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Associations Among Body Mass Index, Depression, and Family Factors Across Two Generations

Lisa M. Hooper · Mark Richardson · Linda L. Knol · Nyshetia White-Chapman · Lixin Qu · Natalie J. Hannah

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Abstract In this pilot study, we examined the relationship between health factors, sociodemographic factors, and body mass index (BMI) across two generations ($n = 41$ parent-child pairs). Generation 1 study variables included parent- and family-focused characteristics and health variables, the Generation 2 variables included child demographic factors, and the outcome variable was youths' physical health (operationalized as BMI). Regression models revealed that Generation 1 variables, taken together, accounted for 26% of the variance in youth BMI. However, only the parent's mental health symptoms (i.e., depression symptoms) made a unique contribution to the variance in youth BMI. Logistic regression analysis revealed that the youths' race and age—but no other demographic factor—were significantly related to youth BMI-for-age. Our findings suggest that youth race, age, and parent mental health are each associated with youth physical health

L. M. Hooper (✉) · N. White-Chapman · N. J. Hannah
Department of Educational Studies in Psychology, Research Methodology, and Counseling, The University of Alabama, Box 870231, 315 B Graves Hall, Tuscaloosa, AL 35487-0231, USA
e-mail: lhooper@bamaed.ua.edu

N. White-Chapman
e-mail: nlwhite@crimson.ua.edu

N. J. Hannah
e-mail: nataliejhannah@gmail.com

M. Richardson
Department of Kinesiology, The University of Alabama, Box 870231, 208 Moore Hall, Tuscaloosa, AL 35487, USA
e-mail: mrichard@bama.ua.edu

L. L. Knol
Department of Human Nutrition and Hospitality Management, The University of Alabama, Box 870158, 206 Doster Hall, Tuscaloosa, AL 35487, USA
e-mail: lknol@bama.ua.edu

L. Qu
Center for the Prevention of Youth Behavior Problems, The University of Alabama, Box 870348, 20 Research Drive, Tuscaloosa, AL 35487, USA
e-mail: lxqu@bama.ua.edu

(i.e., BMI), confirming previous study findings that parental factors and demographic factors should be considered when exploring youth health outcomes.

Keywords Body mass index · Inter-generational health · Mental health · Youth health · Family systems · Depression

Introduction

The rates of children and adolescent obesity have increased more than threefold since 1980 (Menschik et al. 2008; Trust for America's Health 2007, 2009, 2010), placing more American youth at risk for health problems associated with obesity than ever before. The Centers for Disease Control and Prevention (CDC 2008, 2009) have published figures reporting that the prevalence of obesity among youth has increased from 5 to 17.6% in a time span of just 25 years (cf., findings from the National Health and Nutrition Examination Survey [NHANES] 1976–1980 and 2003–2006). These figures are particularly alarming because of obesity's relation to chronic disease and poor overall health (Gable and Lutz 2000; Kitzmann et al. 2008). Obesity, especially when developed at a young age, portends a shorter life expectancy (McDowell et al. 2006; Whitaker et al. 1997). Moreover, in southern regions of the United States, physical health among family members—in particular, rates of obesity in youth—are disproportionately higher than rates in other regions of the United States (CDC 2006a, b, 2008; Jackson et al. 2005; Trust for America's Health 2007, 2009, 2010; Singh et al. 2010; Tudor-Locke et al. 2007).

The importance of uncovering explanations or causes for the increase in rates of youth obesity cannot be overstated. Child and adolescent obesity cannot be attributed to any one factor alone (Center for Health and Health Care in Schools 2007), but it can, in most cases, be partially accounted for by numerous factors, including those related to family systems (Epstein et al. 1990; Gable and Lutz 2000; Hooper et al. 2009; Kowaleski-Jones and Mizell-Christie 2010; Institute of Medicine 2009). Although the impact of genetics in the development of obesity within a family context cannot be ignored (Burrage and McCandless 2007), one factor that appears to play a significant role is the family environment, particularly in terms of interactions with and behaviors of parents (Gable and Lutz 2000; James et al. 2008; Lederman et al. 2004). The influence of parent behaviors and interaction patterns on youth health outcomes has been established. Repetti et al. (2002) suggest that children and adolescents reared in a home characterized by uncaring and unsupportive attitudes and neglect are more likely to experience more physical illness, major health problems, and obesity later in their lives. Their analysis of the literature base proposes that being reared in such a "risky" family environment negatively affects a child's health. Select parent factors such as mental health, physical health, and health behaviors appear to correlate with youth behavior and health (Birch and Davison 2001; Davis et al. 2008; Hooper et al. 2009).

In our study of families living in the southern region of the United States, we explored the relations between intergenerational factors and youth body mass index (BMI), a commonly used index to operationalize obesity and weight status (CDC 2008; n.d.). In the next section, we briefly describe the literature on the intergenerational variables explored in the pilot study and how they may relate to youth BMI. The subsequent section reports the design and results of our study. We conclude with a discussion of the study's implications and the possible importance of a two-generation systems framework—informed by

Bronfenbrenner's (1979) ecological systems framework—when examining health factors among youth populations.

