A Longitudinal Evaluation of Adolescent Depression and Adult Obesity

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Background: Prior studies have had conflicting results regarding the relationship between adolescent depression and adult obesity.

Objective: To test the hypothesis that depression in adolescence would increase the risk for obesity in early adulthood.

Methods: We used data from a longitudinal study of a birth cohort of children born between April 1, 1972, and March 31, 1973, in Dunedin, New Zealand (N=1037). These data included regular diagnostic mental health interviews and height/weight measurements throughout childhood and adolescence. We performed logistic regression analyses to assess the relationship between major depression in early or late adolescence and the risk for obesity at 26 years of age.

Results: Major depression occurred in 7% of the cohort during early adolescence (11, 13, and 15 years of age) and 27% during late adolescence (18 and 21 years of age). At 26 years of age, 12% of study members were obese. After adjusting for each individual's baseline body mass index (calculated as the weight in kilograms divided by the square of height in meters), depressed late adolescent girls were at a greater than 2-fold increased risk for obesity in adulthood compared with their non-depressed female peers (relative risk, 2.32; 95% confidence interval, 1.29-3.83). A dose-response relationship between the number of episodes of depression during adolescence and risk for adult obesity was also observed in female subjects. The association was not observed for late adolescent boys or for early adolescent boys or girls.

Conclusions: Depression in late adolescence is associated with later obesity, but only among girls. Future studies should address reasons for these age and sex differences and the potential for intervention to reduce the risk for adult obesity in depressed older adolescent girls.

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Obesity, a leading cause of morbidity and mortality, is increasing to epidemic proportions in developed countries.

Among adults in the United States, 19% of men and 25% of women are obese. Despite growing awareness of nutritional and physical activity patterns that contribute to the development of obesity, the prevalence of obesity is increasing, particularly in children and adolescents. This has led to increased focus on prevention strategies in at-risk youth. However, successful prevention of obesity in youth requires further research into its etiology, correlates, and risk factors.

Depression has been implicated as a risk factor for the development of obesity in adults. Cross-sectional data show an increased risk for depression in obese women in weight-loss treatment and community-based populations compared with their nonobese peers. However, longitudinal studies of weight gain in depressed adults have had conflicting results, making the temporal sequence of depression and obesity unclear.

The prevalences of depression and obesity have been shown to increase from adolescence to young adulthood. Thus, understanding how depression and obesity interact during this period may provide useful information about the mechanisms involved and potential targets for intervention to prevent the development of obesity. To date, 4 longitudinal studies of major depression and obesity among adolescents have been conducted. Two of these studies found a significant longitudinal association between depression in adolescence and the subsequent development of obesity or increased body mass index (BMI, calculated as weight in kilograms divided by the square of height in meters) in adulthood. In contrast, the other 2 studies found no significant longitudinal association between adolescent depression and adult obesity.

One of the prior studies was...
conducted using data from the same longitudinal study as the present analysis, but the data were not examined for predictor ages other than 15 years, and follow-up data were limited to 21 years of age.19

Limitations of prior studies include inadequate sample size21,22 and age range16 to evaluate different phases of adolescence separately. Depression in early adolescence and childhood has been shown to have different patterns of symptoms,20,22 risk factors, and correlates21,24 compared with depression in late adolescence and young adulthood. Among the many symptom differences, psychomotor retardation has been shown to increase with age in depressed youth,20 whereas depressed younger children are more likely to experience agitation and anxiety.21,22 We hypothesized that these differences would result in a positive relationship between depression in late adolescence and subsequent obesity, but not in early adolescence. The purpose of the current study was to evaluate the role of depression in early and late adolescence on the development of obesity during early adulthood.

METHODS

STUDY DESIGN AND SAMPLE

The Dunedin Multidisciplinary Health and Development Study is an ongoing prospective longitudinal study of health, behavior, and development. The study sample consists of 1037 members (52% male) of a birth cohort born in Dunedin, New Zealand, between April 1, 1972, and March 31, 1973. Beginning at 3 years of age, study members underwent evaluation every 2 to 3 years up to 21 years of age and then again at 26 years of age (1998-1999), when 96% of the living cohort (n=980/1019) were seen. Details of the Dunedin Study have been published elsewhere.26 Cohort families represent the full range of socioeconomic status (SES) in the general population of New Zealand’s South Island and are primarily white. Human subjects approval for this study was obtained from the University of Otago Ethics Committee, Dunedin.

