aspect of African American identity and that the identity dimensions are interrelated but not contingent on each other. For example, an African American girl for whom race is not the central identity (e.g., low racial centrality levels) may still feel positive about being African American (e.g., high private regard levels) and believe that the broader society views African Americans negatively (e.g., low public regard levels). Thus, the varying nature of how African American girls feel about their racial background might mitigate the adverse outcomes of early pubertal timing. Similarly, African American girls in racially homogenous neighborhoods and schools may adapt differently to the early onset of puberty.

Racial Context and Depression

Though neighborhoods and schools are important contexts for minority youth development (Spencer, 2006), prior empirical research has rarely examined the racial composition of neighborhoods and schools in relation to pubertal timing and adverse outcomes (Morales-Chicas & Graham, 2015; White, Deardorff, & Gonzales, 2012). White and colleagues (2012) demonstrated that the relation between early pubertal timing and subsequent depressive symptoms was significant for Mexican American girls who lived in neighborhoods not populated by Mexican Americans. Yet, this relation was not significant for Mexican American girls who lived in predominantly Mexican American neighborhoods (White et al., 2012). Morales-Chicas and Graham (2015) revealed that

Latinas (primarily of Mexican and Central American descent) experiencing the simultaneous transition to menarche and middle school reported less connectedness in schools with more perceived available same-ethnic peers and more connectedness in schools with fewer same-ethnic peers, especially when they tended to be underweight.

It is possible that early pubertal timing does not confer risk for adverse outcome among girls who live in neighborhoods and attend schools with same ethnic/racial adults and peers because the neighborhood and school racial composition of developing African American girls can influence their body image norms. The most common explanations for the effect of early pubertal timing on depressive symptoms imply a psychosocial relationship precipitated by the physical changes associated with puberty (Angold & Costello, 2006). Girls who live in neighborhoods with same ethnic/racial peers may find it less difficult to maintain friendships because the majority of their peers are developing at a similar rate. On the other hand, the stress associated with simultaneously navigating both the pubertal transition and school transition can make the need to fit racial/ethnic group norms more salient in schools when that norm is related to body image. It is possible that racial identity and racial school context will impede the risk for depressive affect among developing girls. These findings are likely applicable for African American girls given that pubertal onset and body mass indicators are similar for Latina and African American girls (Biro et al., 2010; Freedman, Khan, Serdula, Ogden, & Dietz, 2006). It was anticipated that the relation between early pubertal timing, racial identity and depressive symptoms would be influenced by neighborhood and school racial composition.

The Present Study

The current study examined the relations among pubertal timing, racial identity, neighborhood, school racial composition, and depressive symptoms among African American adolescent girls. Few studies have examined both normative developmental processes with ethnic/racial members' unique social contextual experiences. As of this writing, no published research has examined possible relations among pubertal timing, racial identity, neighborhood and school racial context, and depressive symptoms among African American girls. The contextual amplification hypothesis (see Ge & Natsuaki, 2009) and PVEST (Spencer, 2006; Spencer et al., 1997) provided theoretical frameworks for bridging the empirical research on pubertal timing effects, racial identity and school and neighborhood context to understand the pubertal development and depression link among African American girls. Though prior research has demonstrated mixed findings regarding the relation between early and late pubertal timing with depressive symptoms (Carter et al., 2009, 2011; Keenan et al., 2014), no hypothesis is offered regarding this relation. Consistent with prior research, it was anticipated that high racial centrality levels, low public regard levels and high private regard levels would moderate the relation between pubertal timing and depressive symptoms based on previous research (Richardson et al., 2015; Seaton, 2009; Sellers, Copeland-Linder, Martin, & Lewis, 2006). Last, it was assessed if the relations between pubertal timing, depressive symptoms, and the racial identity dimensions were influenced by neighborhood and school racial composition and no hypotheses are offered.

