

Gender Differences in the Relationship of Puberty with Adolescents' Depressive Symptoms: Do Body Perceptions Matter?

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Abstract This study explored how pubertal status is related to depressive symptoms among adolescent boys and girls and whether body perceptions explained this relationship. This study is based on a national random US sample of adolescents from the National Longitudinal Study of Adolescent Health (9,011 girls and 8,781 boys). Results showed that boys and girls responded differently to puberty. During the transition to puberty boys had higher depressive symptoms than post-pubertal boys, due to perceptions that they were not as physically large and developed as their peers. Pre-pubertal and post-pubertal boys did not significantly differ on depressive symptoms. Post-pubertal girls had higher depressive symptoms than pre-pubertal girls, due to perceptions that they were overweight and more physically developed than their peers.

Keywords Adolescence · Body · Depressive symptoms · Gender · Puberty

Adolescence is a time of rapid physical, social, and emotional change, which includes gender differences in psychological well-being that develop during this life stage. During early and middle childhood, girls and boys have similar levels of psychosocial adjustment, and some studies even indicate that girls have better adjustment than boys do at this age (Angold et al. 1998; Petersen et al. 1991; Wichstrom 1999). However, in late childhood and early adolescence, gender differences in psychosocial adjustment change significantly, so that, by late adolescence, girls have

much higher depressive symptoms than boys (Angold et al. 1998; Petersen et al. 1991; Wichstrom 1999). A possible reason for this increase in depressive symptoms for girls could be a different relationship between pubertal status and psychosocial adjustment for girls and boys.

Studies indicate that pubertal status is related to the psychosocial adjustment of adolescents (Angold et al. 1998; Benjet and Hernandez-Guzman 2001; Compian et al. 2004; Ge et al. 2001a, b; Wichstrom 1999). However, these relationships vary by gender, such that puberty generally decreases girls' psychosocial adjustment, whereas it improves boys' psychosocial adjustment. There are two possible explanations for this relationship. First, these results could be due to biological changes that accompany puberty, including changes in hormones or the size and shape of the body. Alternatively, these influences could be due to the psychosocial impact on how adolescents perceive themselves and their bodies. The current study was designed to explore gender differences in the relationship between pubertal status and adolescents' depressive symptoms and whether body mass index (i.e., a measure of objective physical bodily changes) or body perceptions can explain this relationship.

Gender, Puberty, and Psychosocial Adjustment

For girls, puberty is generally associated with poorer psychosocial adjustment (Angold et al. 1998; Benjet and Hernandez-Guzman 2001; Wichstrom 1999), although some studies have not shown this relationship (Brooks-Gunn and Warren 1989; Richards and Larson 1993; Rierdan and Koff 1980). Post-pubertal boys often have better psychosocial adjustment than pre-pubertal boys (Angold et al. 1998; Benjet and Hernandez-Guzman 2001;

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Gaddis and Brooks-Gunn 1985; Richards and Larson 1993). Some research, however, shows that higher hormone levels, which accompany pubertal change, are negatively associated with boys' psychosocial adjustment as well as girls' (Susman et al. 1985).

Although puberty (and in some cases, higher hormone levels) are related to poorer psychosocial adjustment for girls, which is often assumed to be due to biological changes, this assumption may be premature. A feminist perspective posits that girls are socialized to feel negatively about their bodies and normal pubertal bodily changes (Freedman 1986). For instance, the media and authorities have negatively portrayed the menses, which makes women and girls perceive this experience negatively (Chrisler et al. 1994). Likewise, the curviness and increased body mass that accompany puberty for girls is negatively portrayed by the media, which emphasizes a thin body ideal for both girls and women (Freedman 1986). The result is that adolescent girls develop negative body images that result in poor psychosocial adjustment including depression, whereas adolescent boys' body images and psychosocial adjustment both become more positive compared to childhood (Freedman 1986).

Puberty, Body Perceptions, and Psychosocial Adjustment

Puberty brings about changes in the body that are both physical and perceptual. During puberty, girls' bodies become more curved and attain greater body mass, whereas boys' bodies become larger and more muscular. Girls respond negatively to this increase in curviness and body mass, because girls are socialized to focus upon their appearance with thinness as an ideal. The ideal of thinness is indoctrinated by both the media and peers. For instance, women's and teenage girls' magazines and advertisements emphasize thinness as an obtainable goal that will bring happiness (Kilbourne 1994; Malkin et al. 1999). Adolescents also often use media images and peers as a comparison point for their own body perceptions (Jones 2001; Jones et al. 2004). Furthermore, peer interactions focus upon girls' appearance, and peers negatively sanction girls through teasing or exclusion for violating appearance norms of beauty including expectations for thinness (Eder et al. 1995). Likewise, peers also negatively sanction girls whose bodies develop too soon (Summers-Effler 2004).