The present analysis uses data for all Dunedin Study members who had a mental health interview at any time from 11 to 21 years of age and who underwent a nonpregnant height and weight measurement at 26 years of age. Of the 980 study members undergoing assessment at 26 years of age, 9 did not have information on height and weight, and an additional 33 were pregnant at the time of assessment, leaving a total population of 938 study members. Of these 938 study members, 35 had no mental health interview from 11 to 21 years of age and 9 had no mental health interview from 18 to 21 years of age. Stratifying variables necessary for imputation of baseline BMI were not available in an additional 22 study members for the early adolescent analysis and 41 study members for the late adolescent analysis. Teens who were pregnant at the time of baseline BMI measurements at 18 years of age (n=4) were also excluded from the late adolescent depression analysis. Thus, the final population consisted of 881 study members for the analysis of early adolescent depression and obesity at 26 years of age, and 884 study members for the analysis of late adolescent depression and obesity at 26 years of age.

PREDICTOR MEASURES: MEASURES OF DEPRESSION

Age-appropriate mental health interviews were conducted with all available study members within 60 days of their birthdays at 11, 13, 15, 18, and 21 years of age. Interview questions were designed to identify any episodes of major depression in the 12 months before the interview. On the basis of responses to these interviews, we defined study members as having early adolescent depression (11, 13, and 15 years of age) and/or late adolescent depression (18 and 21 years of age). These age categories were selected a priori on the basis of literature findings that depression risk factors, comorbidities, and correlates differ between episodes of depression occurring in early adolescence and late adolescence/young adulthood,27,28 including prior work using data from the Dunedin Study.23

EARLY ADOLESCENT DEPRESSION

In early adolescence, the Diagnostic Interview Schedule for Children27 was completed. The modifications and descriptive epidemiological features of the Diagnostic Interview Schedule for Children in this sample have been previously described.10 For the main analysis, study members were considered to have early adolescent depression if they met Diagnostic and Statistical Manual of Mental Disorders, Third Edition (DSM-III),31 criteria for major depression on the Diagnostic Interview Schedule for Children at 11, 13, or 15 years of age.

LATE ADOLESCENT DEPRESSION

An adult version of the same instrument, the Diagnostic Interview Schedule,32 was administered at 18 and 21 years of age. The descriptive epidemiological features of the Diagnostic Interview Schedule in this sample and the correlation with levels of functional impairment have been previously described.10,34 Study members were considered to have late adolescent depression if they met Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition (DSM-III-R),35 criteria for major depression on the Diagnostic Interview Schedule at 18 or 21 years of age.

RECURRENCE/PERSISTENCE OF DEPRESSION

To evaluate the hypothesis that the risk for adult obesity rises with the increasing recurrence or persistence of depression, we also tested the association between adult obesity and the number of times a study member met criteria for major depression throughout adolescence. This variable was generated using data from all individuals who underwent at least 2 mental health interviews from 11 to 21 years of age (n=916). The numbers of times that subjects met criteria for major depression were summed to produce a categorical variable coded as 0, 1, and 2 or more episodes of major depression.

OUTCOME MEASURE: ADULT OBESITY

Our outcome measure was adult obesity derived from height and weight measurements obtained on study members at 26 years of age. Adult obesity was defined as a BMI of 30, on the basis of World Health Organization criteria.30 This cutoff was chosen because it has been shown to correspond well to increased morbidity associated with obesity.36,37

COVARIATES

We evaluated sex, childhood BMI, parental obesity, SES, and maternal depression as potential confounders and effect modifiers. Each of these covariates was defined as outlined in the following paragraphs.

Measures of Childhood Weight

Childhood obesity has been shown to be a strong predictor of adult obesity.13,30 In the Dunedin Study, height and weight were collected within 2 months of study members’ birthdays at all study
phases. To control for preexisting obesity in our analyses and to allow for within-individual assessment of subsequent obesity risk, BMI was calculated for the baseline age of our predictor variables, ie, 11 years of age (early adolescent analysis) and 18 years of age (late adolescent analysis). Since prior studies have shown baseline weight status to be an effect modifier of the relationship between depression and obesity in adults,9 we also tested for interaction between depression and childhood obesity. For this analysis, childhood obesity was defined as being greater than the 95th percentile for age and sex using Centers for Disease Control and Prevention growth chart standards.39