Method

Participants

The participants were 217 adolescent females ranging in age from 14 to 18 with an average age of 15.7 ($SD = 1.2$) years. The adolescents reported their racial/ethnic background as African American (67%), Afro-Latino (18%), Biracial/multiracial (6%), Caribbean Black (7%) and African (2%).¹ The participants reported that their adult guardian (usually the mother) was either married/cohabiting (46%), separated/divorced/widowed (30%), or single/never married (24%). The participants also reported the following educational levels for this parent/guardian: less than a high school diploma (8%), high school diploma (23%), 1 year of college or an associate's degree (30%), a bachelor's degree (29%), a graduate degree (8%), or missing (2%). Household composition was reported as married (37%), female headed (41%), male headed (2%), parent/extended family (5%), grandparent/extended family (6%), other (1%) or missing (8%).

Procedure

The current study was part of a larger mixed-methods study of adolescent experiences and mental health. The primary criteria were being of African descent and enrolled in high school, and two separate methodologies were used. Initially, adolescents were recruited from high schools in a southeastern city ($N = 87$; 40%). Approval was obtained from two school districts, and eight schools were selected on the basis of the principals' willingness to participate in the research study. Participation was granted if parental consent forms were returned, and the response rate ranged from 10% to 30% per classroom with an average response rate of 20%. The participants signed assent forms, were reminded that their participation was voluntary and were explicitly told that the results from their paper-and-pencil questionnaires would remain confidential. The questionnaires were administered by undergraduate, African American female research assistants. Completion time ranged from 30 to 60 min, and participants were compensated \$20 and debriefed upon completion.

The second procedure used Facebook to increase the study sample ($N = 130$; 60%). A paid advertisement was placed on Facebook that targeted youth between the ages of 13 and 18 in the continental United States. The advertisement ran during peak hours of adolescent consumption, typically Wednesday through Sunday between 3 PM and 11 PM. An interested adolescent would click on the advertisement and was directed to the initial page in SurveyMonkey to assess the adolescent's race/ethnicity. If the adolescent was not of African descent, they were informed that they were ineligible. If the adolescent was of African descent, they were informed of their eligibility and asked to provide their residential address. Once this information was provided, all interested adolescents were mailed a packet containing parental consent forms, adolescent assent forms, information sheets, and self-addressed return envelopes. Once adolescents returned the packet, they were e-mailed a link to complete the questionnaire in SurveyMonkey. The return rate was approximately 30% for the Facebook recruitment procedure. Upon completion of the survey, youth were compensated electronically with gift cards or mailed cash.

Measures

Demographic information. All adolescents provided information regarding their gender, age, race/ethnicity, grade level, household composition, parental marital status, and parental education level.

Pubertal timing. Pubertal timing was assessed using the Pubertal Development Scale (PDS; Petersen, Crockett, Richards, & Boxer, 1988). The girls indicated the extent to which they had experienced pubertal growth during the past year with responses ranging from 1 (*has not yet started*) to 4 (*development completed*). Girls reported on their growth spurt, body hair, skin changes, and breast development. The total PDS scores for the four items were averaged to maintain the original metric with acceptable reliability ($\alpha = .60$). The average PDS scores for this sample of Black girls was 3.40 ($SD = .49$). The PDS scores were standardized within each age (14, 15, 16, 17, and 18 years), which generated a variable, pubertal timing, with a mean of zero and a standard deviation of one. Higher scores indicated earlier maturation relative to same-age peers. Participants also indicated the age at which they began menarche.

The Multidimensional Inventory of Black Identity (MIBI). A shortened version of the MIBI was utilized to assess racial centrality and racial regard (Martin, Wout, Nguyen, Sellers, & Gonzalez, 2017). The scale consists of items with responses ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The racial centrality subscale ($\alpha = .75$) assesses the degree to which being Black is central to respondents' self-definition. A sample item is, "I have a strong attachment to other Black people." The private regard subscale ($\alpha = .68$) measures the extent to which respondents feel positive about being Black. A sample item is, "I feel good about Black people." The public regard subscale ($\alpha = .81$) measures respondents' belief of how others view Blacks. A sample item is, "In general, others respect Black people."