The ideal of thinness is used to control girls and women and decrease their power by making them focus upon appearance rather than women's rights (Wolf 1991). As women gained more power in society, the ideal for women became thinner (Wolf 1991). The current ideal body type is so thin that most women could never attain this ideal (Kilbourne 1994). Thus, through this process, thinness

becomes an unattainable goal, which often overshadows other achievements, including work and educational achievements, resulting in negative body consciousness, eating disorders, and poor psychosocial adjustment (Wolf 1991).

The focus of socialization upon thinness for girls is apparent in the gender differences in ideal body types. Boys are much more likely than girls to desire to be bigger. Boys also have a much larger range of acceptable body types, as some desire to be bigger, others smaller, and others prefer to be the same size as they are (Grogan and Richards 2002; Parks and Read 1997; Yates et al. 2004). For girls, one ideal body type predominates; thus, most girls desire to be thinner (Forbes et al. 2001; Kim and Kim 2001; Wardle and Marsland 1990; Yates et al. 2004).

These ideal body types are manifested in girls' and boys' body perceptions. Boys tend to perceive themselves as too small and to adopt strategies to gain body mass, whereas girls are much more likely to perceive themselves as overweight and to adopt strategies to lose weight (Levinson et al. 1986; McCabe and Ricciardelli 2001). These gender differences contradict differences in BMI, because boys are more likely to be overweight than girls are (Pritchard et al. 1997). Furthermore, even many normal weight girls think that they are overweight (Kim and Kim 2001; Konstanski and Gullone 1998; Pritchard et al. 1997).

These differences in body perceptions are related to psychosocial adjustment. For instance, adolescents with a larger perceived body size and a desire to be thinner generally have lower psychosocial adjustment, especially among girls (Hesse-Biber et al. 1987; Kim and Kim 2001; Konstanski and Gullone 1998; Pesa et al. 2000; Rierdan and Koff 1997). Furthermore, body development is also related to poorer psychosocial adjustment. For instance, compared to smaller-breasted women, women with larger breast size have worse body images and more weight dissatisfaction, which are related to worse psychosocial functioning (Koff and Benavage 1998). These differences in psychosocial adjustment are largely due to perceptions rather than objective differences in body mass, as body perceptions have a stronger relationship with psychosocial adjustment than BMI does (Kim and Kim 2001; Konstanski and Gullone 1998; Pesa et al. 2000; Rierdan and Koff 1997). Thus, because the bodily changes that occur during puberty tend to contradict the ideal body type of girls but not boys (Ge et al. 2001b; Warren 1983), these bodily changes should have more adverse psychosocial consequences for girls than boys.

The Current Study

In the current study, I hypothesized that post-pubertal girls would have higher depressive symptoms than pre-pubertal

girls, whereas post-pubertal boys were expected to have lower depressive symptoms than pre-pubertal boys. The relationship between puberty and depressive symptoms was expected to be explained by body perceptions. Compared to pre-menarcheal girls, post-menarcheal girls were expected to feel overweight and more physically developed than their peers, which resulted in higher depressive symptoms. Compared to boys whose voices had not changed, boys whose voices had changed completely were expected to feel less underweight and to feel more physically developed than their peers, which resulted in lower depressive symptoms. In this way, the bodily changes that occur during puberty are perceived negatively by girls and positively by boys, because they are consistent with boys' ideal body types but are contrary to girls' ideal body types. The result of this process is that post-pubertal girls have higher depressive symptoms than post-pubertal boys. Thus, this result would indicate that psychosocial factors explain the gender differences in the relationship between puberty and depressive symptoms. This study also indicated whether objective or subjective measures of body size had a stronger relationship with depressive symptoms.

Method

Participants

This study is based on data from the 1995 National Longitudinal Study of Adolescent Health (Add Health). Add Health is a school-based study of adolescents in grades 7 through 12 from a nationally-representative, random US sample of 80 high schools and their "feeder" junior or middle schools during the 1994–1995 school year. The sample included several oversampled populations including the disabled, upper class Blacks, and twins; and thus, weights were used in the analyses to correct for this oversampling. The sample size for this study was 8,781 boys and 9,011 girls.

Table 1 shows the weighted sample characteristics. Three percent of the sample ($n=480$) had an underweight BMI, whereas 11% ($n=2,028$) had an overweight BMI. Thirty-one percent of the sample ($n=5,551$) perceived that they were overweight, whereas 17% of the sample ($n=3,007$) perceived that they were underweight. Similarly, 33% of the sample ($n=5,924$) were trying to lose weight, whereas 19% of the sample ($n=3,345$) were trying to gain weight. Forty percent of the sample ($n=7,188$) perceived that they were more developed than their peers, whereas 21% ($n=3,647$) perceived that they were less developed than their peers. Ninety-one percent ($n=8,287$) of the girls had experienced menarche. Fourteen percent ($n=1,259$) of the boys said that they had had no voice change, whereas 35% ($n=3,060$) had experienced some voice change, and

51% ($n=4,462$) had experienced a lot of voice change. Forty-nine percent of the sample were girls, whereas the unweighted gender difference was 51% girls ($n=9,011$). The sample was about 68% White ($n=12,062$) with approximately 15% Black ($n=2,704$), 12% Hispanic ($n=2,064$), 4% Asian ($n=641$), and 2% "other" race ($n=320$). Approximately 29% of the sample ($n=5,088$) lived in a single parent family (reference category), about 11% ($n=1,868$) lived in a stepfamily, 55% ($n=9,786$) lived in a two-parent biological family, and 6% ($n=1,050$) did not live with their parents. The average age of the sample was 15.5 years. Approximately 11% of the sample ($n=1,868$) was on welfare. On average, both father and mother had had 13 years of education, and the average family income was \$45,788.