Background

Parent Obesity and Youth BMI

Genetic factors as well as environmental factors contribute to the development of youth obesity (Barlow and the Expert Committee 2007). Parental obesity makes a child more vulnerable to the development of obesity (Barlow and the Expert Committee 2007; Jahnke and Warschburger 2008). Even if a child or adolescent currently falls into the normal weight category, he or she is more likely to develop obesity in adulthood if one or both of his or her parents are obese (Barlow and the Expert Committee 2007). In fact, findings from several studies suggest that children have an 80% chance of becoming overweight or obese adults if one or more parents are overweight (Center for Health and Health Care in Schools 2007). This finding is consistent for both male and female children. Therefore, understanding the association between parent health behaviors and weight status and those of their children is an important area of study (Jahnke and Warschburger 2008).

Parent Mental Health and Youth BMI

The link between adult obesity and mental health disorders such as depression has been long studied and often reported (Friedman and Brownell 1995; Moore et al. 1962). Simon et al.'s (2006) epidemiological studies and others' community-based studies often, but not always, have found an increase in mental health symptomatology among obese and overweight adults (measured either categorically or continuously), although some of these studies have significant limitations (Hrabosky and Thomas 2008).

There is evidence that depression in parental figures puts youth at risk for future mental and physical health concerns and conditions (Davis et al. 2008). Children and adolescents growing up in family environments filled with anger, aggression, and little emotional nurturance often suffer mental health consequences concurrently as well as later in life (Repetti et al. 2002). Davis et al. studied the influence of parental depression—among other family factors and parental health characteristics—on weight status of youth in 44 non-Hispanic Black families. The authors found that depression and parent weekly activity were significantly related to childhood obesity.

In a study of older adolescents, Turner et al. (2005) studied the similarities and differences between two groups of non-Hispanic White adolescent girls (one index [overweight] group and one control [normal weight] group) regarding parental bonding and some aspects of mental health such as depression, eating disorders, and self-beliefs. The study participants were 17 or 18 years old, and each group consisted of 23 participants. The mean BMI was 27.8 kg/m^2 for the index group and 20.2 kg/m^2 for the control group. The results indicated that girls in the index group "perceived poorer family functioning, particularly in relation to fathers" (p. 385). Also, there appeared to be a positive correlation between overprotection by mothers and thoughts often found in conjunction with eating disorders in the index group participants. In the same group (index group), higher levels of care provided by mothers seemed to reduce negative self-beliefs in children, as well as reduce unhealthy attitudes about eating and fears of being abandoned.

Parent Exercise Behavior and Youth BMI

In addition to the family's emotional environment described above, the eating behavior and physical activity levels of a child's family members may contribute to the child's health outcome, including obesity (Birch and Davison 2001; Zach and Netz 2007). In a study of 298 families, Zach and Netz examined the physical activity levels of students along with those of both their parents and both sets of grandparents. The authors found that children's activity levels were significantly correlated with their mothers' activity levels, but not with the activity levels of any other family member (Zach and Netz 2007). Twenty-three percent of mothers of physically active children were active, while only 8% of mothers of physically inactive students were active. Fogelholm et al.'s (1999) findings were consistent with those of Zach and Netz. Thus, parent inactivity may, in part, help explain the increase in rates of youth obesity.

Family Socioeconomic Status and BMI

The findings regarding the relationship between socioeconomic status and obesity have been inconclusive. Some researchers suggest that poverty increases the likelihood of obesity among youth populations (Griffith 2009; Miech et al. 2006; Sobal and Stunkard 1989). Others report that the link between family socioeconomic status and obesity is inconsistent among less economically advantaged populations, non-Hispanic African American or Black Caribbean participants, Hispanic or Latino participants, and participants residing in areas containing the lowest proportion of high school graduates (Lovasi et al. 2009). For example, populations without access to any source of transportation other than walking may not follow this trend. The authors suggest many possible explanations for the inconsistent relationship between family socioeconomic status and obesity, including greater choice of neighborhood among the economically advantaged participants and the presence of other barriers that may hold back the economically disadvantaged from adopting healthier lifestyles. Yet, disentangling the effects of socioeconomic status on youth BMI remains complex and equivocal (Miech et al. 2006; Kowaleski-Jones and Mizell-Christie 2010).

BMI Across Generations

The measurement most often used to determine overweight and obesity is BMI (Centers for Disease Control and Prevention 2006a; Kitzmann et al. 2008). A person's BMI is determined by dividing that person's weight in kilograms by the square of height in meters, or kg/(m^2) (CDC 2008). This number often relates to body fat and coexisting health risks a person may have (Barlow and the Expert Committee 2007). For adults, weight status (BMI) is defined and operationalized by the National Heart, Lung, and Blood Institute (2000) in the following way: "normal weight" is described as 18.5–24.9 kg/m^2, "overweight" is described as 25.0–29.9 kg/m^2, and "obese" is described as 30.0 or greater kg/m2. Similar to the associations between a high BMI and poor health outcomes seen in youth, devastating, pernicious health outcomes have been seen in adults with a high BMI as well (Berry et al. 2007; CDC 2008).