Neighborhood racial composition. Each respondent's residential address was used to obtain the percentage of African Americans in their respective block group from the 2010 U.S. Census. The block group was used because it is the smallest and most precise unit of analysis (see Collins & Williams, 1999). A single variable was used from the census data: percentage of African American residents per block group.

School racial composition. The ethnic/racial composition of each high school was assessed using archival data from the National Center for Education Statistics. The percentage of students classified as African American, White, Hispanic, and Asian/Pacific Islander was obtained for each participant's respective high school during the year the study was conducted. A single variable was used from the archival data: percentage of African American students per school.

Center for Epidemiological Studies Depression (CES-D) Scale. The shortened 12-item version of the CES-D assessed the frequency of depressive symptoms experienced within the last week (Roberts, Lewinshon, & Seeley, 1999). The subscale included 12 items ($\alpha = .82$) with responses ranging from 0 (*rarely*)

¹ Given the diversity of terms adolescents chose for racial self-designation, the term *Black* will be used for the sample throughout the rest of the article.

to 3 (*most or all of the time*). A sample item is, "I felt that everything I did was an effort."

Data Analytic Strategy

Path analyses were used to examine the hypothesized relations between pubertal timing, depressive symptoms, racial identity, and school and neighborhood racial composition. All path models included adolescent age and recruitment method as covariates. Correlated error between adolescent age and pubertal timing were permitted. The fit for all path models was evaluated using multiple indicators of model fit: chi-square, the CFI, and the root mean squared error of approximation (RMSEA). Hu and Bentler (1999) suggest CFI values greater than or equal to .95 and RMSEA values less than or below .08 represent acceptable model fit. More focused tests were used to examine model fit, namely modification indices and standardized residuals testing the difference between predicted and observed covariances. The overall chi-square, a statistical test of the lack of fit based on over identifying restrictions on the target model, was also reported. Nonsignificant chi-squares suggest good model fit; however, this estimation is a function of sample size and is usually significant with large samples.

We conducted the analyses in three stages. The first stage examined whether pubertal timing and racial identity dimensions (i.e., racial centrality, public regard, and private regard) were related to depressive symptoms. The second stage examined whether racial identity dimensions moderated the relation between pubertal timing and depressive symptoms. The analysis for this stage involved mean centering pubertal timing and racial identity dimensions to avoid problems with multicollinearity, to make coefficients interpretable (Jaccard, Wan, & Turrissi, 1990). Three product terms were created: Pubertal Timing \times Racial Centrality, Pubertal Timing \times Public Regard, and Pubertal Timing \times Private Regard. The third stage examined whether the relations between pubertal timing, racial identity, and depression varied as a function of school and neighborhood racial composition. The school and neighborhood variables used a 60% cutoff such that neighborhoods and schools with percentages 60% or greater were considered "majority Black" and neighborhoods, and schools less than 60% were considered "not majority Black" (see Bower, Thorpe, Rohde, & Gaskin, 2014). Thirty-two percent ($n = 69$) of adolescents lived in residential enclaves with Black densities 60% or greater, and 64% ($n = 139$) lived in neighborhoods with Black densities less than 60%. Fifty-two percent ($n = 114$) of adolescents attended schools that were predominantly Black and 48% ($n = 103$) attended schools that were not predominantly Black. The analysis involved a multigroup strategy, with Majority Black or Not Majority Black representing two groups. The model was simultaneously fit to establish a common model form in the groups with no equality constraints across groups (unconstrained model). Two models were run in which the regression weights were constrained (constrained model) to be equal across the groups, and a model in which the regression weights and covariance's were constrained to be equal across the groups (fully constrained model). Comparisons of the nested models were performed such that a significant chi-square difference would indicate that the models varied as a function of the racial composition. To determine which parameters are significantly different between groups,

each regression path was constrained to be equal across groups. The difference in fit between the unconstrained and constrained models illustrated whether specific paths were moderated by school/neighborhood racial composition. Separate multigroup path models for school racial composition and neighborhood racial composition were conducted.