Table 1 Selected sample characteristics (weighted).

	Mean or percent for categorical variables	SD
Gender		
Girls	49.0%	.500
Pubertal status		
Menarche	90.8%	.290
No voice change	13.8%	.345
Some voice change	35.1%	.477
Mental health		
Depressive symptoms	.472 (Range: 0–3) ^a	.399
BMI		
Underweight BMI	2.7%	.161
Overweight BMI	11.4%	.318
Perceptions for body size		
Perceived overweight	31.2%	.464
Perceived underweight	16.9%	.375
Trying to lose weight	33.3%	.471
Trying to gain weight	18.8%	.390
Perceptions for physical development		
More developed	40.4%	.491
Less developed	20.5%	.404
Control variables		
Black	15.2%	.359
Hispanic	11.6%	.320
Asian	3.6%	.186
"Other" race	1.8%	.132
Stepfamily	10.5%	.306
Two parent biological family	55.0%	.498
Does not live with parents	5.9%	.236
Age (in years)	15.521 (Range: 11–20)	1.800
Welfare	10.5%	.307
Father's education (in years)	13.231 (Range: 8–18)	2.613
Mother's education (in years)	13.176 (Range: 8–18)	2.538
Family income		
(in thousands of dollars)	45.788 (Range: 0–999)	42.688

^a Scale ranges from 0 indicating "never or rarely" to 3 indicating "most of the time."

Procedure

Add Health researchers collected in-school questionnaires from students present on the day the questionnaires were administered. They also selected a nationally representative sample of students in the schools to participate in an in-home interview. This analysis was based on the in-home data. Only the base year data were used in this study. The data from follow-up years were not utilized because there was already limited variability in pubertal status in the base year, especially among girls, which became even more limited in each additional year. Also, the second wave (first follow-up) was collected only 1 year after the base year, which resulted in limited variability in depressive symptoms across time.

Measure

Depressive symptoms

Depressive symptoms were assessed with a modified version of the Center for Epidemiological Studies' Depression Scale (CES-D), which measures the occurrence of 15 depressive symptoms over the past week, such as being unable to shake off the blues, feeling depressed, and feeling lonely (Radloff 1977; Ross and Mirowsky 1984). Response categories ranged from (0) "never or rarely" to (3) "most of the time." In the current study, Cronbach's alpha is .86.

Puberty

Puberty was indicated by menarche for girls and by levels of voice change for boys. Previous research has shown that voice change is a good indicator of puberty for boys (Benjet and Hernandez-Guzman 2001). Voice change is also one part of the Pubertal Development Scale, which is often used to measure boys' pubertal status (Ge et al. 2001a). For menarche, girls were asked the following yes/no question: "Have you ever had a menstrual period (menstruated)?" For voice change, boys were asked, "Is your voice lower now than it was when you were in grade school?" Voice change is indicated by whether boys have no voice change ("No it is about the same"), some change ("Yes it is a little lower" or "Yes it is somewhat lower"), or a lot of change ("Yes it is a lot lower" or "Yes it is a whole lot lower"). Some categories were combined to increase the sample size for the categories, and a lot of change was the reference category (i.e., comparison group) for this three-category dummy variable.

The measurement of pubertal status was potentially problematic, because the measures were self-reported and included some subjective evaluation, especially for boys.

The common way to measure pubertal status for boys is to use the Pubertal Development Scale, which is also based upon self-reported data (Petersen et al. 1988). These self-reports of pubertal status have been found to be reliable and valid (Petersen et al. 1988).

BMI

Body mass index was calculated with self-reported height and weight. The formula used was (weight in pounds divided by height in inches squared) multiplied by 703 (United States Department of Health and Human Services 2004). Previous research shows a high correlation between self-reported and actual height and weight for adolescents (Crockett et al. 1987; Palta et al. 1982; Stewart 1982). Because body mass differs by gender and age, the Center for Disease Control's (2000a, b) growth charts for children were used to calculate the appropriate cut-points for overweight and underweight BMI separately for each gender and age.

