Community, family and individual factors influencing adolescent obesity: mediating role of parental health and the social and mental health consequences of obesity in young adulthood

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For the Major Program
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ABSTRACT

This study explores structural community adversity, family, and individual factors as potential risks of poor parental and adolescent physical health. Poor physical health among adolescents, specifically obesity, in turn may lead to educational, economic, and social disadvantages as adolescents become young adults. Community and family disadvantages uniquely influence the risk of poor general physical health among parents. Poor parental general health in turn is associated with adolescent obesity. Structural community adversity, family, and individual level influences on parental physical health and adolescent obesity emphasize the need for intervention programs to support disadvantaged youth and their families. In addition to exploring factors that influence adolescent obesity, results indicate that being obese/overweight during adolescence has a detrimental influence on a wide range of non-physical life domains. Obese/overweight adolescents are at an increased risk for a lower level of educational attainment and involvement in early sexual activities than normal weight adolescents. In addition, obese/overweight adolescents have higher levels of economic hardship and depressive symptoms in young adulthood. However, results indicate that the influence of adolescent obesity/overweight is moderated by gender.
CHAPTER 1: GENERAL INTRODUCTION

Introduction

Globally, there are more than 1 billion overweight adults, with at least 300 million of these adults being obese. Obesity in the United States has become one of the most important public health problems in recent years (Flegal, Graubard, Williamson, & Gail, 2005). In fact, during the past three decades it has increased to alarming proportions and affects over one quarter of the adult population (Flegal, Carroll, Kuczmarski, & Johnson, 1998). Obesity has dramatically increased over the past two decades and currently 31 percent of the United States population is obese (Hill, Catenacci, & Wyatt, 2005). Obesity and being overweight pose major risks for serious chronic diseases, including type 2 diabetes, cardiovascular disease, hypertension, certain forms of cancer, and psychological problems (The World Health Report, 2002). Studies have shown that obesity frequently occurs with several physical and mental health problems (Blazer, Moody-Ayers, Craft-Morgan, & Burchett, 2002), particularly physical conditions such as diabetes and heart disease. An increasing volume of empirical studies examining consequences of obesity have documented the substantial effect of obesity on morbidity and mortality (Crosnoe & Muller, 2004; Ferraro & Kelley-Moore, 2003; Bender, Jockel, Trautner, Spraul, & Berger, 1999; Durazo-Arvizu, McGee, Cooper, Liao, & Luke, 1998).

Additional estimates indicate that the problem of obesity will continue into the next generation, as current obesity rates among adolescents would suggest. Among adolescents, more than 15 percent are obese, and more than 30 percent are overweight (Hill et al., 2005). Obesity among children and adolescents is of paramount concern as a wide range of adverse
health impacts may occur at an earlier point in time and may persist longer and thus may have an enduring detrimental impact on the long-term health of an adolescent (Must & Strauss, 1999). Excessive weight in childhood and adolescence has been linked to increasing risk for adult mortality (Nieto, Szklo, & Comstock, 1992). Adolescent obesity strongly predicts obesity in adulthood, particularly the earlier the onset and greater the severity of the obese condition (Ferraro & Kelley-Moore, 2003; Garn, & LaVelle, 1985). Obesity experienced early in life is consistently related to physical disability in one’s lower body. The effects of obesity appear to be long-term, a condition that remains consequential throughout the life course (Ferraro & Kelley-Moore, 2003; Wickrama & Noh, 2004).

Purpose

As obesity continues to be a major health problem in our country, it is important that we continue to explore additional causes of adolescent obesity as well as the long-term physical, social, and economic consequences of obesity. By examining multiple risk factors of obesity, we are (1) better able to identify the magnitude of each risk factor and thus address these risks through effective intervention and prevention strategies. In addition, by continuing to explore and identify various detrimental consequences of obesity, we hope to (2) give an incentive to individuals in our society to strive for and maintain a physically healthy lifestyle. We also hope to (3) gain a better understanding of the potential impact that being obese may have on the social aspects of individuals’ lives.

Previous research has examined multiple family and individual factors such as family socioeconomic status, parental education, single parenthood, and race/ethnicity on adolescent obesity (Karlsen & Nazroo, 2002; Smith, 2000). More recently, distal factors such as the
built environment, which is the man-made physical components of human settlements such as buildings, streets, open spaces, and infrastructure have been examined as potential influences on adolescent obesity (Ewing, Schmid, Killingsworth, Zlot, & Raudenbush, 2003; Frank, Andresen, & Schmid, 2004). It is increasingly evident that an individual’s vulnerability to poorer health is affected by a range of both proximal factors, including individual and family factors, and more distal factors, particularly community-level factors (Albrecht, Clarke, & Miller, 1998). This may also be true for obesity; as a result, it is of growing importance that studies implement these three factors in order to account for a wide range of possible factors crucial to our understanding of adolescent obesity. However, only one known study has incorporated all three domains; community, family, and individual factors, into one comprehensive model to assess the influence of each on adolescent obesity (Wickrama & Noh, 2004). Absent from any existing study is the focus on potential variables that may mediate the relationship between community and family economic hardship on adolescent obesity. This current study will explore the home environment, specifically the physical health of parents of adolescents, as a critical mechanism in which community poverty and family economic hardship influence the likelihood of obesity in adolescents. In addition, this study will examine whether the relationship between parental health and adolescent obesity is linked both directly and indirectly through possible mediating variables such as adolescent physical activity/inactivity and adolescent eating behaviors.

In addition to the obvious physical consequences of obesity, of equal importance may be the potential psychological or social ramifications of obesity. Some evidence has been amassed to suggest that obese children may experience more social difficulties than their
average weight peers (Maddox, Back, & Liederman, 1969). Much attention has been given to the physical consequences associated with obesity; however the social consequences that obesity may bring to the surface may be more damaging than the physical. Obese children and adolescents suffer from a lowered self-esteem that affects their school performance and their peer relationships, leading to long term psychosocial effects (Tershakovec, Weller, & Gallagher, 1994; Hill, Draper, & Stack, 1994). Although not all overweight children become obese adults, the likelihood that childhood obesity will persist into adulthood increases with earlier onset and greater severity of the condition (Garn & LaVelle, 1985). Immediate psychosocial effects of childhood obesity may include social isolation, social rejection, discrimination, and peer problems in childhood (Stunkard & Wadden, 1992). By adolescence the effects of obesity include lower self-esteem, (Dietz, 1998) which is associated with increased rates of sadness, loneliness and nervousness (Strauss, 2000). Not only has obesity been linked to psychosocial functioning and attainments of individuals, the influence of obesity may also “spillover” into specific life domains of young adults.

Dissertation Organization

The organization of this dissertation includes four separate chapters. Chapter one includes a general introduction of the research topic. Chapter two includes a journal paper to be submitted to the Journal of Community Psychology that focuses on multiple factors predicting obesity in adolescents. Chapter three includes a journal paper to be submitted to Obesity Research that focuses on the social consequences of obesity in young adulthood. Chapter four consists of the overall summary of the dissertation.
CHAPTER 2. LINKING COMMUNITY AND FAMILY ADVERSITIES TO ADOLESCENT OBESITY: MEDIATING ROLE OF PARENTAL HEALTH

A paper to be submitted to the *Journal of Community Psychology*.

Michael Merten

Abstract

This study investigates the influence of structural community adversity, family, and individual factors on parental general physical health and adolescent obesity. The findings generally support the hypothesized additive and multiplicative association of these factors with parental physical health outcomes and adolescent obesity. Community and family disadvantages uniquely influence the risk of poor general physical health among parents. Poor parental general health in turn is associated with adolescent obesity. Findings also suggest that the influence of community adversity on parental general physical health is more pronounced for Whites compared to any other ethnic group. Family characteristics and individual characteristics, such as physical activity and inactivity as well as adolescent eating behaviors were significant contributors to adolescent obesity, independent of structural community adversity. Structural community adversity, family, and individual level influences on parental physical health and adolescent obesity emphasize the need for intervention programs to support disadvantaged youth and their families.
Background

Globally, there are more than 1 billion overweight adults, with at least 300 million of these adults being obese. Obesity in the United States has become one of the most important public health problems (Flegal, Graubard, Williamson, & Gail, 2005). In fact, during the past three decades it has increased to alarming proportions and affects over one quarter of the adult population (Flegal, Carroll, Kuczmarski, & Johnson, 1998). According to other estimates obesity has increased dramatically over the past two decades and currently 31 percent of the United States population is obese (Hill, Catenacci, & Wyatt, 2005). Additional estimates indicate that the problem of obesity will continue into the next generation, as current obesity rates among adolescents would suggest. Among adolescents, more than 15 percent are obese, and more than 30 percent are overweight (Hill et al., 2005).