Similar to adults, youths' BMI may be calculated by dividing that person's weight in kilograms by the square of height in meters, or kg/m^2 (CDC 2008). In children and adolescents' BMI also may be calculated for each child and then plotted onto the appropriate sex-specific BMI-for-age CDC Growth Chart (www.cdc.gov/nccdphp/dnpa/growthcharts/sas.htm) and reported as percentiles. The CDC (2008) has established cutoff points to determine overweight and obesity in children and adolescents. If a child's BMI is greater than or equal to the 85th percentile but less than the 95th percentile, the child is considered to be overweight (CDC 2008). If the child's BMI is greater than or equal to the 95th percentile, the child is considered to be obese (CDC 2008). The percentiles are determined by normative values based on age and gender (Barlow and the Expert Committee 2007). Research suggests that BMI-for-age is a reliable indicator of youths' physical health (Ogden et al. 2008). As previously mentioned, a high BMI-for-age has been found to correlate with pernicious and deleterious outcomes among youth (US Department of Health and Human Services 2001).

Given the evidence in the literature and the exploratory nature of the study, we put forward three research questions: (1) What are the associations among select intergenerational study variables and youth BMI? (2) What is the predictive value of select intergenerational study variables on youth BMI (operationalized as a continuous variable)? and (3) To what extent do sociodemographic characteristics and health factors of both the parent and the child predict youth BMI (operationalized as BMI-for-age categorical variable)?

Method

Study Sample

The convenience sample consisted of 41 parent-child pairs recruited from three schools in a southern region of the United States. Seventy-three percent of the 41 parent-child pairs self-identified as non-Hispanic White Americans, while the remaining 27% self-identified as non-Hispanic Black Americans. The reported gender of the youth participants was fairly equal (52% female, 48% male), and youth participants ranged in age from 8 to 11 years, with the total youth sample's mean age being 9.61 (SD = 1.02). Parent participants were primarily mothers ($n = 29$; 71%), and they ranged in age from 31 to 57 years, with the total adult sample's mean age being 39.00 (SD = 6.96). We also calculated the Hollingshead Index for SES (Hollingshead and Redlich 1958), which was 34.51 (SD = 11.61), denoting middle class socioeconomic status. Table 1 summarizes the demographic and health variables of the study sample.

Procedure

After Institutional Review Board guidelines for research with human subjects were met, study recruitment took place. Families were recruited from three elementary schools in the southern United States. Flyers were sent home with all 4th, 5th, and 6th grade students. The flyer conveyed a brief description of the study, including goals and objectives, and an introduction of the research team. Families who were interested in participating in the study returned the flyer noting their interest and contact information. These families were contacted by phone to schedule two study visits: (1) a 1-h appointment (visit 1) with a graduate-level research team member and (2) a brief 10-min follow-up appointment (visit 2) approximately 9 days after visit 1. Participation in the study was voluntary.

During visit 1, we obtained informed consent from the parent, assent from the participating youth, and height and weight from both the parent and the youth. Research team members participated in a rigorous training protocol related to interviewing families and collecting weight and height information from both youth and adults.

Table 1 Characteristics of study sample and descriptive statistics

Participants	Sample number (N)	Percentage (%)	Mean (SD)
Parent			
Gender			
Mother	29	70.73	
Others	12	29.27	
Age	41		39.00 (6.96)
Race			
Non-Hispanic Black	11	26.83	
Non-Hispanic White	30	73.17	
Holingshead score	41		34.51 (11.61)
BMI (CDC categorical)			
Underweight	1	2.56	
Normal	10	25.64	
Overweight	12	30.77	
Obese	16	41.03	
BMI (continuous)	39		29.16 (7.45)
Youth			
Gender			
Female	21	52.50	
Male	19	47.50	
Age	41		9.61 (1.02)
Number of siblings	41		2.67 (.90)
BMI (CDC categorical)			
Underweight	0	0	
Normal	24	61.54	
Overweight	4	10.26	
Obese	11	28.21	
BMI (continuous)	39		20.02 (4.09)

BMI body mass index, *CDC* The Center for Diseases Control and Prevention established categories

Also during visit 1, parents completed surveys and youth completed one-on-one interviews. The procedure for capturing BMI was as follows. After the surveys and interviews were completed, family members' (parent and child) weight was measured individually with a portable, platform digital scale (Tanita 350 model) and recorded to the nearest ¼ pound, and height was measured using a portable stadiotmeter (SECA 240 model) and recorded to the nearest 1/8 inch. As previously mentioned, BMI was calculated from the results of these measurements. For the youth participants, each child's BMI was plotted onto the appropriate sex-specific BMI-for-age CDC Growth Chart.

Participants also were given unsealed Yamax SW-200 pedometers, along with instructions for completing the 7-day daily activity logs and using the pedometer during the pedometer-wearing periods of the day. All families were scheduled for a brief follow-up appointment (visit 2), where the completed 7-day pedometer logs were returned and water bottles and pedometers were given to the participants in appreciation for their time.

Measures

Demographic Information

Youth were interviewed and asked for information regarding year in school, race, ethnicity, current age, gender, and number of siblings. Research team members recorded this information on the demographic information sheet. A separate form, created for the study, asked parents to report their years of education completed, age, gender, and location of primary residence.