Body perceptions

Two aspects of body perceptions were measured—perceptions of body size and perceptions of physical development. Perceptions of body size were measured by two types of items. First, perceived body size was indicated by perceptions of overweight and underweight relative to perceptions of being the correct size. The respondents were asked, "How do you think of yourself in terms of weight?" Respondents could indicate that they perceived they were overweight (as indicated by "slightly overweight" or "very overweight"), underweight (as indicated by "slightly underweight" and "very underweight"), or the correct weight (as indicated by "about the same weight"). The correct weight was the reference category for this three-category dummy variable. A second categorical measure of body size indicates whether adolescents were trying to "lose weight," "gain weight," or "stay the same weight." These responses were available for the following question: "Are you trying to lose weight, gain weight, or stay the same weight?" Stay the same weight was the reference category for this three-category dummy variable. Finally, perceptions of relative physical development were indicated by the relative rate of development compared to their same age, same gender peers. For instance, girls were asked: "How advanced is your physical development compared to other girls your age?" Boys were asked: "How advanced is your physical development relative to other boys your age?" The response categories ranged from (1) "I look younger than most" to (5) "I look older than most."

Perceived relative physical development was indicative of not only the potential impact of physical development upon depressive symptoms, but also included development relative to peers. Thus, this measure can also be considered a subjective measure of pubertal timing. Considering that early maturing adolescents, especially girls, tend to have more problems with psychosocial adjustment than adolescents who mature at the normal age (Ge et al. 1996; Graber et al. 1996; Graber et al. 1997; Kaltiala-Heino et al. 2003; Magnusson et al. 1985; Siegel et al. 1999; Swarr and Richards 1996), this variable is a useful control for pubertal timing. An objective measure of pubertal timing was not available in this Add Health data set for boys; thus, for consistency, a subjective measure was used for both boys and girls.

Control variables

Six potential social correlates of depressive symptoms were assessed in the current study: age, race–ethnicity, family structure, mother’s and father’s education, household income, and welfare status. Age indicated years of age, whereas race–ethnicity was measured as Black, Hispanic, and “other” race with White as the reference category. Family structure was indicated by whether the respondent lived in a stepfamily, lived in a two-parent biological family, lived alone (i.e., did not live with parents), or lived in a single-parent family. Mother’s and father’s education was indicated by years of education, whereas household income was measured as income in thousands of dollars, which was based upon parental report. Welfare status indicated whether or not either residential mother or father was currently receiving welfare.

Data analysis

First, in the preliminary analyses, means tests indicated whether there were gender and pubertal differences in body perceptions and depressive symptoms. Effect sizes (d) were also shown to indicate the relative magnitude of these relationships, as the sample size was large (Cohen 1988). Then, multivariate regression analyses were conducted to determine whether pubertal status was related to adolescents’ depressive symptoms controlling for covariates. These analyses were performed separately by gender, because measures of pubertal status differed by gender. An additional control for BMI was added to test whether the bodily changes that influence depressive symptoms were due to objective bodily changes, such as BMI, or subjective body perceptions. Measures of body perceptions were added separately to determine which aspects of body perceptions

explained the association between pubertal status and adolescents’ depressive symptoms.

Because Add Health’s sampling design sampled students based upon schools, sampled students were not selected independently. Therefore, analyses were performed in STATA using robust standard errors to account for the effects of the multistage, stratified, school-based, clustered sampling design using the strategy specified by Chantala and Tabor (1999). All descriptive statistics, bivariate correlations, and multivariate analyses used nationally representative weights to adjust for oversampling.

Results

Preliminary analyses

Table 2 shows how the means for depressive symptoms, BMI, body size perceptions, and physical development perceptions differed by gender, menarche, and voice change. These results show substantial gender differences in most of the study variables. Girls reported higher depressive symptoms. Although there were no gender differences in underweight BMI, boys were more likely to have an overweight BMI. However, girls were more likely to perceive that they were overweight and were more likely to be trying to lose weight. Boys were more likely to perceive that they were underweight and were more likely to be trying to gain weight. Finally, girls were more likely to perceive that they were more developed than their peers, whereas boys were more likely to perceive that they were less developed than their peers.

As shown in Table 2, the effect sizes (d) generally indicated that the gender differences in these variables were small, as most of the effect sizes were .20 or smaller. For example, the effect size for the gender difference in depressive symptoms was small at .26. Some of the effect sizes for gender differences in perceptions of body size reached medium (or near medium) size levels, such as the effect sizes for perceived overweight at .37, trying to lose weight at .56, and trying to gain weight at .58.

Menarche status also was related to the study variables (as shown in Table 2). Post-menarcheal girls reported higher depressive symptoms than pre-menarcheal girls. Post-menarcheal girls were less likely to have had an underweight BMI and to perceive that they were underweight than pre-menarcheal girls. Girls who had experienced menarche were also less likely to be trying to gain weight than pre-menarcheal girls. Even though they were not more likely to have had an overweight BMI, post-menarcheal girls were significantly more likely to perceive that they were overweight and to be trying to lose weight than pre-menarcheal girls. Finally, post-menarcheal girls were more likely to perceive that they were more developed than their peers and were less likely to per-

Table 2 Means, standard deviation, and effect sizes for survey variables by gender, menarche, and voice change (weighted).