The health consequences of obesity range from increased risk of premature death to serious chronic conditions that reduce the overall quality of life. Being obese or overweight poses a major risk for serious chronic diseases, including type 2 diabetes, cardiovascular disease, hypertension, and certain forms of cancer. Excess weight and physical inactivity are reported to account for over 300,000 premature deaths each year in the United States, second only to tobacco-related deaths among preventable causes of death (Allison, Fontaine, & Manson, 1999; McGinnis & Foege, 1993). Studies have shown that obesity frequently occurs with several physical and mental health problems (Blazer, Moody-Ayers, Craft-Morgan, & Burchett, 2002), particularly physical conditions such as diabetes and heart disease. Approximately 60% of diabetes and 21% of ischaemic heart disease were attributed to a body mass index (BMI) above 21 (The World Health Report, 2002). Body mass index (BMI) is
calculated by taking a person’s weight in kilograms and dividing that number by their height in meters squared (kg/m²). Children or adolescents with a BMI more than the 95th percentile for age and sex should be considered obese, whereas those with a BMI more than the 85th percentile but less than 95th percentile should be considered overweight. Ferraro and Kelly-Moore (2003) showed that obesity has long-term health consequences throughout adulthood, thus altering one’s life course in an enduring way.

Of paramount concern is the increasing incidence of child and adolescent obesity (Engeland, Bjorge, Tverdal, & Sogaard, 2004; Zametkin, Zoon, Klein, & Munson, 2004). The incidence of obesity increases during adolescence (Dietz, 1994; Morrison, Barton, Biro, Sprecher, Falkner, & Obarzanek, 1994) and tends to persist into adulthood (Serdula, Ivery, Coates, Freedman, Williamson, & Byers, 1993). Obesity among adolescents and children is associated with a range of adverse health impacts that can affect children both short- and long-term. Excessive weight in childhood and adolescence has been linked to increasing risk for adult mortality (Nieto, Szklo, & Comstock, 1992). Adolescent obesity strongly predicts obesity in adulthood, particularly the earlier the onset and greater the severity of the obese condition (Ferraro & Kelley-Moore, 2003; Garn, & LaVelle, 1985). Obesity experienced early in life is consistently related to physical disability in one’s lower body. The effects of obesity appear to be long-term, a condition that remains consequential throughout the life course (Ferraro & Kelley-Moore, 2003; Wickrama & Noh, 2004).

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built environment which is the man-made physical components of human settlements such as buildings, streets, open spaces, and infrastructure have been examined as potential influences on adolescent obesity (Ewing, Schmid, Killingsworth, Zlot, & Raudenbush, 2003; Frank, Andresen, & Schmid, 2004). It is increasingly evident that an individual's vulnerability to poorer health is affected by a range of both proximal factors, including individual and family factors, and more distal factors, particularly community-level factors (Albrecht, Clarke, & Miller, 1998). This may also be true for obesity; as a result, it is of growing importance that studies account for these three factors in order to account for a wide range of possible factors crucial to our understanding of adolescent obesity. However, only one known study has incorporated all three domains; community, family, and individual factors, into one comprehensive model to assess the influence of each on adolescent obesity (Wickrama & Noh, 2004). Absent from any existing study is the focus on potential variables that may mediate the relationship between community and family economic hardship on adolescent obesity. The current study will explore the home environment, specifically the physical health of parents of adolescents, as a critical mechanism in which community poverty and family economic hardship influence the likelihood of obesity in adolescents. In addition, this study will examine whether the relationship between parental health and adolescent obesity is linked directly and indirectly through possible mediating variables such as adolescent physical activity/inactivity and adolescent eating behaviors.

Hypothesized Relationships

Figure 1 presents the theoretical model which utilizes both the social disorganization theory as well as social learning theory to explain expected relationships among variables.
The social disorganization theory posits that adverse structural community conditions such as the concentration of poverty erode community social resources, norms, and values (Shaw & McKay, 1942). Residents who perceive their communities as disadvantaged are less likely to form relationships with other residents (Kowaleski-Jones, 2000) and may have a higher level of isolation, which may lead to a decrease in availability and accessibility of health services subsequently having a detrimental impact on an individual's physical health. Thus, not only may adverse community conditions directly influence parental health outcomes, but in addition such community conditions may also have a detrimental influence on the physical health of adolescents. Social learning theory explains the hypothesized relationship between parental physical health and adolescent obesity. Adolescents emulate the behavior of their parents on things such as exercise and eating habits, therefore parental health may be an important link to adolescent obesity.

The theoretical model proposes that structural community adversity and family economic hardship are associated with adolescent obesity directly and indirectly through parental physical health. Also, parental physical health affected by community and family economic adversity will influence the likelihood of obesity among adolescents both directly and indirectly through adolescent physical activity/inactivity and adolescent eating behaviors. In addition, the relationships between community, family, and individual factors on adolescent obesity as potentially moderated by gender and ethnicity will also be explored. Each hypothesized path in the proposed theoretical model will be discussed in the paragraphs that follow.
Structural Community Adversity and Adolescent Obesity

Although the United States is the richest nation in the world, millions of adults and children live in poverty. In 2003, 35.8 million people were reported to be living below the poverty threshold, which was then $18,810 for a family of four (United States Census Bureau, 2003). Alarmingly, 40% of those in poverty were children. This rate is the highest for any age group, with one in five children living below the poverty level (Wake, Salmon, Waters, Wright, & Hesketh, 2002). In addition to high poverty rates, there are additional socioeconomic concerns in the United States, specifically in the area of unemployment, the number of female headed households with children, and low paying service level occupations. In 2004, the percentage of unemployed adults in the United States was 5.5 percent (The World Fact Book, 2005). According to 2004 estimates, 23 percent of families with children under age 18 in the United States are headed by a female (United States Census Bureau, 2004). Also, the 2000 census reported that approximately 15 percent of all civilian workers 16 and older were employed in service level jobs (United States Census Bureau, 2003). The majority of these service jobs were in the area of food preparation, building and grounds cleaning, and personal care and service. More importantly, the above noted detrimental structural conditions tend to be concentrated in communities that have a high level of poverty, unemployment, and crime (Wilson, 1987). Wilson focuses on the connection between the economic structure of a city and the behavior of the residents living in the poor neighborhoods of the city. A community's economic structure is critical because
it affects the economic health of the families that reside in the community. If there are limited employment opportunities in a neighborhood, many residents may be forced to obtain government assistance or engage in illegal money-making activities as a means to providing for themselves and their families. These actions in turn have consequences for the children or adolescents in the community. Among African American, these consequences may be at an increased level. The limited opportunities available in many poor neighborhoods may be the result of a “spatial mismatch” between the location of African Americans and jobs. African American residential locations remain fairly centralized in urban neighborhoods, however many of the job opportunities in the past decade have continued to decentralize towards suburban areas (Stoll, 2005). Community scholars have shown that adverse structural conditions operate as a cluster of traits, which are mutually reinforcing (Elliot, William, Huizinga, Sampson, Elliot, & Rankin, 1996; Sampson, 1992). Therefore, it is of importance that a number of dimensions such as unemployment, poverty, and service level jobs all be taken into consideration when assessing structural community adversity.

Previous research has demonstrated that community conditions uniquely influence an array of youth behavioral and health outcomes (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993; Leventhal & Brooks-Gunn, 2003; South & Crowder, 1999; Wickrama & Bryant, 2003). Adverse community and family conditions seem to influence developmental outcomes most powerfully in early childhood and late adolescence (Hayward & Gorman, 2004; Massey, 1998). Adolescents living in low-income neighborhoods have more physical health problems than those living in middle-income neighborhoods (Leventhal & Brooks-Gunn, 2003). In fact, there is growing interest in how physical activity/inactivity, obesity,
and related chronic health problems are affected by environmental factors (Cervero & Duncan, 2003; Ewing et al., 2003; Saelens, Sallis, Black, & Chen, 2003), as it has become critical to recognize social environments as major determinants of health (path 1a, Figure 1). There may be several adverse community processes generated by community adversity that contribute to an increased risk of obesity in adolescents. These processes may influence health related behavior such as the day-to-day exercise and eating behaviors of adolescents, thus contributing to obesity.