Results

The results indicate variation along the pubertal development dimensions (see Table 1). The average age of menarche was 12.1 ($SD = 1.7$), ranging from age 8 to 16. The means, standard deviations, and zero-order correlations for the study variables were presented in Table 2.

Testing Direct Relations

The model fit was adequate, $\chi^2(6) = 2.73, p = .01$, (CFI = 0.94; RMSEA = 0.09; 90% CI [0.04–0.14]), explaining 15% of the variance in depressive symptoms. The results suggested that late developing adolescent girls were more likely to report depressive symptoms than average and early developing girls ($B = -2.88, p < .01$). Adolescent girls with high levels of racial centrality ($B = 1.08, p < .05$) and low levels of private regard reported high levels of depressive symptoms ($B = -2.04, p < .01$).

Testing for Moderated Relations

Racial centrality. The model fit was good, $\chi^2(6) = .414, p = .87$, (CFI = 0.99; RMSEA = 0.01; 90% CI [0.01–0.05]). Examination of the Pubertal Timing \times Racial Centrality interaction indicated a significant, negative association between pubertal timing and depressive symptoms, ($B = -2.17, p < .012$). This interaction was probed at the mean, one standard deviation above the mean, and one standard deviation below the mean (Aiken & West, 1991). The results indicated that high racial centrality levels were related to depressive symptoms among adolescent girls with late pubertal timing relative to girls with early pubertal timing (see Figure 1).

Public regard. The model fit was good, $\chi^2(6) = .416, p = .87$, (CFI = 0.99; RMSEA = 0.01; 90% CI [0.01–0.05]). Examination of the Pubertal Timing \times Public Regard interaction indicated a significant, negative association between pubertal timing and depressive symptoms ($B = -2.17, p < .012$). The results indicated that low public regard levels were related to depressive symptoms among adolescent girls with early pubertal timing relative to girls with late pubertal timing (see Figure 2).

Table 1
Variation in Pubertal Dimensions

Pubertal indicators	Not yet started	Barely started	Definitely started	Completed	Missing
Growth spurt	5%	9%	20%	59%	7%
Body hair	1%	4%	27%	61%	8%
Skin	4%	12%	42%	34%	9%
Breast	0%	8%	40%	44%	8%

Table 2
Correlations, Means, and Standard Deviations for the Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. Age									
2. Recruit ^a	.37**								
3. Pubertal timing	.00	.02							
4. Racial centrality	.05	.05	-.01						
5. Private regard	-.01	-.06	-.11	.55**					
6. Public regard	-.02	-.18**	-.27**	.21**	.34**				
7. Neighborhood composition	-.06	-.14	-.06	.04	.09	.05			
8. School composition	.08	.20**	-.02	-.13	-.07	-.01	.22**		
9. Depressive symptoms	.06	.13	-.16*	-.03	-.26**	-.03	.00	-.07	
M	15.7		.00	4.7	5.8	3.6	41.7	58.2	13.3
SD	1.2		.99	1.9	1.3	1.3	28.2	34.1	7.1

^a 0 = in-schools, 1 = online.
* $p < .05$. ** $p < .01$.

Private regard. The model examining private regard indicated no moderation between pubertal timing and depressive symptoms. No multigroup analyses were conducted for school and neighborhood racial composition.

Multi-Group Analyses

School racial composition. The first path model evaluated racial centrality as a moderator of the direct and indirect paths between pubertal timing and depressive symptoms. The change chi-square test showed that the constrained and fully constrained models were significantly different from each other, $\Delta\chi^2(\Delta 15) = 37.09$, $p < .05$, indicating that school racial composition moderated one or more parameters (see Table 3). The racial centrality and pubertal timing interaction on depressive symptoms, $\Delta\chi^2(\Delta 1) = 5.51$, $p < .01$, differed significantly such that the interaction was stronger for girls attending not majority Black schools ($B = -2.26$, $p < .001$) than for girls attending majority Black schools ($B = -.39$, $p < .38$).