Mental Health

We used the Beck Depression Inventory (BDI; Beck et al. 1996) to assess the parents' level of mental health symptoms. The BDI consists of 21 self-report questions that capture depressive symptomatology. Scores for each item range from 0 to 3. The maximum possible total score is 63, and higher scores reflect greater severity of depression symptomatology and a greater likelihood of major depression. The BDI is one of the most widely used instruments that measure depression, and scores from this instrument have been shown to have good reliability and validity. Consistent with stability coefficients in other studies (Beck et al. 1996), the obtained reliability in the current study was more than adequate; Cronbach's alpha was .89 for parent participants.

Physical Health

For youth participants, we used BMI to assess the physical health and weight status (as previously described). In youth participants, the age-adjusted *z* score for BMI was used for the logistic regression analyses. Among youth participants, overweight and obese were categorized as BMI greater than the 85th percentile and 95th percentile, respectively, which is consistent with the CDC guidelines for children and adolescents. BMI was also calculated using the following standardized formula: BMI = weight (in kilograms) divided by height squared (in meters). We used calculated BMI continuous and categorical scores for study analyses so that our findings would be comparable to previous studies that used both approaches.

For the parent participants, physical health was captured in three ways: BMI, self-reported health status, and weight goals. To ascertain BMI, all participants' height (in feet and inches) and weight (in pounds) were measured by a trained research team member. BMI was then calculated using the following standardized formula: BMI = weight (in kilograms) divided by height squared (in meters). Among parent participants, BMI was calculated and then categorized as defined by the National Heart, Lung, and Blood Institute (2000) in the following way: "normal weight" is described as 18.5–24.9 kg/m^2, "overweight" is described as 25.0–29.9 kg/m^2, and "obese" is described as 30.0 or greater kg/m^2. In addition to BMI, we asked a single question regarding parents' weight goals and health status. Parents' self-reported health status has been used as a general health indicator in many studies and is typically measured with a single question asking subjects to rate their health as "poor," "fair," "good," "very good," or "excellent." Self-rated health status has been found to be a valid predictor of mortality, healthcare utilization, and physical functioning in adults (Appels et al. 1996; Fylkesnes and Forde 1991; Goldstein et al. 1984; Idler and Benyamini 1997; Manderbacka et al. 1998). For this study, responses were dichotomized by combining the responses of excellent, very good, and good into one category of “excellent/very good/good” and combining the responses of fair and poor into a second category of “fair/poor.”

Daily Physical Activity

Created for the current study, the activity log form captured daily pedometer-determined activity (i.e., steps) over a period of 7 days. Pedometers, in general, have been widely used as a research tool to measure physical activity because of their convenience and affordability (Barfield et al. 2004; Le Masurier and Tudor-Locke 2003; Rowe et al. 2004; Strycker et al. 2007). We used Yamax Digi-Walker SW-200 pedometers to capture parent-participants’ daily activity. The Yamax Digi-Walker SW-200 pedometer, in particular, has been deemed one of the most accurate and reliable pedometers available (Rowe et al. 2004). Although pedometers may not accurately measure activities that do not involve as much hip movement as walking does, such as biking (Beets et al. 2007), they are still the most widely used devices for measuring physical activity.

Data Analysis Plan

We employed the following data analytic procedures to examine the data. First, descriptive data (means and standard deviations) for all intergenerational study variables were examined. Second, Pearson product-moment correlation coefficients were used to explore the strength of the relations between the intergenerational study variables. Finally, we conducted several regression analyses to examine the predictive ability of the study variables on youth BMI (as a continuous and categorical variable) and the proportion of variance explained by the study variables. An a priori significance level of .05 was used in the current study. All analyses were conducted with Statistical Package for the Social Sciences software (SPSS; version 15.0) and Statistical Analysis System (SAS; version 9.1).

Results

As shown in Table 1, the “normal weight” category ($n = 24$, 62%) was the largest group for youth participants, followed by the “obese” category ($n = 11$, 28%). And for the parent–participants, the “obese” category ($n = 16$, 41%) was the largest group, followed by the “overweight” category ($n = 12$, 31%). As previously mentioned, the sample self-identified as primarily White American families ($n = 30$, 73%). Two thirds of the parent sample was comprised of mothers (71%), and the youth gender was about evenly split (52% female, 48% male). We calculated the Hollingshead Index for SES (Hollingshead and Redlich 1958), which was 34.51 (SD = 11.61), denoting middle class socioeconomic status.

Research Question 1

To examine research question 1, we explored bivariate relations between the study variables. Table 2 displays the intercorrelations among the intergenerational study variables. There were no statistically significant associations between youth BMI and parent and family intergenerational factors, with the exception of the parent mental health factor

Table 2 Intercorrelations for study variables

Variables	1	2	3	4	5	6
1. Parent BMI score	–					
2. Parent BDI score	.24	–				
3. Parent age	.29	.26	–			
4. Parent PED steps	−.02	−.13	.06	–		
5. Family hollingshead score	.07	.15	.23	.11	–	
6. Child BMI score	.30	.42**	.06	.27	.22	–

BMI body mass index, *BDI* Beck depression inventory score, Parent PED steps = total 7-day pedometer steps

* $p < .05$, ** $p < .01$

(parent BDI). Specifically, higher levels of parental mental health symptoms, measured by the BDI, were positively associated with higher levels of youth BMI ($r = .42$, $p < .05$).