	Girls		Boys		Menarche		No menarche		No voice change		Some voice change		A lot of voice change				
	Mean or %	SD	Mean or %	SD	d	Mean or %	SD	d	Mean or %	SD	Mean or %	SD	Mean or %	SD			
Mental health																	
Depressive symptoms	.524***	(.429)	.421	(.361)	.26	.531**	(.429)	.455	(.425)	.18	.441	(.375)	.428	(.366)	.412	(.353)	.08 ^d
BMI																	
Underweight	2.2%	(.148)	3.0%	(.172)	.05	1.9%***	(.137)	5.4%	(.226)	.24	4.3% ^a	(.203)	3.7% ^a	(.190)	2.2% ^{bc}	(.148)	.12 ^d
BMI																	
Overweight	9.5%***	(.294)	13.2%	(.338)	.12	9.6%	(.294)	9.3%	(.291)	.01	15.0%	(.358)	12.5%	(.331)	13.1%	(.338)	.07 ^e
Perceptions for body size																	
Perceived overweight	40.0%	(.490)	22.9%	(.420)	.37	40.8%**	(.492)	31.4%	(.464)	.19	23.8%	(.426)	22.1%	(.415)	23.2%	(.422)	.04 ^e
Perceived underweight	11.1%***	(.314)	22.5%	(.418)	.30	10.3%***	(.304)	19.1%	(.393)	.28	18.4% ^b	(.388)	25.0% ^{ac}	(.433)	21.9% ^b	(.414)	.16 ^e
Trying to lose weight	46.8%***	(.499)	20.5%	(.404)	.56	47.9%***	(.500)	36.0%	(.480)	.24	23.6% ^b	(.425)	19.6% ^c	(.397)	20.2%	(.402)	.10 ^e
Trying to gain weight	7.3%***	(.260)	29.8%	(.457)	.58	6.7%***	(.249)	13.7%	(.344)	.27	27.4%	(.446)	29.8%	(.457)	30.4%	(.460)	.07 ^d
Perceptions for physical development																	
More developed	42.2%**	(.494)	38.7%	(.487)	.07	44.4%***	(.497)	21.0%	(.408)	.47	24.4% ^a	(.430)	27.9% ^a	(.448)	50.0% ^{bc}	(.500)	.53 ^d
Less developed	18.9%**	(.392)	22.0%	(.414)	.08	16.9%***	(.375)	39.2%	(.488)	.57	41.6% ^{ab}	(.493)	28.2% ^{ac}	(.450)	12.5% ^{bc}	(.331)	.70 ^d
N	9,011		8,781			8,287		724		1,259		3,060		4,462			

* $p < .05$; ** $p < .01$; *** $p < .001$ ^aSignificantly differs from a lot of change; $p < .05$.^bSignificantly differs from some change; $p < .05$.^cSignificantly differs from no voice change; $p < .05$.^dCompares the largest difference in means—little change compared to a lot of voice change.^eCompares largest difference in the means—little change compared to some voice change.

ceive that they were less developed than their peers compared to pre-menarcheal girls. The effect sizes (*d*) for the differences between post-menarcheal and pre-menarcheal girls were generally small at .20 levels or smaller (as shown in Table 2). Although a few effect sizes for menarche status differences in body perceptions were slightly above .20, there were only two effect sizes that reached medium size levels—perceptions of physical development for feeling more developed (*d*=.47) and less developed (*d*=.57) than their peers.

For boys, voice change was not significantly associated with depressive symptoms, as indicated by the mean differences (see Table 2) But, there was a significant difference between some change and a lot of change, once the control variables were adjusted for (as shown in Model 1 of Table 4). BMI and perceptions of body size differed by pubertal status for boys (as shown in Table 2). Boys whose voices had changed a lot were less likely to have an underweight BMI than boys whose voices had changed none or some. However, boys whose voices had changed some were more likely to perceive that they were underweight compared to either boys who had a lot or no voice change. There were no significant differences by pubertal status for overweight BMI or perceptions of overweight for boys, but boys who had no voice change were more likely to be trying to lose weight than boys with some voice change. Finally, there were differences in perceptions of relative physical development by pubertal status for boys. Boys whose voices had changed a lot were more likely to perceive that they were more developed than their peers compared to boys who had experienced no or some voice change. Furthermore, boys whose voices had changed a

lot were less likely to perceive that they were less developed than their peers compared to boys whose voices had changed none or some. Boys whose voices had changed some were also less likely to perceive that they were less developed than their peers compared to boys with no voice change.

As shown in Table 2, the effect sizes (*d*) for boys were calculated to reflect the largest difference in the means for the three categories. The largest differences were sometimes between no voice change and a lot of voice change and other times were between some and no voice change. The effect sizes for differences in the study variables by boys' pubertal status were generally small. The only effect sizes to reach medium size levels were the effect sizes for boys' pubertal status differences in feeling more developed (*d*=.53) and less developed (*d*=.70) than their peers.