First, neighborhoods characterized as impoverished provide environmental barriers towards an increase in physical activity (path 1b, Figure 1). The use of walking and bicycling as modes of transportation for residents in these communities may be less so due to the elevated safety concerns with crime and traffic. The lack of recreational activities, biking, or walking trails in these communities (United States Department of Transportation, 1994), may also limit physical activities that may contribute to higher rates of obesity in impoverished communities (Ross & Mirowsky, 2001).

Second, the influence of structural community adversity on subsequent obesity among adolescents may operate through structural constraints that limit the availability of healthy foods in the community (Sorensen, Emmons, Hunt, & Johnston, 1998). According to Kaplan (1995) low-income neighborhoods have a greater number of fast food restaurants than do higher income neighborhoods, thus increasing the likelihood of these residents to consume such food. With the presence of an overabundance of fast food options available in low-income communities, these communities are less likely to meet the dietary needs of their residents (Kaplan, 1995). The lack of availability and accessibility of health services in these
communities may also contribute to higher prevalence of adolescent obesity (Surgeon General Report, 2001). Unaffordable prices may limit access to proper food in poor neighborhoods. In fact, due to the relatively expensive ingredients, health food is often more expensive than junk food (Levy, 2002), therefore poor communities may be less likely to promote or sell items that are not affordable for members of the community.

Third, the structural community adversity influence may operate through community norms and values (Kowaleski-Jones, 2000; Wickrama & Bryant, 2003) that do not exert social control over improper body management practices and unhealthy dietary practices, or do not have prospective power to enforce healthy dietary practices. The reduced importance of local norms regarding both overweight and obesity may adversely influence the motivation for adolescents to properly manage their bodies. Also, perceived community disorder has been linked to psychological distress and perceived powerlessness of individuals within these communities (Cutrona, Russell, Hessling, Brown, & Murry, 2000). This sense of powerlessness may lead to the inability of individuals to feel a sense of control in terms of proper weight status.

Adolescents who live in adverse communities may be less likely to find positive role models that promote healthy activities among youth (Kowaleski-Jones, 2000). Instead, they may more often find negative role models that exert negative influences on adolescent health behaviors. This detrimental influence on adolescent health behaviors can be explained by both social learning theory (Bandura, 1977), and a 'prototype' perspective (Thornton, Gibbons, & Gerrard, 2002). Social learning theory emphasizes social variables as determinants of behavior and personality (Thomas, 2000). According to Bandura, one way
we learn is by observing others. Through observational learning ("modeling" or "imitation"), we cognitively represent the behavior of others and potentially adopt this behavior ourselves (Santrock, 1999). A wide range of behaviors, thoughts, and feelings such as aggression, hostility, poor exercise, and poor eating habits may be acquired through observing others' behavior, which may shape our own development. Consistent with social learning theory, adolescents may model or emulate community members who engage in obesity-related unhealthy behaviors available to them through social learning (Wickrama, Conger, Wallace, & Elder, 1999). According to a risk or 'prototype' perception perspective, adolescents may operate with favorable attitudes and perceptions developed toward obesity and obesity-promoting behaviors and thus engage in them (Thornton et al., 2002). This behavioral willingness results from exposure to risk opportunity in the community (a community characteristic) rather than an individual intention to engage in a behavior.

Studies investigating the neighborhood or community effects on individual physical health should also account for family characteristics such as family income, parental education, and race/ethnicity in order to demonstrate whether community effects go "above and beyond" family and individual influences. Including these particular family and individual measures minimizes the possibility that unmeasured individual and family characteristics associated with neighborhood residence (i.e., selection bias) may account for observed neighborhood effects (Leventhal & Brooks-Gunn, 2003).

*Family Socioeconomic Adversity and Obesity*

Recent studies have found that family socioeconomic status such as poverty, single parenthood, and low parental education contributes to adolescent health problems (Cristol,
Obesity occurs more frequently among children of low socioeconomic status than in the general population (Blank Sherman, Liao, Alexander, Kim, & Kim, 1995; Majem, Barba, Bartrina, Rodrigo, Santana, & Quintana, 2003; Yip, Scanlon, & Trowbridge, 1993). Children living in poverty are at greater risk for poor developmental outcomes, particularly poorer physical health (Miller & Korenman, 1994), due in part to the low quality of health services available and affordable to them. Based on this previous research, it is contended that family economic hardship will have a direct influence on adolescent obesity (path 2a, Figure 1).

Families with both parents present have been shown to be a protective factor against the development of obesity, because a two-parent family environment is more stable and regulated (Blank Sherman et al., 1995). Research documents that low parental education also places children at greater risk for obesity (Blank Sherman et al., 1995; Majem et al., 2003), as many parents may be less educated about the importance of healthy nutrition and exercise behaviors. Although the association between low socioeconomic status and health is well established (Frank & Mustard, 1994), the mechanisms by which income influences health are less clear. Evans and Stoddart (1994) suggest that health and disease are determined by interactions between influences in the social environment, physical environment, access to healthcare, and individual behavioral and biological responses. Abernathy, Webster, and Vermeulen (2002) provide evidence for an association between income adequacy and several dimensions of well-being, including the important association between poverty and lower levels of physical activity (path 2b, Figure 1). Low socioeconomic status groups consistently show a higher prevalence of leisure time physical inactivity (Rose and Marmot, 1981; Shea,
Stein, Basch, Lantigua, Maylahn, Strogatz, & Novick, 1991) than more affluent groups. Adolescents from socio-economically disadvantaged families lack balanced meals, healthy dietary practices (Fitzgibbon, Spring, Avellone, Blackman, Pingitore, and Stolley, 1997), and physical exercise (Wickrama et al., 1999). This lack of physical activity in turn may lead to an increased risk of obesity. In order to maintain a healthy weight, there must be a balance between calories consumed and calories expended through metabolic and physical activity. For most individuals, weight gain results from a combination of excess calories consumption and inadequate physical activity. Even though a large portion of a person’s total caloric requirement is used for basal metabolism and processing food, an individual’s various physical activities may account for as much as 15 to 40 percent of the calories he or she burns each day. While vigorous exercise uses calories at a higher rate, any physical activity will burn calories (United States Department of Health and Human Services, 2002).

Unaffordable prices and low incomes affect food choices, dietary habits and diet quality (Drewnowski & Specter, 2004). Poor nutrition is often a problem that persists among children from disadvantaged neighborhoods (Bhattacharya, Currie, & Haider, 2004). Parents trapped in poverty may be less likely to engage in prevention behaviors. The effect of family poverty on diet quality has normally been ascribed to a higher educational level or to a greater awareness of health issues among higher-income respondents (Bowman, Linn, Gerrior, & Basiotis, 1998). However, nutrition knowledge alone does not necessarily lead to a healthy diet (Berg, Jonsson, Connor, & Lissner, 2002). Another possibility is that healthier diets cost more and are beyond the reach of many low-income families. Kaufman, MacDonald, Lutz, and Smallwood (1997) report that wealthier households tend to purchase
higher-quality meats, more fish and seafood, and more fruit and vegetables than low-income households.

According to Drewnowski and Specter (2004) food choices and quality are influenced by social and economic resources or conditions and by food costs. Poor diet and physical inactivity are the two most powerful behavioral determinants of chronic disease for 75% of Michigan’s population (National Research Council, 1989). It is clear that low income children may consume a less “prudent diet” (Devaney, Gordon, & Burghart, 1995; Johnson, Guthrie, Smiciklas-Wright, & Wang, 1994). Children in poor families had lower consumption of certain nutrients found widely in fruits and vegetables (Adamson, Rugg-Gunn, Butler, Appleton, & Hackett, 1992; Johnson-Down, O’Laughlin, Koski, & Gray-Donald, 1997). Thus, it is expected that family economic hardship will have a direct influence on adolescent eating behavior, as well as the nutritional quality of the food consumed (path 2c, Figure 1).