Research Question 2

For research question 2, and to allow for a comparison with other studies, we conducted a multiple regression analysis with parent and youth BMIs as continuous variables. Youth BMI was regressed on four predictor variables: parent BMI, parent emotional health scores (i.e., parent BDI scores), parent age, and family socioeconomic status (i.e., Hollingshead's score). All continuous variables were entered simultaneously. Table 3 presents the findings from the regression analysis. The overall model established the existence of a significant relationship between the four predictor variables and the criterion variable ($F = 3.03$, $p < .03$, $r^2 = .26$). The R value ($r = .507$) for this model meets the criterion for a medium effect size, as defined by Cohen (1992) and Cohen and Cohen (1983). The R^2 value reveals that 26% of the variance observed in the criterion variable of youth BMI was explained by the model.

Examination of the t tests on each beta weight (see Table 3) showed that parent depression scores (parent BDI) made a significant unique contribution above and beyond the other variables: $\beta = .37$, $p < .001$. Valence of the beta weight suggested that a higher level of depression symptoms was associated with a higher level of youth BMI. No other predictor variable was found to be statistically significant, and thus no other predictor variable helped to explain the variance in the criterion variable of youth BMI.

Table 3 Regression analysis summary for predictor variables and youth BMI

Predictor variable	*B*	SE *B*	*β*
1. Parent BMI score	.18	.28	.25
2. Parent BDI score	.27	.08	.37*
3. Parent age	.03	.33	−.16
4. Family hollingshead score	−4.99	−3.59	.18

Youth BMI (continuous score), Parent BMI score (continuous score), Parent BDI = Beck depression inventory score

$R^2 = .26$ ($n = 41$, $p < .03$)

* $p < .05$

Table 4 Odds ratios from logistic regression models predicting youth BMI (categorical)

Predictors	Youth overweight[a]		Youth obese[b]	
	Odds ratio	95% CI	Odds ratio	95% CI
Parent BMI category				
Underweight and normal	1.00		1.00	
Overweight and obese	1.13	.27, 4.80	1.07	.22, 5.07
Parent health status				
Good and excellent	1.00		1.00	
Poor and fair	.88	.24, 3.18	.83	.21, 3.38
Parent weight goals				
Weight loss	1.00		1.00	
Stay the same	.70	.18, 2.69	.50	.11, 2.29
Parent PED step				
More than 10,000 steps/day	1.00		1.00	
Less than 10,000 steps/day	.86	.12, 6.26	1.50	.14, 16.26

CDC The Center for Diseases Control and Prevention

Statistically significant odds ratios = * $p < .05$, ** $p < .01$

[a] Youth overweight = CDC BMI-for-age greater than the 85th percentile

[b] Youth obese = CDC BMI-for-age BMI greater than the 95th percentile

Research Question 3

Using BMI as a categorical variable, we also conducted a logistic regression analysis. The results of the logistic regression models are reported using odds ratios (see Table 4). These analyses indicated that none of the categorical parent and family factors was related to youth BMI. Finally, as part of research question 3, we also considered the influence of youth-participants' demographic factors and family demographic factors on BMI (see Table 5). The results of the logistic regression models are once again reported using odds ratios. The data revealed a few significant findings. Non-Hispanic Black American youth were more likely to be classified as overweight than non-Hispanic White American youth. And youth ages 9–11 were more likely to be classified as overweight than youth of age 8.

Discussion

The purpose of this study was to explore intergenerational health correlates and predictors of overweight and obesity in youth ages 8 -12. The study used a self-selected, convenience sample of parent-youth pairs from a southern region of the United States. The primary finding of our pilot study was the significant relation between parent mental health and youth physical health. Several studies have uncovered evidence on the cross-generational association between depression in parents and children's *mental health* (Beardslee et al. 1998); thus, it is not surprising that the link is evinced between depression in parents and children's *physical health* (operationalized as weight status). While this finding is correlational and thus we cannot infer causality, the magnitude of the positive association between parent mental health and youth physical health is important and consistent with other studies (e.g., Kowaleski-Jones and Mizell-Christie 2010). The lack of a statistically

Table 5 Child demographic variables and youth BMI (categorical)

Predictors	Youth overweight[a]		Youth obese[b]	
	Odds ratio	95% CI	Odds ratio	95% CI
Child gender				
Female	1.00		1.00	
Male	2.81	.73, 10.77	1.75	.43, 7.17
Child race				
Non-Hispanic White	1.00		1.00	
Non-Hispanic Black	5.14*	1.00, 26.46	2.53	.51, 12.59
Child age				
8	1.00		1.00	
9	.05*	.003, .67	.33	.04, 2.77
10	.05**	.004, .52	.33	.06, 2.00
11	.06*	.004, .82	.17	.01, 2.09
Number of siblings				
1–2	1.00		1.00	
3	1.07	.23, 4.89	1.13	.23, 5.54
4–6	.91	.17, 4.81	.50	.07, 3.46

CDC The Center for Diseases Control and Prevention

Statistically significant odds ratios = * $p < .05$, ** $p < .01$

[a] Youth overweight = CDC BMI-for-age greater than the 85th percentile

[b] Youth obese = CDC BMI-for-age BMI greater than the 95th percentile

significant association between parent BMI and youth BMI was surprising. This relation, while not statistically significant based on our a priori criterion of .05, "approached" significance ($r = .30$, $p < .06$).