Puberty and depressive symptoms

Tables 3 and 4 show the multivariate results for girls and boys respectively. Model 1 shows the relationship of pubertal status with depressive symptoms. All of these models included controls for correlates. Post-menarcheal girls had higher depressive symptoms than pre-menarcheal girls (*b*=.045; *p*<.05). Boys who had experienced some voice change had higher depressive symptoms than boys who had experienced a lot of voice change (*b*=.025; *p*<.05). Boys who had experienced no voice change did not differ significantly on depressive symptoms from either boys who had experienced a lot of voice change or boys who had experienced some change (*b*=.020; *p*>.05 and *b*=.005; *p*>.05, respectively).

Table 3 Depressive symptoms regressed upon menarche, BMI, and body perceptions for girls (weighted; *n*=9,011).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	<i>b</i>	se	<i>b</i>	se	<i>b</i>	se	<i>b</i>	se	<i>b</i>	se	<i>b</i>	se
Pubertal status												
Menarche	.045*	(.021)	.046*	(.021)	.036	(.020)	.050*	(.021)	.031	(.021)	.054*	(.022)
BMI												
Underweight BMI			.044	(.037)	.095*	(.037)	.018	(.038)	.057	(.038)	.036	(.037)
Overweight BMI			.034	(.022)	-.035	(.023)	.040	(.021)	.025	(.022)	.037	(.021)
Perceptions of body size												
Perceived overweight					.079***	(.017)						
Try to lose weight					.068***	(.015)						
Perceived underweight							-.022	(.022)				
Try to gain weight							.100***	(.028)				
Perceptions of physical development												
More developed									.060***	(.012)		
Less developed											.033	(.017)
Constant	.375	(.064)	.367	(.065)	.336	(.063)	.358	(.064)	.326	(.066)	.362	(.065)
<i>R</i> ²	.053		.053		.071		.056		.058		.054	

Controls (included in all models) are age (in years), race–ethnicity, family structure, mother’s and father’s education (in years), household income (in thousands of dollars), and welfare status.

p*<.05; *p*<.01; ****p*<.001

Table 4 Depressive symptoms regressed upon voice change, BMI, and body perceptions for boys (weighted; $n=8,781$).

	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6	
	<i>b</i>	se	<i>b</i>	se	<i>b</i>	se	<i>b</i>	se	<i>b</i>	se	<i>b</i>	se
Pubertal status												
No voice change	.020	(.019)	.019	(.019)	.018	(.019)	.021	(.019)	.028	(.019)	.014	(.020)
Some voice change	.025*	(.012)	.024*	(.012)	.025*	(.011)	.022	(.012)	.032**	(.012)	.022	(.012)
BMI												
Underweight BMI			.023	(.031)	.031	(.031)	-.008	(.030)	.031	(.031)	.020	(.030)
Overweight BMI			.001	(.016)	-.032	(.019)	.017	(.016)	-.005	(.016)	.002	(.016)
Perceptions of body size												
Perceived overweight					.027	(.020)						
Try to lose weight					.032	(.018)						
Perceived underweight							.063***	(.014)				
Try to gain weight							.010	(.013)				
Perceptions of physical development												
More developed									.038**	(.013)		
Less developed											.018	(.013)
Constant	.167	(.076)	.167	(.076)	.151	(.076)	.164	(.075)	.151	(.075)	.166	(.076)
R^2	.057		.057		.060		.063		.059		.057	

Controls (included in all models) are age (in years), race–ethnicity, family structure, mother’s and father’s education (in years), household income (in thousands of dollars), and welfare status.

* $p < .05$; ** $p < .01$; *** $p < .001$

Puberty, BMI, and depressive symptoms

In Model 2 of Tables 3 and 4, analyses explored whether these differences were explained by variations in body mass index that often accompany pubertal changes. Underweight body mass index was not significantly associated with depressive symptoms for either girls or boys ($b = .044$; $p > .05$ and $b = .023$; $p > .05$, respectively). Likewise, overweight BMI was not associated with depressive symptoms for either girls or boys ($b = .034$; $p > .05$ and $b = .001$; $p > .05$, respectively). Thus, as BMI was not related to depressive symptoms, BMI did not explain the association between pubertal status and depressive symptoms. BMI was included in the rest of these models as an additional control for objective body mass changes.

Puberty, body perceptions, and depressive symptoms

Greater pubertal change was expected to be detrimental to girls due to their perceptions that their bodies were too large and more developed than girls their own age. On the other hand, lower pubertal change was expected to be detrimental to boys due to their perceptions that their bodies were too small and not as developed as boys their own age. Thus, perceptions regarding body size were separated into two categories—perceptions that their body size is too large compared to perceptions that their body size is too small. Model 3 added the two indicators of a perceived too large body size—perceptions of being overweight and trying to

lose weight. Model 4 added the two indicators of a perceived too small body size—perceptions of being underweight and trying to gain weight. Body perceptions regarding relative physical development were separated into the following two categories—perceptions of being more developed and less developed than their same age, same gender peers. Thus, Model 5 added the variable for perceptions of being more physically developed than their peers, whereas Model 6 added the variable for perceptions of being less physically developed than their peers.