Community and Family Adversities, and Parental Physical Health

As discussed previously, structural community adversity as well as family economic hardship may contribute to adolescent physical health in a number of ways. The same mechanisms previously discussed regarding the detrimental influence of community and family poverty on adolescent physical health may also operate for the physical health of the parents of adolescents (path 3a and 3b, Figure 1).

Lower socioeconomic status is associated with poor health status (Kington & Smith, 1997). The association between socioeconomic status (SES) and health is complex, but includes factors such as (1) access to health care (2) treatment for chronic conditions, and (3)
practice of health behaviors (Kington & Smith, 1997). As the result of these factors, individuals living in lower level socioeconomic conditions may be more likely to be in poor physical health. The rates of obesity and other illnesses in the United States tend to follow a socioeconomic gradient, such that the burden of disease falls disproportionately on people within limited resources, racial-ethnic minorities, and the poor (United States Department of Health and Human Services, 2000). This also appears to be true with regard to obesity. The highest obesity rates among United States adults are associated with the lowest incomes and educational levels (Schoenborn, Adams, & Barnes, 2002). Obesity has been more prevalent among both men and women having low incomes, although less consistently among men (Flegal, Carroll, Ogden, & Johnson 2002; Wardle, Waller, & Jarvis, 2002). Type 2 diabetes (often attributed to obesity) is strongly, consistently, and inversely associated with SES in both African American and Caucasian women (Robbins, Vaccarino, Zhang, & Kasl, 2001). African Americans, and African American women in particular are a population subgroup at increased risk for poor health status and adverse health outcomes (Cunningham, Hays, Burton, & Kington, 2000; Kuczmarski, Flegal, Campbell, & Johnson, 1994) as they are more likely to be overweight or obese (Flegal et al. 1998; Kumanyika, 1987). Recent demographic studies have also found increasing evidence for a relationship between poverty and risk for disability (Fujiura & Yamaki, 2000; Kaye, LaPlante, Carlson, & Wenger, 1996). Fujiura and Yamaki (2000) found that an increased risk for disability was among constituencies defined by poverty.

In short, poverty disrupts the home environment, in particular the health of adult parents. In turn, the home environment impacts the emotional and physical health of all
family members (Park, Turnbull, & Turnbull, 2002). Therefore, the influence of parental health on subsequent adolescent obesity will be examined.

*Parental Physical Health and Adolescent Obesity*

The mechanisms in which structural community adversity influences adolescent obesity may be explained using the *relationships and ties* model proposed by Leventhal & Brooks-Gunn (2000). This model posits that families are the critical mechanism of community effects. Important variables in this model include parental attributes (e.g., mental and physical health), as well as characteristics of the home environment (e.g., family routines). The home environment has been shown to be partly responsible for the link between neighborhood and children’s development (Leventhal & Brooks-Gunn, 2003).

Potentially troubling are the high rates of obesity/overweight among the adult population. Recent data from the National Health and Nutrition Examination Survey (NHA-NES) found that approximately 65 percent of the United States adult population is overweight and almost one in three is obese (Flegal et al., 2002). These rates among adults may translate into troubling rates among the youth in this country.

Reviews of weight and obesity (Maes, Neale, & Eaves, 1997) indicate that body weight and obesity are substantially influenced by heredity. Although several forms of obesity can be attributed to single-gene disorders, such as Bardet-Biedle, Laurence-Moon, and Alstrom syndromes, fewer than 5% of cases of obesity may be attributed to such effects. It is also conceivable that some cases of obesity may be attributed to overriding environmental factors. However, most instances of obesity are probably due to the joint influence of many genetic loci and environmental factors. According to Fitzgibbon, Stolley,
Dyer, VanHorn, and Kaufer-Christoffel (2002), the influence of parental health on their children can be transmitted both directly and indirectly. In terms of a direct influence, previous studies have shown that the higher the BMI of the mother the greater the likelihood that her children will become obese. In fact, overweight children, aged 10 to 14, and with at least one overweight or obese parent were found to have a 79 percent greater likelihood of overweight persisting into adulthood (American Obesity Association, 2002). This finding may reflect environmental as well as genetic factors (Alexander & Sherman, 1991; Sherman, Alexander, Clark, Dean, & Welter, 1992).

Parental health status may have a direct influence on the risk of obesity in adolescents. Parents may also indirectly influence their child’s physical health through modeling of a physically inactive lifestyle and poor eating habits. Using a social learning theoretical framework (Bandura, 1977), which asserts that behaviors exhibited in one’s environment are more likely to be learned, due to repeated exposure of the behavior(s), it is expected that adolescents living in a home environment characterized by poor parental physical health will be more likely to be obese (path 4, Figure 1). However, this parental influence may be transmitted to adolescents in a number of different ways. In particular, adolescent obesity may have a genetic component as well as an environmental component to which it can be attributed. The major focus of the current study is the potential influence of environmental factors on adolescent obesity, in particular parental health status. The influence of parental health status on adolescent obesity may operate indirectly through adolescent behavior, specifically adolescent physical activity and eating behaviors. (path 5a and 5b respectively, Figure 1).
An environment that encourages unhealthy eating and discourages exercise behaviors is a critical factor driving the obesity epidemic (Hill, & Peters, 1998). Exercise and eating behaviors exhibited in the family environment, particularly by parents may be most critical in the encouragement or discouragement of healthy eating and exercise patterns. Similarities within families are documented in relation to exercise behavior (Sallis, Patterson, Buono, Atkins, & Nader, 1988) and eating behavior (Fitzgibbon, Stolley, Avellone, Sugerman, & Chavez, 1996; Patterson, Rupp, Sallis, Atkins, & Nader, 1988). Adolescent physical activity and eating behaviors are modeled by family members, particularly parents, and thus are established at an early age. Intervention efforts addressing both child and family are needed to prevent obesity later in life (Fitzgibbon et al., 2002). However, the modeling of positive eating and exercise behaviors should extend through childhood on into adolescence, as these children's behaviors are very much being "molded" by the behaviors of their parents during this stage of life.

Again, the parental health influence on adolescent obesity may be explained through a number of mechanisms, in particular, a supportive environment that encourages exercise and healthy eating behaviors and through modeling of physical exercise and healthy eating behaviors (Perusse, Tremblay, Leblanc, & Bouchard, 1989). Parents with a lower level of physical health may live a lifestyle in which physical activity and healthy eating behaviors are not a major part of their daily or weekly activities. In these circumstances, parental activity/inactivity and eating behavior is a choice on the part of the parent. The parent may be physically capable of engaging in healthy exercise and eating behaviors, but due to a wide range of factors, (e.g. lack of motivation, lack of understanding of the importance of exercise,
etc.) may choose not to accept such a lifestyle. As a result, when parents exhibit a lifestyle void of physical activity and healthy eating behaviors they may inhibit their adolescent’s opportunity and motivation to adequately acquire regular physical activity patterns that are important in reducing the likelihood of obesity. The presence of healthy practicing behaviors by parents may allow them to convey a positive and/or motivating message regarding the importance of such behaviors. Children of parents who are physically active are almost six times more likely to be active than children whose parents report being inactive (Perusse et al., 1989). Obesity has also been directly linked to a reduction in level and amount of physical activity in adults (Davies, Gregory, & White, 1995; Eck, Klesges, Hanson, & Slawson, 1992) and participation in active sporting activities. This supports the idea that obese adults are less likely to engage in sports. Their children may be more likely to acquire this same sedentary lifestyle, thus increasing their adolescents’ risk for becoming obese.

Alternatively, there may be situations in which parents may be less capable of engaging in physical activities due to a physical condition such as a disability which restricts their amount of physical activity. This too may have a detrimental impact on the physical activity of an adolescent, in that physical activity may not be a major component of the home environment in which the adolescent lives.