The second multigroup analyses evaluated public regard and the change chi-square test showed that the constrained and fully constrained models were significantly different from each other, $\Delta\chi^2(\Delta 15) = 37.77$, $p < .05$, indicating that school racial composition moderated one or more parameters (see Table 4). The public

regard and pubertal timing interaction on depressive symptoms, $\Delta\chi^2(\Delta 1) = 4.81$, $p < .03$, differed significantly such that the interaction was stronger for girls attending not majority Black schools ($B = -1.65$, $p < .001$) than for girls attending majority Black schools ($B = .24$, $p < .64$).

Neighborhood racial composition. The change chi-square tests showed that the nested models evaluating racial centrality and public regard as moderators of the direct and indirect paths between pubertal timing and depressive symptoms were not significantly different from each other (see Tables 3 and 4). The associations between pubertal timing, racial centrality, public regard and depressive symptoms were not moderated by neighborhood racial composition.

Discussion

The results bridge empirical research on pubertal timing with racial identity to understand the puberty-depression link. We examined whether racial centrality, public regard and private regard moderated the relation between pubertal timing and depressive symptoms among Black adolescent girls. These variables have not been examined together in previous research. The results indicated that high racial centrality levels were linked to depressive symptoms for adolescent girls with late pubertal timing relative to their

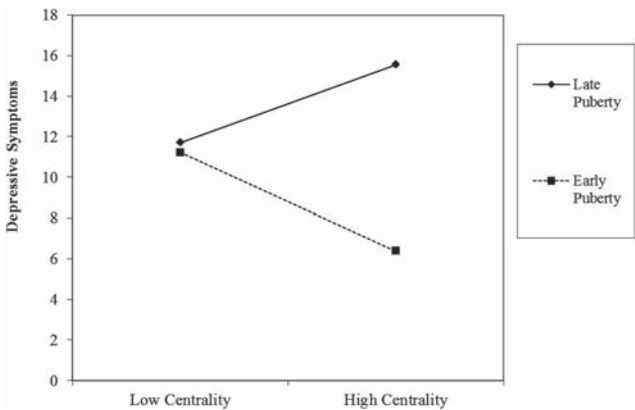


Figure 1. Interaction between centrality and pubertal timing.

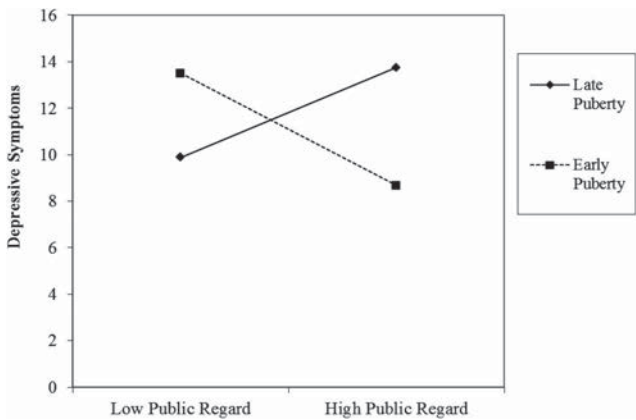


Figure 2. Interaction between public regarding and pubertal timing.