Both perceptions of being overweight and trying to lose weight increased depressive symptoms for girls, as shown in Model 3 of Table 3 ($b = .079$; $p < .001$ and $b = .068$; $p < .001$, respectively). Menarche was not significant in this model ($b = .036$; $p > .05$). Thus, perceptions that their body size was too large explained the association between menarche and depressive symptoms. Whereas perceptions of underweight were not related to depressive symptoms ($b = -.022$; $p > .05$), trying to gain weight increased depressive symptoms for girls ($b = .100$; $p < .001$). However, these two indicators of perceiving that their bodies were too small did not explain the association between menarche and depressive symptoms, as menarche was still significantly related to depressive symptoms in Model 4 of Table 3 ($b = .050$; $p < .05$). Being less physically developed than their peers was not significantly related to girls’ depressive symptoms, as shown in Model 6 of Table 3 ($b = .033$; $p > .05$). But, being more physically developed than their peers was associated with higher depressive symptoms for girls ($b = .060$; $p < .001$) and

explained the association between menarche and depressive symptoms, as shown in Model 5 of Table 3 ($b=.031$; $p>.05$).

For boys, both perceiving that they were overweight and trying to lose weight were not significantly associated with depressive symptoms, as shown in Model 3 of Table 4 ($b=.027$; $p>.05$ and $b=.032$; $p>.05$, respectively). Boys with some voice change still had significantly higher depressive symptoms than boys with a lot of voice change ($b=.025$; $p<.05$). Thus, perceptions that their bodies were too large did not explain the association between voice change and boys' depressive symptoms. Trying to gain weight was not related to boys' depressive symptoms ($b=.010$; $p>.05$). However, perceptions of being underweight were related to higher depressive symptoms ($b=.063$; $p<.001$), which explained the difference in depressive symptoms between boys with some voice change and boys with a lot of voice change, as shown in Model 4 of Table 4 ($b=.022$; $p>.05$). Being more developed was related to higher depressive symptoms for boys ($b=.038$; $p<.01$), but did not explain the difference in depressive symptoms between boys with some voice change and boys with a lot of voice change, as shown in Model 5 of Table 4 ($b=.032$; $p<.01$). Although being less developed than their peers was only weakly associated with boys' depressive symptoms ($b=.018$; $p>.05$), the difference in depressive symptoms between boys with some voice change and a lot of voice change was insignificant, once being less developed was included in Model 6 of Table 4 ($b=.022$; $p>.05$).

Discussion

This study explored how pubertal status was related to depressive symptoms for both boys and girls and whether body perceptions explained these differences. Although boys' depressive symptoms were expected to be highest when they had undergone the least pubertal change, they were actually highest when their voices had undergone some change but had not changed a lot. This finding seems to imply that the relationship between pubertal change and depressive symptoms for boys is short-term occurring only during the transition to puberty, but boys' depressive symptoms are relatively stable both before and after puberty. For girls, depressive symptoms were highest post-menarche indicating that puberty is associated with lower psychological well-being. However, these findings do not indicate the underlying mechanism for the relationship between pubertal status and depressive symptoms.

Using a feminist perspective, I expected that the psychosocial processes of body perceptions explained gender differences in the relationship between pubertal status and depressive symptoms. That is, girls' body ideal of thinness is contrary to normal pubertal changes of increasing body mass and curviness. Thus, girls' depressive

symptoms were expected to be highest post-menarche, due to post-menarcheal girls being more likely than pre-menarcheal girls to perceive that they had larger body mass and greater physical development than their peers. This relationship was confirmed with perceptions of larger body mass and perceptions of being more developed than peers both explaining the relationship between girls' pubertal status and depressive symptoms. For boys, puberty is also associated with greater body mass and more physically developed bodies. As normal pubertal changes conform to boys' ideal body types of being larger and more developed, body perceptions were expected to explain why post-pubertal boys had lower depressive symptoms than pre-pubertal boys. Results instead indicated that boys who were in the transition to puberty appeared to be most detrimentally influenced by body image ideals and had higher depressive symptoms, due to perceptions that their bodies were too small. The findings also indicated that body perceptions had a stronger influence on depressive symptoms for girls and boys than body mass did. Thus, these results indicated that gender differences in ideal body types are important in understanding how body perceptions explain the relationship between pubertal status and the depressive symptoms of adolescent boys and girls.

These findings leave unanswered an important question regarding how to solve this problem. If body perceptions are a major component in explaining the gender divergence in depressive symptoms during adolescence, how is this process to be overcome? A possible solution is for the media to portray less restrictive and more realist body ideals for adult women; however, this goal may be difficult to achieve. Feminist research seems to indicate that other approaches would also be effective. First, some research indicates that providing positive portrayals of the adult female body would make women evaluate their bodies and experiences more positive. For instance, women who were given positive portrayals of the menses were more likely to indicate positive experiences than other women (Chrisler et al. 1994). Providing positive portrayals for the normal bodily changes that occur during puberty might be beneficial for changing girls' and women's perceptions of their body mass and development as well. Likewise, feminist approaches towards treating eating disorders suggest that the history of gender-role prescriptions upon women and girls must be recognized (Wooley 1995). Therefore, feminist therapy focuses upon the following goals for women and girls—empowerment, self-determination, and informed refusal of patriarchal ideals (Wooley 1995).