Although the study was exploratory in nature, we expected to find statistically significant associations between other parent health (e.g., BMI) and family factors and characteristics (e.g., socioeconomic status) as well as exercise behavior and youth health (e.g., BMI). For example, Gable and Lutz (2000) found a significant relation between annual household income and children's and family members' rates of obesity.

A secondary finding—related to research question 2—derived from the regression analysis, was empirical support for the linear model of the association of parent factors on youth BMI. More specifically, all four parent factors jointly were part of a statistically significant model, although three of the four factors were not unique statistically significant predictors of youth BMI. Only one factor was found to predict youth BMI: parent mental health symptoms, measured by the BDI. Thus, inclusion of this variable ought to be considered in future explanatory models of youth BMI.

Toward this end, it would be easy for researchers, educators, and practitioners to delimit their focus on the relation between parent *physical health* and youth *physical health*. However, this possibly myopic view could miss the important link between parents who are physically fit but suffer from mental health symptoms and the resulting youth physical health factors, such as obesity. The Institute of Medicine (2009) underlines the importance of providing effective treatments and interventions that integrate a focus on physical *and* mental health. Additionally, these data support the importance of considering factors beyond the individual level, as recommended by Bronfenbrenner's (1979) ecological model. The ability of mental health symptom scores to predict youth BMI is consistent with the literature documenting the relations between health statuses across generations (Institute of Medicine 2009). Despite the study's limitations, the results buttress the importance of the far-reaching, bidirectional, reciprocal effects of family members' health

(Hooper et al. 2009; Kowaleski-Jones and Mizell-Christie 2010). Going forward, we hope that the approach to youth health will include—at a minimum—a two-generation systemic framework, and also will include a multi-disciplinary treatment team, including mental health care providers. Thus, novel and effective treatments would be both integrative (i.e., considering the interactions between physical and mental health) and systemic (i.e., considering the influence of one family member's health on multiple family members' health) (Hooper et al. 2009; Kowaleski-Jones and Mizell-Christie 2010). Because family-centered programs have shown the most promise for culturally, regionally, and economically diverse school-aged children (Griffith 2009), they ought to be explored once additional modifiable factors related to obesity and BMI are uncovered.

Finally, sociodemographic factors matter in considering correlates and predictors of youth BMI (Kowaleski-Jones and Mizell-Christie 2010). Related to research question 3, in our study the youths' age and race influenced the likelihood of being overweight, although parent and family factors such as age, socioeconomic status, and gender did not significantly predict youth BMI classification. However, we readily admit that the small sample size possibly attenuated our findings.

Given the multifactorial nature of obesity and weight in youth and adults, understanding factors related to and predictive of youth BMI is critical. In particular, studies such as the current one are vital in disentangling health factors and family characteristics that help clarify the exploding rates of obesity in the southern region of the United States (Singh et al. 2010; Trust for America's Health 2009, 2010).

Study Limitations

Limitations of the study should be considered. Our study was limited by the self-selected sample, cross-sectional nature, and small sample size. Therefore, associations between generations may have been attenuated. Additionally, the sample was homogeneous, with participants overwhelmingly self-identifying as White American. Thus, despite the current study's useful findings, the generalizability is limited by the constraints of the sample. Future research that includes a larger, more heterogeneous, racially diverse sample could extend the study's findings.

All data were derived from self-report, with the exception of BMI (e.g., weight and height). Although a strength of this study is that weight and height were measured by rigorously trained research assistants, other data were self-reported and not substantiated by direct observation or measures. The study collected data over a brief period (1 week). We can't be sure whether the findings would be the same had participants been followed over more time. We also cannot be sure that we had the adequate power to detect differences in our study areas of interest. Therefore, some limitations may be overcome by extending the length of the study and the size of the sample. In addition, the use of longitudinal designs could uncover relations not evinced in this cross-sectional study.

Conclusion

Our study provided an opportunity to better understand the extent to which intergenerational factors may relate to youth BMI among children, ages 8 -12, in southern regions of the United States. The results of the study suggest a linear relationship between parent mental health symptoms and youth BMI. Moreover, the results suggest that parent mental health symptoms *may* be an important consideration in the context of multiple factors that aid in intervening and managing the weight status of youth. Clearly, the associations and models explored in this study ought to be considered preliminary, and more studies are needed to fully understand and make meaning of the current study's nonsignificant and significant findings. The correlational research design of the study also underscores the preliminary nature of our findings. Nonetheless, the strong positive relationship found between parent mental health and youth physical health is noteworthy and consistent with the literature.

References

Appels, A., Bosma, H., Grabauskas, V., Gostautas, A., & Strumans, F. (1996). Self-rated health and mortality in a Lithuanian and Dutch population. *Social Science Medicine, 42*, 681–689.

Barfield, J. P., Rowe, D. A., & Michael, T. J. (2004). Interinstrument consistency of the Yamax Digi-Walker pedometer in elementary school-aged children. *Measurement in Physical Education and Exercise Science, 8*, 109–116.

Barlow, S. E., & The Expert Committee. (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics, 120*(4), S164–S192.