Table 3
Fit Statistics and Comparisons of Nested Models for Racial Centrality

Model	χ^2	df	CFI	RMSEA (90% CI)	$\Delta\chi^2(\Delta df)$
School racial composition					
1. Unconstrained	11.31	13	.99	.01 (.01–.06)	
2. Constrained	17.60	18	.99	.01 (.01–.06)	
Model 1 vs. Model 2					6.29 (5)
3. Fully constrained	54.72	33	.22	.06 (.03–.08)	
Model 2 vs. Model 3					37.12 (15)*
Neighborhood racial composition					
1. Unconstrained	7.12	13	.99	.01 (.01–.03)	
2. Constrained	8.04	18	.99	.01 (.01–.02)	
Model 1 vs. Model 2					.922 (5)
3. Fully constrained	24.06	33	.99	.01 (.01–.03)	
Model 2 vs. Model 3					16.02 (15)

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation.
* $p < .05$.

early counterparts. The results also indicate that low public regard levels were linked to depressive symptoms among adolescent girls with early pubertal timing relative to their late counterparts. The observed link between racial identity dimensions, late pubertal timing and increased depressive symptomatology reflect the complexity of the pubertal process for Black adolescent girls.

The current results suggest that high racial centrality levels were more strongly related to depressive symptoms for late maturing girls, and this relation was stronger for girls who attended schools that were not predominantly Black. Black girls with high racial centrality levels consider race to be very important to their overall self-concept (Sellers et al., 1997). It is possible that Black girls who develop late relative to their peers feel dissatisfied with the pace of their developing bodies due to their bodies' childlike appearance. As such, the cultural benefits related to being Black and having a Black women's body, which may be valued by some Black girls, may not yet be realized by late developing Black girls, which may lead to psychological distress (Parker et al., 1995; Thompson & Stice, 2001). This might be true and salient for Black girls who consider race to be important to their overall identity.

An additional explanation concerns the fact that late developing Black girls may be subject to peer victimization which might lead to psychological distress. Previous research indicates that peer victimization predicted subsequent increases in depressive symptoms among Black girls with later pubertal timing, but not among those with earlier pubertal timing (Hamlat et al., 2015). Although one published study identifies a link between later pubertal timing and peer victimization among Black girls, this relation should be further disentangled. Future research should also consider the degree to which Black girls who develop late may be at risk of receiving racialized peer victimization or racial discrimination, which may be especially heightened for those who consider race to be important to their overall self-concept (e.g., high racial centrality levels) and attend schools in which they are the minority. This is especially relevant since previous research indicates that peer victimization has a racial component (see Graham, 2006; Verkuyten & Jochem, 2006) and that Black youth's racial discrimination experiences overlapped with peer victimization experiences (see Seaton, Neblett, Cole, & Prinstein, 2013). Furthermore, previous research indicates that Black adolescents reported more

Table 4
Fit Statistics and Comparisons of Nested Models for Public Regard

Model	χ^2	df	CFI	RMSEA (90% CI)	$\Delta\chi^2(\Delta df)$
School racial composition					
1. Unconstrained	13.07	13	.99	.01 (.01–.07)	
2. Constrained	18.51	18	.99	.01 (.01–.06)	
Model 1 vs. Model 2					5.44 (5)
3. Fully constrained	56.28	33	.81	.05 (.03–.08)	
Model 2 vs. Model 3					37.77 (15)*
Neighborhood racial composition					
1. Unconstrained	5.20	13	.99	.01 (.01–.02)	
2. Constrained	6.48	18	.99	.01 (.01–.0)	
Model 1 vs. Model 2					1.28 (5)
3. Fully constrained	24.67	33	.99	.05 (.01–.03)	
Model 2 vs. Model 3					18.19 (15)

Note. CFI = comparative fit index; RMSEA = root mean square error of approximation.
* $p < .05$.

racially discriminatory incidents in schools with greater racial diversity (Seaton & Yip, 2009). Thus, there may be a relation between late pubertal timing, racialized peer victimization and being in contexts that are not majority Black for Black girls with later pubertal timing. It is important to note that our findings contribute to the sparse research illuminating the effects of late pubertal timing on internalizing problems such as anxiety and depression among Black girls (Carter et al., 2009; Michael & Eccles, 2003). The varied experiences of Black girls may lead late developers to perceive positive qualities associated with being Black, but they may also lead them to see difficulties associated with late pubertal changes.