This research has some potential limitations. First, this study, due to data limitations, did not measure hormone levels, which have been shown by other research to influence the relationship between pubertal changes and adolescents' psychosocial adjustment (Brooks-Gunn and

Warren 1989; Susman et al. 1985). A similar problem is that other types of biological confounds, such as length of menses, were also not controlled in this research. While this research cannot completely discount the potential importance of biological factors, the relationship between pubertal status and depressive symptoms is explained in its entirety by body perceptions. Thus, this research provides strong support for the psychosocial factors of body perceptions being a large part of the explanation for this relationship. However, despite this finding, puberty is a complex experience that often involves the inter-play between both biological and psychosocial changes. Future research should explore the relationship between puberty and depressive symptoms more fully by considering how the biological components and the psychosocial aspects of puberty are inter-connected in their effects upon depressive symptoms.

Another potential problem is that the data set does not include continuous measures of pubertal change. This is particularly problematic for girls because puberty is measured as a distinct transition point indicated by an event, the initiation of menarche. Using a dichotomous measure to measure pubertal status probably does not completely capture the pubertal experience for girls (Brooks-Gunn et al. 1985). However, the research findings are still of significance, because they suggest a distinct difference in depressive symptoms both before and after menarche. Future longitudinal research is needed to determine whether each incremental change in pubertal status is related to a significant change in depressive symptoms. Future research should also explore racial–ethnic differences in the relationship between puberty and depressive symptoms as well as in the relationship between body perceptions and depressive symptoms. Although this data set has adequate samples of racial–ethnic groups to explore these issues, these analyses would be too extensive and lengthy to include in this current study.

An additional limitation is that the timing of puberty was indicated by a subjective rather than an objective measure. Thus, the results could potentially be different if an objective measure was more accurate. For instance, girls who experienced puberty early may be more likely to feel negatively about their bodies. Thus, they may be more likely to perceive themselves to be overweight than girls who experienced puberty on time or late. Similarly, girls who experienced puberty early may be particularly conscious of being more developed than their peers resulting in negative feelings about their bodies and higher depressive symptoms. Despite this alternative explanation, the results indicate that a subjective measure of relative development is an important explanation for the association between pubertal status and depressive symptoms. Moreover, previous research indicates that subjective measures of pubertal

timing are more significant than objective measures (Rierdan and Koff 1985).

Alternative explanations for boys seem less likely, because the results from the current study did not clearly indicate that early or late timing is problematic, as neither a lot of voice change nor no voice change were associated with higher depressive symptoms. Furthermore, although being more developed was significantly related to higher depressive symptoms for boys, perceived greater development did not explain the relationship between some voice change and depressive symptoms for boys. Thus, the stage in the pubertal transition appears important for boys but not the relative timing. However, these results still have limitations as well. The measure for boys is a perceptual measure rather than an objective measure. To the extent that boys misreport their own voice change, these results could also contain inaccuracies. Future research needs to confirm this finding for boys using objective measures of both pubertal status and timing.

Finally, this research explored this issue cross-sectionally rather than exploring this issue over time. The decision to explore this issue cross-sectionally was made for several reasons. First, variation in pubertal status for girls was already limited with 91% of girls having experienced menarche and the variability would become even more limited as girls aged. Variation in pubertal status among boys suffers from a similar, but less extreme, problem with only 14% of boys indicating no voice change. Additionally, the second wave of this data was collected only one year later than the base year, and thus, depressive symptoms showed limited change across this short time period. The third wave of this data would be inappropriate to use for this study, because the adolescents were all young adults by then and would be beyond the pubertal years. Third, the results indicate the relationship between pubertal status and depressive symptoms is short-term among boys and only limited to the time period when the pubertal transition is occurring. Finally, although there is always the possibility in cross-sectional research that the dependent variable of depressive symptoms could be the cause of the independent variable of pubertal status thereby reversing the causal order that was proposed in the current study, causal order is not likely to be a tremendous problem for this research. Because depressive symptoms are generally fairly low among prepubescent children, depressive symptoms are unlikely to be a cause of changes in pubertal status among adolescents. However, the causal order between depressive symptoms and body perceptions could be the opposite of the order expected in this current study, which should be considered by future research.

In conclusion, the current study highlights the role of body perceptions in understanding the way that pubertal status influences depressive symptoms. Although the effects

of biology cannot be ruled out, the current study indicates that the psychosocial aspects of puberty play an important role in why girls develop more depressive symptoms than boys during adolescence. Thus, the underlying explanation for the relationship between pubertal status and depressive symptoms is probably more due to psychosocial rather than biological factors. Furthermore, the solution for the gender divergence in depressive symptoms during adolescence should be sought by using a feminist approach to modify ideal body images for girls to be more in line with the normal bodily changes that occur during puberty.

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