Adolescent Physical Activity/Inactivity, Eating Behaviors and Obesity

The links between physical activity and health outcomes are well established. At the time of the Surgeon General’s Report on Physical Activity and Health in 1996, hundreds of research studies were amassed providing evidence of these links (United States Department of Health and Human Services, 1996). Problems with overweight and obesity occur when
there is not a proper balance between the number of calories consumed and the number of calories expended through physical activity. Weight gain results from a disproportionate amount of calories consumed relative to those expended (United States Department of Health and Human Services, 2002). Despite the health benefits of physical activity, 74% of United States adults do not get enough physical activity to meet public health recommendations and about one in four U. S. adults remain completely inactive during their leisure time (Pratt, Macera, & Blanton, 1999). Large shifts towards less physically demanding work have been observed worldwide. Moves towards less physical activity are also found in the increasing use of technology in the home and more passive leisure pursuits (World Health Organization, 2004). More than one-third of young people in grades 9-12 do not regularly engage in vigorous physical activity (United States Department of Health and Human Services, 2002). In addition, physical inactivity rates are also far too high as 43 percent of students in grades 9-12 watch television more than two hours per day (Kann, 2000). Previous studies have found that time spent in sedentary behaviors (particularly television watching) is most strongly associated with increased BMI (Andersen, Crespo, Bartlett, Cheskin, & Pratt, 1998; Muller, Mast, Languix, & Frunch, 1999). Robinson (1999) has suggested potential mechanisms that may link these sedentary behaviors with obesity. They include a reduction in the energy expenditure by diminished physical activity as well as an increase in energy intake through excess eating while viewing television or videos.

In addition to physical activity/inactivity patterns of adolescents as critical components of risk of obesity (path 6a, Figure 1), eating behaviors may also form a key component of the obesity epidemic (Majem et al., 2003) (path 6b, Figure 1). Eating habits
formed in adolescence continue into adulthood; consequently, poor dietary patterns among youth have important implications for health and well-being in adulthood (Kemm, Douglas, & Sylvester, 1987). According to the United States Department of Agriculture (USDA) Health Index Rating for 1994 to 1996, by adolescence 94% of children between ages 13 to 18 years show poor quality diets or diets in need of improvement (Bowman et al., 1998). Of particular interest are the eating behaviors of adolescents, specifically, breakfast consumption. Skipping breakfast is a decision that adolescents frequently make (Dwyer, Evans, Stone, 2001; Shaw, 1998). Consuming an inadequate breakfast or no breakfast at all may have adverse effects on physical and mental performance and on overall health (Mathews, 1996; Michaud, Musse, Nicholas, & Mejean, 1991). In a sample of 20-70 year olds, skipping breakfast was associated with a significantly higher risk of obesity (Ma, Bertone, Stanek, Reed, Hebert, Cohen, Merriam, & Ockene, 2003). Individuals who do not eat early in the day may tend to be hungry later on and then may consume a greater number of calories during the evening hours than individuals who eat consistently throughout the day (Hunt & Groff, 1990). Should breakfast be omitted, food consumption during the rest of the day may not provide sufficient nutrients to meet the recommended dietary allowances for vitamins and minerals (Preziosi, Galan, Deheeger, Yacoub, Drewnowski, & Hercberg, 1999). Although a regular breakfast is an important part of healthy eating habits, there is no general agreement as to what foods ought to be consumed and in what amounts (Preziosi et al., 1999). However, most will agree that foods high in sugar and fat are not ideal. Perhaps a factor in adolescents having a higher quality of eating habits is having parents that are eating healthy, thus creating an environment that offers positive eating choices for adolescents.
Adolescents identify parents as important influences on their meal consumption patterns (Neumark-Sztainer, Story, Perry, & Casey, 1999).

Summary

In summary, this study hypothesizes that structural community adversity will increase the likelihood of adolescents being obese. In addition, a higher level of structural community adversity and family economic hardship will decrease the level of general physical health in parents. Poorer parental general physical health in turn will increase the likelihood of adolescent obesity.

The following hypotheses will be examined in the current study:

1. Adolescents that live in a community with a higher level of structural community adversity will be more likely to be obese than adolescents that live in other communities (path 1a).

2. Adolescents that live in families with a higher level of family economic hardship will be more likely to be obese than adolescents that live in other families (path 2a).

3. Parents that live in a community with a higher level of structural community adversity will have a lower level of general physical health than parents that live in other communities (path 3a).

4. Parents that report a higher level of family economic hardship will have a lower level of general physical health than other parents (path 3b).

5. Parents that report a lower level of general physical health will be more likely to have adolescents that are obese than other parents (path 4).
6. Adolescents that have a lower level of physical activity and a higher level of physical inactivity will be more likely to be obese than other adolescents (path 6a).

7. Adolescents that have a lower level of eating patterns will be more likely to be obese than other adolescents (path 6b).

8. Parents with a higher level of general physical health will have children with a higher level of physical activity and a lower level of physical inactivity than other parents (path 5a).

9. Parents with a higher level of general physical health will be more likely to have children that have healthier eating patterns (path 5b).

10. Adolescents living in a community with a higher level of structural community adversity will have a lower level of physical activity and a higher level of physical inactivity than other adolescents (path 1b).

11. Adolescents living in families with a higher level of economic hardship will have a lower level of physical activity and a higher level of physical inactivity than other adolescents (path 2b).

12. Adolescents living in families with a higher level of economic hardship will be less likely to have healthy eating patterns than other adolescents (path 2c).
Method

Sample

Data came from Wave 1 (1995) of the National Longitudinal Study of Adolescent Health (Add Health), a longitudinal study of United States adolescents focusing on their lives, particularly their health and health behaviors. Further details regarding the data set are available at http://www.cpc.unc.edu/projects/adhealth. The National Longitudinal Study of Adolescent Health uses a school-based complex cluster sampling frame. The primary sampling frame included all high schools in the United States that had an 11th grade and at least 30 students enrolled in the school. A systematic random sample of 80 high schools was selected from this sampling frame. The sample was stratified by region, urbanicity, school type, ethnic mix, and size. For each high school, the primary feeder school that included seventh grade was also recruited. The final sample included 134 schools. Schools varied in size from 100 to more than 2,000 students. Using school rosters, a sample of adolescents was selected for in-home interviews. Ninety-minute interviews were completed by 20,745 adolescents during the first wave of data collection in 1995. During Wave 1, adolescents ranged in age from 12 to 18 years. This present study uses the in-home interview data from adolescents and parents, along with 1990 Census data. Approximately 17,000 parents provided interview data, with the mother or mother figure providing the interview data 93 percent of the time. The father or father figure provided the interview data in the other instances. Sample weights were used to ensure that each participant was representative of their particular race/ethnic population. The sample included 55% Whites, 22% African Americans, 16% Hispanics, 6% Asians and approximately 1% Native Americans. About
51.1% of the adolescents were boys and 48.9% were girls. Small proportions of mothers (14.1%) and fathers (11.1%) had completed less than a high school education, while 24.4% of households were below the poverty line. At least one parent was employed as a manual laborer in 40% of the families. A total of 84 percent of adolescents reported living with their biological mother, whereas 56 percent reported living with their biological father.

**Measures**

*Adolescent Obesity.* In 1994, the International Obesity Task Force convened a workshop on pediatric obesity to determine the most appropriate measurement to assess overweight and obesity in children and adolescents around the world (Morgan, Tanofsky-Kraff, Wilfley, & Yanovski, 2002). It was agreed that the body mass index (BMI), calculated as weight in kilograms divided by height in meters squared (kg/m²), provides a satisfactory measure with which to assess fatness in pediatric populations (Dietz & Bellizzi, 1999). BMI has the advantage of being very reliable and easily calculated. BMI also correlates well with direct measures of fatness in children and adolescents (Deurenberg, Weststrate, & Seidell, 1991; Dietz & Robinson, 1998; Killeen, Vanderburg, & Harlan, 1978), and is positively correlated with the prevalence of obesity-related conditions (Clarke, Woolson, & Lauer, 1986) and long-term mortality (Must, 1996). Importantly, BMI status also depends on age, gender, and race, factors that must be considered when assessing adiposity in youth (Troiano & Flegal, 1998). Reference BMI percentile curves that enable age and gender-specific percentiles to be determined have been published by the Centers for Disease Control (2000) and are used to define overweight and obesity. Children or adolescents with a BMI more than the 95th percentile for age and sex should be considered
obese, whereas those with a BMI more than the 85\textsuperscript{th} percentile but less than 95\textsuperscript{th} percentile should be considered overweight. Obesity is not equivalent to overweight; obesity denotes excess body fat, whereas overweight might relate to fat or other tissue in excess with relation to height (Troiano & Flegal, 1999). In adults, presently a BMI of 25 is considered overweight and a BMI of more than 30 is considered obese (Drewnowski & Specter, 2004; Wardle et al., 2002). These markers provide common benchmarks for assessment for adolescents and adults.