The results suggest that low public regard levels were more strongly related to depressive symptoms among early maturing girls, and this relation was stronger for girls attending schools that were not predominantly Black. Black girls with low public regard levels believe that the broader society views their racial group negatively (Sellers et al., 1997). However, it is possible that there are advanced social role expectations for early developing girls since their appearance is more physically mature, and in turn they are expected to act more mature. Similarly, early maturing Black girls may be exposed to increasing racial discriminatory experiences from adult perpetrators, which may explain the link between early pubertal timing and depressive symptoms. Previous research indicates that Black youth report increasing racially discriminatory incidents from adult perpetrators as they age (Greene, Way, & Pahl, 2006) often with adults in positions of authority like teachers, shopkeepers and police officers (Rosenbloom & Way, 2004). When considering the school context, Black adolescents reported that their teachers possessed low academic expectations and troubling stereotypes of them (Rosenbloom & Way, 2004). These adult racial discrimination experiences may be exacerbated for early maturing Black girls as prior research indicates that White adults overestimated the age of Black adolescents compared with White adolescents (Goff, Jackson, Di Leone, Culotta, & DiTomasso, 2014). Specifically, Black children were considered to be adolescents and Black adolescents were considered to be young adults by White adults (Goff et al., 2014). These experiences may be more likely to occur in schools that are predominantly White or racially diverse as opposed to predominantly Black schools. Early maturing Black girls who subscribe to the view that the broader society considers Blacks negatively may be at risk if they experience more adult racial discrimination experiences in school settings that are not predominantly Black. Consequently, early maturing girls may be unprepared for the challenges associated with looking like an adult woman and being the recipient of increased discriminatory experiences from adult perpetrators in predominantly White or racially diverse schools.

Though private regard was shown to be a moderator in previous research among Black adolescents (Seaton, 2009), the current results suggest no evidence of moderation with pubertal timing. The extent to which Black girls feel positively or negatively toward membership in their respective racial group, does not play a role in the association between pubertal timing and depressive symptoms. One explanation concerns body dissatisfaction, which may be relevant in the pubertal timing and racial identity association among Black adolescent females. Previous research indicates that Black college students with high private regard levels and low body dissatisfaction levels had higher self-esteem compared to

college students who also had high private regard levels but reported greater body dissatisfaction levels (Oney, Cole, & Sellers, 2011). Thus, the group with the highest self-esteem felt positive about their racial group and felt positive about their physical appearance. It may be necessary for Black adolescent females to feel positive about both their racial group membership and their developing bodies in the context of pubertal development but future research should disentangle these relations.

The results indicate that neighborhood racial composition did not moderate the associations between pubertal timing, racial centrality, public regard, and depressive symptoms. Previous research has illustrated that neighborhood racial composition attenuated the relation between early pubertal timing and internalizing symptoms for Mexican American girls (White et al., 2012). Yet, there are no significant effects for neighborhood racial composition regarding the pubertal timing, racial identity, and depressive symptoms association. There may be other aspects of the neighborhood that are more important among Black girls. Prior work illustrates that pubertal development was positively linked to alcohol use, which was amplified for Black girls residing in high disadvantaged neighborhoods (Tanner-Smith, 2012). Disadvantaged neighborhoods were operationalized economically such as the proportion of single female-headed households, the proportion of households receiving public assistance, and the proportion of persons below the poverty level (see Tanner-Smith, 2012). The effects of early pubertal maturation were heightened among Black girls who lived in neighborhoods characterized as economically impoverished (Tanner-Smith, 2012). It is possible that whether a neighborhood amplifies or attenuates the effects of early or late pubertal development may depend on whether the neighborhood's economic or racial profile is being examined given the nonsignificance in the present study. It may be especially relevant to consider the economic profile of one's neighborhood and adolescent girls' household socioeconomic status (SES) as previous research reported interesting findings related to household income, father absence and pubertal development among African American girls (Deardorff et al., 2011). Future research needs to disentangle the relation among neighborhood characteristics, pubertal development, and racial identity among Black girls.