Beardslee, W. R., Versage, E. M., & Gladstone, T. R. G. (1998). Children of affectively ill parents: A review of the past 10 years. *Journal of the American Academy of Children and Adolescent Psychiatry, 37*, 1134–1141.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *BDI-II manual*. San Antonio, TX: The Psychological Corporation.

Beets, M. W., Vogel, R., Chapman, S., Petetti, K. H., & Cardinal, B. J. (2007). Parent's social support for children's outdoor physical activity: Do weekdays and weekends matter? *Sex Roles, 56*, 125–131.

Berry, D., Savoye, M., Melkus, G., & Grey, M. (2007). An intervention for multiethnic obese parents and overweight children. *Applied Nursing Research, 20*, 63–71.

Birch, L. L., & Davison, K. K. (2001). Family environmental factors influencing the developing behavioral controls of food intake and childhood overweight. *Pediatric Clinical North American, 48*, 893–907.

Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.

Burrage, L. C., & McCandless, S. E. (2007). Genetics of childhood obesity. *US Pediatrics Review, 1*, 60–63.

Center for Health and Health Care in Schools. (2007). Childhood overweight: What the research tells us. Retrieved August 5, 2009, from http://www.healthinschools.org/News-Room/Fact-Sheets/ChildhoodObesityUpdated07.aspx.

Centers for Disease Control and Prevention. (2006a). Obesity still a major problem. Retrieved January 22, 2009, from http://www.cdc.gov/nchs/pressroom/06facts/obesity03_04.htm.

Centers for Disease Control and Prevention. (2006b). Prevalence of overweight among children and adolescents: United States, 2003-2004. Retrieved January 22, 2009, from http://www.cdc.gov/nchs/products/pubs/pubd/hestats/overweight/overwght_child_03.htm.

Centers for Disease Control and Prevention. (2008). Obesity prevalence. Retrieved January 22, 2009, from http://www.cdc.gov/nccdphp/dnpa/obesity/childhood/prevalence.htm.

Centers for Disease Control and Prevention. (n.d.). About BMI for children and teens. Retrieved August 5, 2009, from http://www.cdc.gov/healthyweight/assessing/bmi/childrenbmi/aboutchildrensbmi.html.

Centers for Disease Control and Prevention. National Health and Nutrition Examination Survey (NHANES). (2009). http://www.cdc.gov/nchs/about/major/nhanes/datalink.htm. Accessed January 02.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155–159.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum Associates.

Davis, M., Young, L., Davis, S., & Moll, G. (2008). Parental depression, family functioning, and obesity among African American children. *Journal of Cultural Diversity, 15*, 61–66.

Epstein, L. H., Valoski, A., Wing, R. R., & McCurley, J. (1990). Ten-year follow-up of behavioral, family-based treatments for obese children. *Journal of the American Medical Association, 264*, 2519–2523.

Fogelholm, M., Nuutinen, O., Pasanen, M., Myohanen, E., & Saatela, T. (1999). Parent-child relationships of physical activity patterns and obesity. *International Journal of Obesity, 23*(12), 1262–1268.

Friedman, M. A., & Brownell, K. D. (1995). Psychological correlates of obesity: Moving to the next research generation. *Psychological Bulletin, 117*, 3–20.