The BMI is the preferred method of expressing body fat percentile from clinical measurements. The BMI better reflects the amount of body fat compared with the amount of muscle or bone and is used for a proxy for measurement of body fatness in adolescents and adults in the absence of laboratory determinations. The BMI has good specificity so that it seems to exclude subjects who are not overweight or obese, but it misses some that are obese (poorer sensitivity) (Malina & Katzmarzyk, 1999).

The current study uses age and gender specific percentiles to categorize adolescents as 0 (obese) or 1 (not obese). Adolescents with a BMI more than the 95\textsuperscript{th} percentile for their age and sex were categorized as being obese. Adolescents in this study were asked to self report their current height and weight. BMI was then calculated by taking each adolescent's self-reported weight in kilograms and dividing that number by their height in meters squared (kg/m\textsuperscript{2}).

Structural Community Adversity. Community adversity is captured by five adverse community characteristics corresponding to a census track from the 1990 United States census. These census data contain hundreds of contextual variables that have been calculated.
and compiled and are already linked to each individual respondent in the Add Health data set. These variables include rates and proportions of population measures at the state, county, census tract, and census block levels. The current study used census tract level data, as 2,000 census tract areas are represented, with an average of approximately 10 families represented in each tract. A census tract consists of approximately 40 blocks and therefore represents a greater number of people than a single block. This structure allows us to examine contextual factors associated with individual outcomes. The five items used to measure structural community adversity include: (1) proportion of female headed households with children 18 years of age or younger (2) proportion of households with public assistance income (3) proportion of individuals with service level or clerical jobs (4) proportion of persons or households with income below poverty (5) proportion of individuals unemployed (Boardman, et al 2001; Baumer & South, 2001; Kowaleski-Jones, 2000; Wickrama & Bryant, 2003; Vartanian & Gleason, 1999). To assess the level of community adversity, a single score was computed by summing these five items, with a range for the scale being 0 to 5. The Cronbach's alpha for the community adversity measure was .91. The use of multiple indicators to assess structural community poverty was used to create a measure of cumulative disadvantage in a community.

**Family Economic Hardship.** A measure of family economic hardship was generated by summing three hardship items reported by the parent. These economic hardship items asked whether any member of the household (1) received food stamps, (2) Aid to Families with Dependent Children (now TANF), or (3) was a welfare recipient. Similar items have been used previously to assess family economic hardship (Wickrama & Bryant, 2003).
Scores have a range of 0-3, with higher scores reflecting greater economic hardship. The Cronbach's alpha for this measure was .86.

*Single Parenthood.* Single parenthood was assessed by creating a dichotomous variable 0 (not a single parent) or 1 (single parent). Parents who reported currently being married were coded as 0, while parents who reported never being married, widowed, divorced, or separated were coded as 1.

*Parental Education.* Parental education was measured by summing both mother's and father's level of formal education and dividing by two to create a mean value for parental education. For single-parent families, parental education was computed by doubling the single parent's level of education and dividing by two. Education categories ranged from 0 to 4, with 0 = did not graduate high school; 1 = high school graduate or GED; 2 = attended college, but did not graduate; 3 = college or university graduate; 4 = training beyond four year college degree.

*Parental General Physical Health.* The general physical health of parent(s) was assessed by a single item which asked, "How is your general physical health?" Initial scores on this measure ranged from 1 (poor) to 5 (excellent). Albrecht et al. (1998) and Ferraro and Farmer (1999) used a similar self-report measure to assess individual physical health status. Self-reports of health are highly correlated with physicians' assessments of morbidity (Romelsjo, Kaplan, Cohen, Allebeck, & Andreasson, 1992) and also with the number of visits to a physician (Linn & Linn, 1980). In addition, Fillenbaum (1979) found that self reports of physical health status reflect, to a degree, objective medical or physical conditions that influence an individual's everyday activities. Although I use a measure of perceived
physical health, rather than a measure based on physiological assessments, previous research has shown that this type of assessment is strongly linked to actual physical health status (Ferraro & Kelley-Moore, 2003; Wickrama, Conger, Lorenz, & Matthews, 1995).

**Parental Disability.** An additional item used to assess parental health status was whether or not one of the residential parents had a physical disability. The primary caregiver was asked whether they were disabled, and in addition they were asked about the disability status of their partner. Responses to these questions were 0 (not disabled) or 1 (disabled). The data set did not allow for an in-depth look into the scope and severity of the disability reported by the parent. However, upon correlating it with the general physical health measure, there is strong evidence that the parental disability measure reflects predominantly physical disability as it has a correlation of -.40 with the general physical health measure.

**Parental Obesity.** The final dimension of parental physical health status examined was the presence of obesity among parents. Parents were asked whether they were obese. The primary parent respondent was the mother or mother figure. The parent respondent not only reported their own obesity status, but also the obesity status of the adolescent’s biological father. Responses for this question were 0 (biological parents not obese) and 1 (at least one biological parent is obese).

**Adolescent Physical Activity.** Adolescent physical activity was assessed using a total of 3 items. Previous studies have used similar items to assess physical activity among an adolescent population (Gordon-Larsen, Adair, & Popkin, 2002; Gordon-Larsen, McMurray, and Popkin, 2000). These items asked about the adolescents’ involvement in physical activities during the past week. The following three questions were asked, (1) “During the
past week, how many times did you go rollerblading, rollerskating, skateboarding, or bicycling?" (2) During the past week, how many times did you play an active sport, such as baseball, softball, basketball, soccer, swimming, or football?" (3) During the past week, how many times did you exercise, such as jogging, walking, karate, jumping rope, gymnastics, or dancing?" Responses on each of these items ranged from 0 (not at all) to 3 (five or more times). Scores on the three items were summed together and divided by three to generate a total physical activity score for each adolescent. Scores ranged from 0 (low) to 2 (high). Scores were then grouped into three categories (based on average number of times doing these three activities), low (2 or less episodes of exercise a week), moderate (3 or 4 times a week), and high (5 or more times a week) to represent the amount of adolescent physical activity. These categories reflect various levels of physical activity, with a moderate level of activity (at least 3 episodes of physical activity per week) reflecting the minimum level of activity individuals in the United States should be engaging in (Healthy People 2010). The mean score of physical activity was .87, which corresponds to less than a moderate level of exercise or a little less than 3 to 4 episodes of exercise per week.

Adolescent Physical Inactivity. In addition to measuring adolescent physical activity, the physical inactivity patterns of adolescents must also be recognized. Physical inactivity and physical activity are measured independently of each other, because one can not assume that adolescent engagement in physical activity is negatively correlated with television viewing patterns. In fact, athletic adolescents who are involved in daily physical activities may enjoy watching sporting events on television or playing sports video games. The quantification of physical inactivity has received much less attention than that of physical
activity (Dietz, 1996). However, quantifying physical inactivity is generally less complex than physical activity, because physical inactivity lacks concern over energy expended and intensity of an activity (Gordon-Larsen et al., 2000). Three items were included to measure the level of physical inactivity in adolescents. These questions focused on sedentary activities such as television viewing and video or computer game playing. The following three questions were asked, (1) “How many hours a week do you watch television?” (2) “How many hours a week do you watch videos?” (3) “How many hours a week do you play video or computer games?” Responses to these items are on a continuous scale. An increase in the number of hours engaged in these activities indicates a higher level of adolescent physical inactivity. The three items were summed together to create a total inactivity score. Three categories were then created based upon previous studies (Gordon-Larsen et al., 2002; Gordon-Larsen et al., 2000), with the following categories: low (0-10 hours a week), moderate (11-24 hours a week), high (25 or more hours a week). The average number of hours adolescents report engaging in physical inactivity is approximately 23 hours per week.

Adolescent Eating Behaviors. Two separate measures of adolescent eating behaviors were assessed. Both measures focus on adolescent consumption of breakfast, based on previous research that associated skipping breakfast with a significantly higher risk of obesity (Ma et al., 2003). The first measure assesses the presence of breakfast consumption, while the second measure assesses the quality of the foods consumed for breakfast by adolescents.