The current study provides evidence for the context amplification hypothesis and PVEST, suggesting that racial identity and school racial context moderate the effects of pubertal timing differentially for early and late maturing Black girls. The results support the notion that the psychological effects of pubertal timing on internalizing symptoms are context dependent (see Natsuaki, 2013). We found that racial identity dimensions moderate the relation between pubertal timing and depressive symptoms differently for early and late maturing Black girls, and school racial composition is an important moderator for these associations. High racial centrality levels were more strongly related to depressive symptoms for late maturing girls attending schools that were not predominantly Black. Yet, low public regard levels were more strongly related to depressive symptoms among early maturing girls attending schools that were not predominantly Black. We find evidence of the mechanisms by which context moderates the effect of pubertal timing since the moderating capacity of specific racial identity dimensions varies for early and late maturing Black girls attending schools that are not predominantly Black. Future re-

search should examine additional mechanisms in the relation between pubertal timing and adverse outcomes among Black girls.

Limitations and Conclusion

There are several limitations that should be noted. The study relied on self-reports to assess pubertal timing, which is consistent with prior research. Yet, the relation between pubertal timing and outcomes depends on the rater (e.g., parent, adolescent, physician; see Dorn, Susman, & Ponirakis, 2003), and future studies should include multiple raters. Similarly, the PDS reflects self-perception of puberty rather than corresponding directly to actual pubertal stage by physical exam, thus it is possible that the depressive symptomatology would be different as a function of which reference group—peers, siblings, media, friends—the girl is using as a reference point. There is also potential for individual concerns about puberty to influence a girls' perceptions of their pubertal stage. More research is needed to examine the ways in which the physical and hormonal changes associated with puberty are made meaningful to girls. A final related point concerns the relatively low reliability for the PDS ($\alpha = .60$) observed in this study. Future studies should include an even broader source assessment approach for measuring puberty than that used in this study. The study was also cross-sectional so future research should focus on longitudinal examinations of pubertal timing, racial identity and depressive symptoms for clarity. The current research utilized a convenience sample of mid-to-late Black adolescent girls so the results may not generalize to Black girls in early adolescence or other settings. A related point is the inability to examine ethnicity as a moderator given that Black Americans comprise individuals with varied languages, countries of origin, histories, cultural beliefs, and socialization practices (Hopp & Herring, 1999). This diversity may influence the meaning that adolescent girls attribute to pubertal changes (Carter et al., 2011) and the meaning and significance linked to ethnic/racial identity.

The interplay between pubertal timing, racial identity, and racial context was examined among Black adolescent females. Specific racial identity dimensions are adaptive with pubertal timing, which adds to existing literature illustrating the protective capacity of racial identity among Black youth. The results also suggest that bridging biological transitions with a critical developmental task (e.g., racial identity) amid specific contexts (e.g., school racial composition) further elucidates the social experiences of Black girls during adolescence. Future research is necessary to understand how Black youth's social contexts are linked to pubertal development.

The findings have implications for schools. When designing programs to educate girls about pubertal development, schools should promote multiple body ideal norms so that girls are encouraged to critique the thin-ideal. Programs that deemphasize the thin-ideal may be instrumental in reducing early developing girls' susceptibility to depression. Similarly, there are benefits and challenges with racial/ethnic diversity that have not been systematically examined in the school context during the pubertal transition. Current findings suggest the presence of more same-race peers and less school diversity has protective functions. The challenge for future research is to identify the specific conditions in which having more same-race peers is beneficial. Replications with multiple racial/ethnic groups may stimulate new thinking about the

numerical racial representation of one's peer group when examining how girls shape their ethnic/racial identities during pubertal development while trying to fit in or stand out.

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