Maternal Depression

A depression questionnaire was administered to all mothers at study member ages of 9, 11, 13, and 15 years. Based on prior work with this instrument, maternal depression was considered present if a mother had a depressed mood or anhedonia and at least 5 depressive symptoms on the depression questionnaire at any of these study member ages.40 This variable was included as a covariate in the early adolescent depression analysis only; prior research has shown that maternal depression is commonly associated with early adolescent depression, but not late adolescent/young adult depression.23,27 Furthermore, we hypothesized that maternal depression may affect dietary choices and physical activity in the home during early adolescence. In late adolescence, few teens were still living with their parents, and it was presumed that baseline obesity status at 18 years of age would account for physical activity and diet experienced during childhood.

Childhood SES

The SES of the study members’ families was measured with a 6-point scale assessing the parents’ self-reported occupational status.41 This scale places each occupation into 1 of 6 categories (6 indicates unskilled laborer; 1, professional) on the basis of the educational levels and income associated with the occupation in data from the New Zealand census. The childhood SES variable used in our analyses was generated by averaging the highest available parental SES score (the mother’s or the father’s) from each of 7 ages (3, 5, 7, 9, 11, 13, and 15 years). This variable reflects the socioeconomic conditions experienced by each of the study members from 3 to 15 years of age.

Maternal Obesity

Maternal obesity has been shown to be associated with the development of obesity in children25 and may theoretically be associated with the development of adolescent depression. In the Dunedin Study, mothers were asked to report their weight and height measurements when the child was 11 years of age. These data were used to calculate the BMI, and a dichotomous variable was generated for each mother using a BMI of 30 or greater as a cutoff for obesity.

MISSING DATA

Information was missing for maternal obesity in 20% of the study members, for BMI at 11 years of age in 26% of the study members, and for BMI at 18 years of age in 11% of the study members. The distributions of early and late depression, obesity at 26 years of age, and other covariates did not differ between study members who were and were not missing these data. Because maternal obesity and baseline BMI were hypothesized to be important confounders, multiple imputation was used by an adaptation of the approximate Bayesian bootstrap method.42 Imputation groups were formed by simultaneous stratification on

main variables from the regression equation and on variables found to be strongly associated with the variable to be imputed when its value was known, ie, sex and BMI categories at 15 years of age. Ten complete data sets were generated by this method. Parallel regression analyses were then performed on all 10 sets, and the results were combined using methods that account for the uncertainty in the imputed data.

DATA ANALYSIS

Basic descriptive statistics and logistic regression analyses were performed using Stata statistical software, version 7.0.43 To evaluate differences in categorical and continuous covariates between groups defined by depression status, we performed χ² and t tests.

To test our main hypothesis that depressive disorders in adolescence are associated with increased risk for obesity in adulthood, analyses were performed treating early and late adolescent depression as predictors and obesity at 26 years of age as the outcome variable. To assess for different effects by age, regression analyses were performed separately for each of these predictor variables.

To test the hypothesis that the risk for obesity would increase with increasing recurrence or persistence of depression in adolescence, regression analyses were performed treating the number of episodes of depression as a predictor and obesity at 26 years of age as the outcome. Wald tests of trend were performed to test for increasing risk for obesity at 26 years of age with increasing recurrence or persistence of depression.

For all regression analyses, unadjusted odds ratios were progressively adjusted to determine the effects of preexisting obesity, childhood SES, maternal obesity, and maternal depression (early adolescent analysis only). After all potential confounders were included in the analyses, interaction terms were modeled for sex and baseline obesity status. All choices of confounders and effect modifiers were made a priori on the basis of results of literature review and biological plausibility. To avoid overadjusting for obesity at baseline that may be a result or cause of depression in adolescence, we performed subanalyses limited to only those adolescents who were not obese at baseline. The results of these analyses were not significantly different from those of the main analyses and are not presented in this article. As the outcome variable (obesity) occurred in more than 10% of our study population, odds ratios were converted to relative risks using a commonly accepted method.34