A single item was created from the existing data which assessed whether adolescents eat breakfast on weekday mornings; 0 (do not consume breakfast) and 1 (consumes breakfast). The quality of the breakfast was also measured using the following four items: (1)
Do you have milk for breakfast on a weekday morning?” (2) Do you have cereal for breakfast on a weekday morning?” (3) Do you have fruit for breakfast on a weekday morning?” (4) Do you have eggs for breakfast on a weekday morning?” Similar items have been used previously (Videon & Manning, 2003) to assess adolescent consumption of healthy foods. These four items were summed together to yield a possible score range of 0 (none of these items consumed) to 4 (all of these items consumed). Higher scores indicate a higher quality of breakfast consumed by adolescents. The Cronbach’s alpha for these four breakfast consumption items was .70.

Race/Ethnicity. A set of five dichotomous variables (coded 0 and 1) were used to contrast race/ethnicity categories of White Caucasians, African Americans, Hispanics, Asians, and Native Americans against all other racial or ethnic groups.

Analytic Approach

Multi-level regression models were tested in order to examine the influence of community, family, and individual predictors on the individual level outcome variable—adolescent obesity. Because of the nested nature of the data (individuals within communities) individual error terms may be correlated within communities, and ordinary least square estimates, standard errors in particular, may be biased (Raudenbush & Bryk, 2002). To take into account this dependency among individuals within communities, I estimated multilevel models using the SAS Glimmix procedure, for categorical outcomes (obesity) as well as the SAS Proc Mixed procedure for continuous outcomes (parent’s general physical health).

\[
\text{Log-odd (Adolescent Obesity)}_{ij} = \beta_0 + \beta_1 X_{ij} + \beta_2 W_j + \beta_3 (W \times X)_{ij}
\]

Individual adolescent obesity of the \text{i}th adolescent in the \text{j}th community are predicted
by individual and family-level $X$ variables, community-level $W$ variables, and the interaction terms ($W \times X$).

**Results**

*Descriptive Statistics*

Zero-order correlations among all the major study variables were examined (Appendix). Structural community adversity and family economic hardship are both significantly correlated with adolescent obesity ($p < .01$). As the level of structural community adversity and family economic hardship increases, the likelihood increases that an adolescent will be obese. Parental education and single parenthood are also significantly correlated with adolescent obesity. All parental physical health variables as well as adolescent activity/inactivity and eating behaviors are also significantly correlated with adolescent obesity ($p < .01$). Structural community adversity and family characteristics are all significantly correlated with parental general physical health and adolescent physical activity and inactivity ($p < .01$). Adolescent obesity is significantly correlated with all family and individual level variables.

Table 1 shows the means, standard deviations, and ranges of the major study variables. Structural community adversity has a range of 0.27 to 2.82, with a mean value of 0.94. The mean level of parental education is 1.70, which means that the average household parental education is well above a high school graduate and just under having some education beyond high school. Of the parents interviewed in the study, 30 percent of them were single parents. The mean body mass index of the adolescent study participants is 22.49. In terms of parental health, there is at least one parent in the household that is disabled in 11
percent of the families. In addition, 22 percent of the adolescents have at least one biological parent that is obese. Among adolescents, the mean level of physical inactivity was 1.01, which on the 0 (low) to 2 (high) scale corresponds as a “moderate” level of physical inactivity for adolescents. Also, the mean level of breakfast consumption is 0.80, thus 80 percent of adolescents report consuming breakfast on weekday mornings.

Table 2 shows the general physical health status of the reporting parent (primarily the mother, 93% of the time) broken down by ethnicity. According to the table, self-reported general physical health varies considerably among ethnic groups. Native Americans reported the highest percentage of “poor” health, followed by Hispanics and African Americans. In contrast, Whites and Asians report the highest percentage of “excellent” health among ethnic groups. Consistent within the percentages of the table is the discrepancy in self-reported physical health among Whites and the minority ethnic groups, with the exception of Asians. Overall, the percentage of reporting parents having poor, fair, good, very good, and excellent general physical health are 3.79%, 14.62%, 31.80%, 30.90%, and 18.89% respectively.

Table 3 shows the percentage of adolescents with at least one obese biological parent. The interviewed parent was asked about their obesity status and they were also asked to give the weight status of their child’s other biological parent, if known. Approximately 40 percent
of Native American adolescents have at least one biological parent that is obese. This is by far the highest percentage among all ethnicities. A larger sample of Native Americans in the current study may decrease this percentage somewhat; however, there is no reason to expect it to drop considerably. Whites are the second leading ethnicity in terms of obesity among biological parents (24.55%) followed by African Americans (20.80%) and Hispanics (18.92%). Asians have the lowest reported biological parent obesity rates (8.72%).

Insert Table 3 about here

Table 4 presents the percentage of obese and overweight adolescents by ethnicity. These obesity rates are based on the Centers for Disease Control (CDC) growth chart that is age and gender specific for children and adolescents between the ages of 2 and 20. Native American adolescents have the highest rate of obesity (25.49%). African Americans have the second highest rate of obesity (14%) followed by Hispanics (13.51%), Whites (10.14%), and Asians (8.72%). In terms of overweight, Hispanics have the highest percentage (17.79%) followed closely by African Americans (17.68%). The percentage of Whites, Native Americans, and Asians that are overweight are 14.28%, 13.07%, and 11.97% respectively. The total percentage of adolescents that are obese (14.37%) is strikingly similar to the percentage of overweight adolescents (14.96%). Approximately 29 percent of the adolescents in the current study are considered overweight or obese.

Insert Table 4 about here
Table 5 presents the percentage of obese and overweight adolescents by ethnicity based strictly on the computed BMI for each adolescent. As previously mentioned, a BMI between 25 and 30 is classified as "overweight" whereas a BMI over 30 is considered "obese". Compared to obesity and overweight percentages in Table 4, percentages of overweight and obese adolescents are lower when using strictly the BMI of an adolescent. The percentage of obese adolescents when using a BMI of over 30 is 8.64 percent. However, when the CDC growth chart guidelines are used taking into consideration age and gender, the percentage of obese adolescents is 14.37 percent. Thus, the failure to use CDC guidelines that take into consideration the age and gender to assess overweight and obesity may lead to the underestimation of the actual percentage of overweight and obese adolescents in our country.

Insert Table 5 about here

Multi-Level Regression Analysis

Table 6 presents multi-level regression models with unstandardized regression coefficients that predict parental general physical health. Model 1 shows that structural community adversity significantly decreases parental physical health (B = -0.22, p<.001) even after controlling for family level economic predictors. The results also indicate that family economic hardship (B = -0.17, p<.001); parent education (B = 0.20, p<.01); and single parenthood (B = -0.14, p<.01) uniquely influence parental physical health. Differences among ethnic groups were also examined. Self-reported general physical health is the highest among Whites (B = 0.13, p < .001). African American, Hispanic, Asian, and Native
American status are all negatively correlated with general physical health, indicating that these minority groups have poorer physical health than Whites. In addition, there is no evidence of significant gender differences in the general physical health of parents.

Model 2 (Table 6) adds the interaction between race/ethnicity and structural community adversity in order to identify multiplicative or moderating effects of community and race/ethnicity. The interaction between community adversity and White racial status is negative and statistically significant (B = -0.24, p < .001). This indicates that among Whites, for every unit increase in structural community adversity, the detrimental influence that community has on parental physical health increases from -0.27 to -0.51. Thus, Whites that live in a community with a higher level of adversity will have a substantial decrease in their level of physical health. This indicates that structural community adversity has a much larger detrimental effect on the parental health of Whites than it does on the parental health of minorities.

Table 7 presents models predicting adolescent obesity using community, family, and individual factors. Community adversity was entered into the model initially followed by family, parental health, and individual level variables. This order of variable entry was based on the fact that community level variables are the first order variables, in which family, parental, and individual level variables are embedded. By subsequently adding family, parental, and individual level variables to a model that contains a community level variable, this allows for an illustrative way to assess the unique influence of a community level
variable. Model 1 shows that structural community adversity significantly increases the likelihood of adolescent obesity ($B = 0.43, p < 0.001$), even after controlling for family poverty, parental education, and single parenthood. In fact, for every 1.0 increase in structural community adversity adolescents are 1.54 times more likely to be obese. When looking at the range of structural community adversity levels (Table 1), we can see that they range from 0.27 to 2.82. Therefore if an individual living in a community with the lowest level of adversity (0.27) were to live in a community that had a one unit increase in community adversity (1.27), their likelihood of being obese would increase 1.54 times. Additionally, if an adolescent lived in a community that had a community adversity level of 2.27 (a 2.0 increase), they would be 3.08 times more likely to be obese. In addition, among family characteristics, increased parental education significantly decreases the likelihood of obesity among adolescents ($B = -0.12, p < 0.001$). Adolescents from a single-parent family are also more likely to be obese than those from two-parent families ($B = 0.12, p < 0.05$).