Fylkesnes, J., & Forde, O. H. (1991). The Tromoso Study: Predictors of self-evaluated health- has society adopted the expanded health concept? *Social Science Medicine, 32*, 141–146.
Gable, S., & Lutz, S. (2000). Household, parent, and child contributions to childhood obesity. *Family Relations, 49*(3), 293–300.
Goldstein, M. S., Siegel, J. M., & Boyer, M. A. (1984). Predicting changes in perceived health status. *American Journal of Public Health, 32*, 141–146.
Griffith, J. R. (2009). Assessing childhood obesity programs in low-socioeconomic and diverse communities. *Journal of the National Medical Associations, 101*, 421–429.
Hollingshead, A. B., & Redlich, F. L. (1958). *Social class in mental illness*. New York: Wiley.
Hooper, L. M., Burnham, J. J., & Richey, R. (2009). Select parent and family system correlates of adolescent current weight status: A pilot study. *Family Journal, 17*, 14–21.
Hrabosky, J. I., & Thomas, J. J. (2008). Elucidating the relationship between obesity and depression: Recommendations for future research. *Clinical Psychology: Science and Practice, 15*, 28–34.
Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortaility: A review of twenty-seven community studies. *Journal of Health and Social Behavior, 38*, 21–37.
Institute of Medicine. (2009). *Fact sheet: Childhood obesity in the US: Facts and figures*. Washington, DC: National Academies.
Jackson, J. E., Doescher, M. P., Jerant, A. F., & Hart, G. L. (2005). A national study of obesity prevalence and trends by type of rural county. *Journal of Rural Health, 21*, 140–148.
Jahnke, D. L., & Warschburger, P. A. (2008). Familial transmission of eating behaviors in preschool-aged children. *Obesity, 16*, 1821–1825.
James, K. S., Connelly, C. D., Rutkowski, E., & McPherson, D. (2008). Family-based weight management with Latino mothers and children. *Journal of Specialists in Pediatric Nursing, 13*, 250–262.
Kitzmann, K. M., Dalton, W. T., III, & Buscemi, J. (2008). Beyond parenting practices: Family context and the treatment of pediatric obesity. *Family Relations, 57*(1), 13–23.
Kowaleski-Jones, L., & Mizell-Christie, C. A. (2010). Depressed mood and body weight. Exploring race differences in adolescence. *Youth and Society, 41*, 503–518.
Le Masurier, G. C., & Tudor-Locke, C. (2003). Comparison of pedometer and accelerometer accuracy under controlled conditions. *Medicine and Science in Sports and Exercise, 35*(5), 867–871.
Lederman, S. A., Akabas, S. R., & Moore, B. J. (2004). Editors' overview of the conference on preventing childhood obesity. *Pediatrics, 114*, 1139–1145.
Lovasi, G. S., Neckerman, K. M., Quinn, J. W., Weiss, C. C., & Rundle, A. (2009). Effect of individual or neighborhood disadvantage on the association between neighborhood walkability and body mass index. *American Journal of Public Health, 99*(2), 279–284.
Manderbacka, K., Lahelma, E., & Martikaninen, P. (1998). Examining the continuity of self-related health. *International Journal of Epidemiology, 27*, 208–213.
McDowell, M. A., Hughes, J. P., & Borrud, L. G. (2006). Health characteristics of US adults by body mass index category: Results from NHANES 1999–2002. *Public Health Reports, 121*, 67–73.
Menschik, D., Ahmed, S., Alexander, M. H., & Blum, R. W. (2008). Adolescent physical activities as predictors of young adult weight. *Archives of Pediatrics and Adolescent Medicine, 162*(1), 29–33.
Miech, R. A., Kumanyika, S. K., Stettler, N., Link, B. G., Phelan, J. C., & Chang, V. W. (2006). Trends in the association of poverty with overweight among US adolescents, 1971–2004. *Journal of the American Medical Association, 295*, 2385–2393.
Moore, M. E., Stunkard, A., & Srole, E. (1962). Obesity, social class, and mental illness. *Journal of the American Medical Association, 181*, 962–966.
National Heart, Lung, and Blood Institute. (2000). *The practical guide to identification, evaluation, and treatment, of overweight and obesity in adults*. Washington, DC: National Institutes of Health.
Ogden, C. L., Carroll, M. D., & Flegal, K. M. (2008). High body mass index for age among US children and adolescents, 2003–2006. *Journal of the American Medical Association, 299*(20), 2401–2405.
Repetti, R. L., Taylor, S. E., & Seeman, T. E. (2002). Risky families: Family social environments and the mental and physical health of offspring. *Psychological Bulletin, 128*(2), 330–366.
Rowe, D. A., Mahar, M. T., Raedeke, T. D., & Lore, J. (2004). Measuring physical activity in children with pedometers: Reliability, reactivity, and replacement of missing data. *Pediatric Exercise Science, 16*, 343–354.
Simon, G. E., Von Korff, M., Saunders, K., Miglioretti, D. L., Crane, P. K., van Belle, G., et al. (2006). Association between obesity and psychiatric disorders in the US adult population. *Archives of General Psychiatry, 63*, 824–830.
Singh, G. K., Kogan, M. D., & Van Dyck, P. C. (2010). Changes in state-specific childhood obesity and overweight prevalence in the United States from 2003 to 2007. *Archives of Pediatric Adolescent Medicine, 164*, 598–607.

Sobal, J., & Stunkard, A. J. (1989). Socioeconomic status and obesity: A review of the literature. *Psychological Bulletin, 105*, 260–275.

Strycker, L. A., Duncan, S. C., Chaumeton, N. R., Duncan, T. E., & Toobert, D. J. (2007). Reliability of pedometer data in samples of youth and older women. *International Journal of Behavioral Nutrition and Physical Activity, 4*(4). Retrieved February 5, 2009, from http://www.ijbnpa.org/content/4/1/4.

Trust for America's Health. (2007). F as in fat 2007: How obesity policies are failing in America. Washington, DC: author. Retrieved August 5, 2009, from http://healthyamericans.org/reports/obesity2007.

Trust for America's Health. (2009). F as in fat 2009: How obesity policies are failing in America. Washington, DC: author. Retrieved August 5, 2009, from http://healthyamericans.org/reports/obesity2009.

Trust for America's Health. (2010). F as in fat 2010: How obesity threatens America's future 2010. Washington, DC: author. Retrieved July 5, 2010, from http://healthyamericans.org/reports/obesity2010.

Tudor-Locke, C., Kronenfeld, J. J., Kim, S., Benin, M., & Kuby, M. (2007). A geographical comparison of prevalence of overweight school-aged children: The National Survey of Children's Health 2003. *Pediatrics, 120*, e1043–e1050.

Turner, H. M., Rose, K. S., & Cooper, M. J. (2005). Schema and parental bonding in overweight and nonoverweight female adolescents. *International Journal of Obesity, 29*, 381–387.

US Department of Health and Human Services. (2001). *The Surgeon General's call to action to prevent and decrease overweight and obesity*. Rockville, MD: Author.

Whitaker, R. C., Wright, J. A., Pepe, M. S., Seidel, K. D., & Dietz, W. H. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *New England Journal of Medicine, 337*, 869–873.

Zach, S., & Netz, Y. (2007). Like mother like child: Three generations' patterns of exercise behavior. *Families, Systems and Health, 25*(4), 419–434.