RESULTS

Of the 938 study members, 67 (7%) met DSM-III criteria for major depression at 11, 13, or 15 years of age. The prevalence of depression increased in late adolescence; 254 study members (27%) met DSM-III-R criteria for major depression at 18 or 21 years of age. Our outcome measure, obesity at 26 years of age, occurred in 109 members (12%). Compared with study members who were not depressed, those who had depression diagnoses were more likely to be female (Table 1). Members with early adolescent depression were more likely to have a depressed mother than their nondepressed peers (P = .03). However, this relationship did not persist into late adolescence. We found no significant differences in SES or maternal obesity between depressed and nondepressed adolescents in the early or late adolescence study. In the early adolescence study, baseline BMI at greater than the 95th percentile was more common among depressed than nondepressed members (P = .05). We found no signifi-
EARLY AND LATE ADOLESCENT DEPRESSION DIAGNOSES AND OBESITY IN ADULTHOOD

In late adolescence, the direction of the association between depression and adult obesity was positive for girls and negative for boys, indicating the presence of an interaction between sex and depression on the subsequent risk for obesity (interaction term, \( P = .07 \)). In early adolescence, we found no evidence of the interaction; the association was negative and of similar magnitude for boys and girls (interaction term, \( P = .20 \)). Thus, results are presented separately by sex in late adolescence and for the whole population in early adolescence. Although it was a significant confounder, baseline BMI did not modify the relationship between adolescent depression and obesity in early or late adolescence.

Girls who met criteria for a diagnosis of depression at 18 or 21 years of age were more than twice as likely to be obese at 26 years of age compared with those who were not depressed (Table 2). We found no significant association between depression diagnosis in late adolescence and obesity at 26 years of age for boys. In early adolescence, there was a nonsignificant trend toward decreased risk for adult obesity for depressed adolescents of both sexes when compared with their nondepressed peers.

As a post hoc analysis, we evaluated whether variations in antidepressant use might account for some of the observed differences between the sexes. Of those with late adolescent depression, 13% (5%) reported antidepressant use at 21 years of age, and 22% (9%) reported antidepressant use at 26 years of age. Antidepressant use also occurred in study members who did not meet criteria for late adolescent depression.

Table 1. Distribution of Covariates by the Presence of Major Depressive Disorder in Early or Late Adolescence*  

<table>
<thead>
<tr>
<th></th>
<th>Early Adolescence</th>
<th></th>
<th>Late Adolescence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Not Depressed</td>
<td>Depressed</td>
<td>Not Depressed</td>
<td>Depressed</td>
</tr>
<tr>
<td></td>
<td>(n = 836)</td>
<td>(n = 67)</td>
<td>(n = 675)</td>
<td>(n = 254)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>391 (47)</td>
<td>37 (55)</td>
<td>273 (40)</td>
<td>166 (65)</td>
</tr>
<tr>
<td>Male</td>
<td>445 (53)</td>
<td>30 (45)</td>
<td>402 (60)</td>
<td>88 (35)</td>
</tr>
<tr>
<td>Mother obese</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>34 (4)</td>
<td>5 (7)</td>
<td>28 (4)</td>
<td>11 (4)</td>
</tr>
<tr>
<td>No</td>
<td>687 (82)</td>
<td>49 (73)</td>
<td>540 (80)</td>
<td>201 (79)</td>
</tr>
<tr>
<td>Data missing</td>
<td>115 (14)</td>
<td>13 (19)</td>
<td>107 (16)</td>
<td>42 (17)</td>
</tr>
<tr>
<td>Mother depressed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>199 (24)</td>
<td>23 (34)</td>
<td>155 (23)</td>
<td>67 (26)</td>
</tr>
<tr>
<td>No</td>
<td>628 (75)</td>
<td>41 (61)</td>
<td>500 (74)</td>
<td>183 (72)</td>
</tr>
<tr>
<td>Data missing</td>
<td>9 (1)</td>
<td>3 (4)</td>
<td>20 (3)</td>
<td>4 (2)</td>
</tr>
<tr>
<td>Childhood SES†</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (categories 5 and 6)</td>
<td>300 (36)</td>
<td>24 (36)</td>
<td>239 (36)</td>
<td>89 (35)</td>
</tr>
<tr>
<td>Middle (categories 3 and 4)</td>
<td>486 (58)</td>
<td>36 (54)</td>
<td>391 (58)</td>
<td>144 (57)</td>
</tr>
<tr>
<td>High (categories 1 and 2)</td>
<td>49 (6)</td>
<td>7 (10)</td>
<td>40 (6)</td>
<td>21 (8)</td>
</tr>
<tr>
<td>Baseline obesity status‡</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI &lt; 85th percentile</td>
<td>566 (68)</td>
<td>43 (64)</td>
<td>509 (75)</td>
<td>186 (73)</td>
</tr>
<tr>
<td>BMI 85th to 95th percentile</td>
<td>38 (5)</td>
<td>4 (6)</td>
<td>64 (9)</td>
<td>35 (14)</td>
</tr>
<tr>
<td>BMI &gt; 95th percentile</td>
<td>9 (1)</td>
<td>3 (4)</td>
<td>22 (3)</td>
<td>8 (3)</td>
</tr>
<tr>
<td>Missing</td>
<td>223 (27)</td>
<td>17 (25)</td>
<td>80 (12)</td>
<td>25 (10)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); SES, socioeconomic status.
*Early and late adolescence, for purposes of this study, are described in the “Study Design and Sample” subsection of the “Methods” section. This table contains data for all youth for whom each variable was available. Percentages have been rounded and may not total 100.
†Described in Elley and Irving. Data were missing for 1 nondepressed individual in the early adolescence group and for 5 depressed individuals in the late adolescence group.
‡Baseline BMI was measured at 11 years of age for the early adolescence analysis and 18 years of age for the late adolescence analysis.

Table 2. Adjusted Relative Risk for Obesity for Depressed Adolescents Compared With Nondepressed Adolescents of the Same Sex and Age Groups*  

<table>
<thead>
<tr>
<th></th>
<th>RR (95% CI)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early Adolescent</td>
<td>Late Adolescent</td>
<td>Late Adolescent</td>
</tr>
<tr>
<td></td>
<td>Boys and Girls</td>
<td>Girls</td>
<td>Boys</td>
</tr>
<tr>
<td>Early adolescent depression</td>
<td>0.50 (0.19-1.28)</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Late adolescent depression</td>
<td>NA</td>
<td>2.32 (1.29-3.83)</td>
<td>0.90 (0.37-2.02)</td>
</tr>
<tr>
<td>Baseline BMI†</td>
<td>1.50 (1.37-1.64)</td>
<td>1.54 (1.38-1.71)</td>
<td>1.59 (1.41-1.78)</td>
</tr>
<tr>
<td>SES</td>
<td>0.75 (0.61-0.92)</td>
<td>0.76 (0.56-1.04)</td>
<td>1.06 (0.35-2.75)</td>
</tr>
<tr>
<td>Maternal obesity</td>
<td>0.91 (0.43-1.81)</td>
<td>2.96 (1.19-5.68)</td>
<td>0.93 (0.69-1.25)</td>
</tr>
<tr>
<td>Maternal depression</td>
<td>1.06 (0.67-1.65)</td>
<td>ND</td>
<td>ND</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by the square of height in meters); CI, confidence interval; NA, not applicable; ND, not determined; RR, relative risk; SES, socioeconomic status.
*Early and late adolescence, for purposes of this study, as described in the “Study Design and Sample” subsection of the “Methods” section.
†Baseline BMI was measured at 11 years of age for the early adolescence analysis and 18 years of age for the late adolescence analysis.
pression, including 2 (0.3%) at 21 years of age and 13 (2%) at 26 years of age. These study members may have been using antidepressants for conditions other than depression, or their depressive symptoms may have resolved at the time of assessment. Antidepressant use was slightly more common in girls than boys, but sex differences in antidepressant use were not significant at either time point. We found no significant differences in BMI at 26 years of age when comparing study members who used antidepressants with those who did not for members of either sex.

RECURRENCE/PERSISTENCE OF MAJOR DEPRESSION AND ADULT OBESITY

Of the 273 study members who had at least 1 episode of depression during adolescence, 73% had only a single episode, 23% had 2 episodes, and 4% had 3 or more episodes. Recurrent or persistent depression was more common among girls than boys ($P<.001$). In girls, we found an increased risk for obesity with the increasing number of times the study member met criteria for major depression during adolescence ($P=.03$) (Figure). We observed no significant association between the number of episodes of depression and adult obesity in boys ($P=.17$).

This study adds to existing literature that supports a longitudinal association between adolescent depression and adult obesity and expands on this literature by delineating the effect in different phases of adolescence. Recent literature suggests that depression in childhood and early adolescence differs from that in late adolescence and young adulthood by neurobiological correlates, patterns of risk factors, and comorbidity. In our study, we found that depression was associated with a within-individual change in obesity status for late adolescent girls. This association was not observed for older adolescent boys or for younger adolescents, for whom depression carried a somewhat decreased risk for obesity.

In a recent study of adolescents meeting clinical criteria for depression, depressive symptom duration (obtained by retrospective interview) was an independent predictor of obesity severity. In this longitudinal community-based cohort, we found a similar dose-response relationship in which girls with more episodes of depression during adolescence were more likely to be obese in adulthood. Although not definitive, this suggestion of a dose-response relationship lends support to the idea that depression in late adolescent girls leads to the development of obesity.

Although this is the first longitudinal study to find that the relationship between depression and obesity significantly differs by sex, this finding is consistent with prior cross-sectional studies that have observed a positive association among women and a negative association among men. Many possible reasons exist for the sex and age differences observed in this study. First, women with depression report more symptoms of psychomotor retardation and increased appetite and weight gain, compared with men. Psychomotor retardation has also been shown to increase with age, whereas younger children tend to experience more agitation and somatic and anxiety complaints. Although few studies have specifically examined appetite changes with depression in children, eating dysregulation and binge eating also increase with adolescence and are more common in girls than boys. Thus, sex and age differences in the association between depression and obesity may be due to different patterns of depressive symptomatology and comorbidity with age and in male and female subjects.

Another possibility is that depression treatment may vary by age and sex and that treatment might affect weight gain. Studies of psychotropic medication use among youth have shown that antidepressant use increases with age, although sex differences have not been consistent. Although we found no significant association between antidepressant use and obesity at 26 years of age for boys or girls, we do not have detailed information about the types of antidepressants used and cannot fully address this possibility in this study.

In addition, environmental factors, such as engagement in physical activity, may differ by sex and with age and may account for differences in the relationship between adolescent depression and adult obesity. In prior work with data from the Dunedin Study, physical activity was found to decrease with age for male and female study members, but the decrease was more profound in female members. Girls have also been shown to experience a profound decrease in physical activity during adolescence, according to recent studies from the United States. This may be due to decreasing opportunities for noncompetitive athletic activity, lack of interest or motivation, or changes in family involvement that allow older adolescents to define their own physical activities. Although few studies have examined differences in physical activity for depressed vs nondepressed adolescents, depressive symptoms could conceivably interfere with seeking out exercise, particularly for older adolescents. In a large epidemiological study of adults, physical activity level was negatively associated with the later development of depression. Thus, physical activity level...
Although some research has associated adolescent depression with the development of obesity in later life, results have been conflicting. Depression in childhood and early adolescence has been shown to have different patterns of symptoms, risk factors, and correlates than depression in late adolescence and young adulthood. In particular, depressed older adolescents have been shown to have more psychomotor retardation, whereas depressed younger adolescents tend to have more agitation and anxiety. In previous studies that have combined depressed youth from early and late adolescence, relationships that differed by age may have weakened the power to detect a significant association between adolescent depression and adult obesity.

We found that adolescent depression is associated with within-individual increased risk for later obesity among late adolescent girls and that this risk increases with the increasing number of episodes of depression during adolescence. In contrast, we found no association between depression and obesity for late adolescent boys or early adolescent boys or girls. Future research determining causes of these age and sex differences may increase our understanding of behavioral correlates of obesity. If this relationship holds in other populations, it may allow for the development of interventions to reduce the risk for adult obesity in older adolescent girls.

What This Study Adds

Although some research has associated adolescent depression with the development of obesity in later life, results have been conflicting. Depression in childhood and early adolescence has been shown to have different patterns of symptoms, risk factors, and correlates than depression in late adolescence and young adulthood. In particular, depressed older adolescents have been shown to have more psychomotor retardation, whereas depressed younger adolescents tend to have more agitation and anxiety. In previous studies that have combined depressed youth from early and late adolescence, relationships that differed by age may have weakened the power to detect a significant association between adolescent depression and adult obesity.

We found that adolescent depression is associated with within-individual increased risk for later obesity among late adolescent girls and that this risk increases with the increasing number of episodes of depression during adolescence. In contrast, we found no association between depression and obesity for late adolescent boys or early adolescent boys or girls. Future research determining causes of these age and sex differences may increase our understanding of behavioral correlates of obesity. If this relationship holds in other populations, it may allow for the development of interventions to reduce the risk for adult obesity in older adolescent girls.

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