Model 2 adds parental general physical health. Controlling for community and family level factors, there is a significant effect of general parental physical health on adolescent obesity ($B = -0.21, p < 0.001$). For every 1.0 increase in general physical health status of the reporting parent, the odds of their adolescent being obese decreases by 21 percent (0.81 times). This finding is even more alarming considering the differential influence that occurs among obesity likelihood for parents in the extreme levels of general physical health status. Parents that report "poor" general physical health are 3.25 times more likely to have an obese
adolescent than parents who report being in "excellent" general physical health. In addition, parents that report "good" general physical health are 1.62 times more likely to have an obese adolescent than parents who report being in "excellent" general physical health. After adding parental general physical health to the model, the effect of structural community adversity decreases minimally, remaining statistically significant (B = .38, p < .001), thus there is a unique additive influence of parental general physical health on adolescent obesity, and unsubstantiated evidence of a mediating mechanism that links structural community adversity and adolescent obesity. Parental education also remains significant in this model.

In Model 3, two additional measures of parental health status are added. First, I examine whether having at least one parent in the home who is disabled is a significant predictor of adolescent obesity. In addition, I take into account biological or genetic factors in the model as I examine whether having at least one biological parent that is obese significantly predicts obesity among adolescents. Results indicate that having at least one biological parent who is obese significantly predicts adolescent obesity (B = .91, p < .001). In fact, adolescents with at least one biological parent who is obese are 2.48 times more likely to be obese than adolescents whose biological parents are not obese. In addition to this result, which accounts for biological factors in obesity, general physical health remains statistically significant, indicating that taking into account other measures of parental health status (parental disability and parental obesity) general parental physical health remains a significant predictor of adolescent obesity (B = -0.16, p < .001). There is no significant relationship between parental disability and adolescent obesity. Structural community
adversity remains relatively unchanged \( (B = 0.40, p < .001) \), thus illustrating its independence from other factors in the model.

Model 4 adds individual adolescent physical activity and eating behaviors in order to account for these important variables and to also test whether adolescent physical activity/inactivity and eating behaviors mediate the relationship between parental general physical health and adolescent obesity. Results indicate that there is a statistically significant relationship between adolescent physical activity and obesity \( (B = -0.08, p < .05) \), and an even stronger relationship between adolescent inactivity and obesity \( (B = 0.24, p < .001) \). In addition, adolescents who report consuming breakfast on a weekly basis are 78 percent less likely to be obese than adolescents who do not consume breakfast on a weekly basis \( (B = -0.25, p < .001) \). In addition to examining whether adolescents consume breakfast or not, I also take into account what they are eating for breakfast. The results show that eating a breakfast characterized as more healthy, (fruit, milk, etc.) does not significantly lower the likelihood of obesity among adolescents \( (B = -0.02, p < \text{n.s.}) \). The inclusion of these adolescent-level physical activity and inactivity, and eating patterns decreases the detrimental effect of structural community adversity on obesity only minimally \( (B = 0.35, p < .001) \), thus community adversity remains a statistically significant predictor of adolescent obesity.

Parental general physical health and parental obesity also remain statistically significant. In Model 5 ethnicity variables and gender are examined. Obesity among Hispanic, African American, and Native American adolescents is more prevalent than among Whites. Hispanics are 1.31 times more likely to be obese than Whites. Although, Native Americans have the largest beta coefficient, the t-value is not as high as that of Hispanics and African American...
Americans; therefore we must interpret this effect size more cautiously. A larger sample size for Native Americans would help in getting a more accurate assessment of the effect. Gender differences were also found ($B = 0.44, p < .001$), as males are 1.55 times more likely than females to be obese. Structural community adversity remains statistically significant, after controlling for all family, parental, and individual characteristics ($B = 0.25, p < .001$). In addition, general physical health of parents remains a significant predictor of adolescent obesity, even after controlling for all other variables in the model. Parental obesity remains a significant predictor of adolescent obesity, however its effect remains independent from that of the general parental health effect on adolescent obesity, thus there is evidence that general parental health status represents something independent of a biological or genetic influence, specifically a behavioral influence that adolescents acquire from their parents. Adolescent physical activity remains a significant predictor of adolescent obesity, if fact, it becomes an even stronger predictor of obesity ($B = -0.13, p < .001$). The influence of physical inactivity, breakfast consumption, and breakfast quality on adolescent obesity all remain relatively the same.

In addition to the above models tested, all interactions among the study variables were also examined. None of the interactions among community, family, and individual level factors reached statistical significance, nor decreased the Akaike Information Criterion (AIC), a goodness of fit measure. Therefore they were not included in the final model.

To complete testing of the theoretical model (Figure 1), the association between community, family, and individual level variables and adolescent outcome variables are examined (Table 8). Results indicate that structural community adversity significantly
predicts an adolescent’s decrease in physical activity (B = -0.11, p < .001) as well as their increase in physical inactivity (B = 0.25, p < .001). Family economic hardship significantly predicts an increase in adolescent physical inactivity (B = 0.06, p < .001) as well as a lower level of breakfast quality (B = -0.06, p < .001). Parental general physical health is a significant predictor of both adolescent physical activity and inactivity (B = 0.03, p < .001; B = -0.03, p < .001, respectively). There is also evidence that a higher level of parental general physical health has a positive influence on adolescent eating behaviors, particularly that it increases the likelihood of an adolescent consuming breakfast (B = 0.03, p < .01). African Americans are more likely to have a higher level of physical inactivity than any other ethnic group (B = 0.26, p < .001), whereas Hispanics are more likely to have a lower level of physical activity (B = -0.05, p < .001). Regarding gender differences, males are more likely than females to have a higher level of physical activity (B = 0.24, p < .001) as well as a higher level of physical inactivity (B = 0.22, p < .001). In addition, males are also more likely to consume breakfast (B = 0.09, p < .001) and to eat a better quality of foods for breakfast (B = 0.32, p < .001).

Discussion

The findings in this study generally support the proposed hypotheses, which emphasize the importance of community, family, and individual factors in predicting parental and adolescent physical health outcomes. The influence of structural community adversity directly contributes to the increased likelihood of obesity among adolescents, even after
controlling for family and individual characteristics. Structural community adversity also significantly decreases the level of parental physical health, even after taking into account family and individual factors. Therefore, the effect of community on parental and adolescent health is not dependent upon family and individual factors; instead it provides its own unique and powerful effect on the health status of both parents and their children.

In addition to the direct influence of structural community adversity on parental physical health and adolescent obesity, there is also a strong additive effect of family economic hardship on parental physical health. Parents that have a higher level of economic hardship will have a lower level of general physical health. In addition, low parental education and single parenthood significantly predict parental physical health. Of significant importance is that these family characteristics significantly predict poor parental health even after controlling for community and individual level factors.

This study provides strong support that parental general physical health is an important predictor of obesity among adolescents. Parental physical health significantly predicts adolescent obesity, even after controlling for community, family, individual, and other parental health factors. Of equal importance is that parental physical health remains statistically significant even after parental obesity (a genetic indicator of obesity) is taken into account. Therefore we must recognize the importance of parental health as we continue to move ahead in our struggle with obesity. Not only has this study shed new light on the importance of parental physical health on adolescent obesity, this study also provides evidence for the intergenerational transmission of poor physical health. Impoverished communities and adverse family conditions decrease the level of physical health among
adults. As a result, a decrease in physical health status among adults is then transmitted to their children. This pattern may continue for several generations as adults are unable to escape community or family poverty. The potential end result is a continuing pattern of poor physical health among adults and their children. As a result, it is critical that the focus of our intervention and preventive measures be both at the community and family levels, due to the interconnectedness of structural community adversity, parental physical health, and adolescent obesity.

The individual characteristics in the model also have a unique influence on adolescent obesity. Physical activity and inactivity both influence the likelihood of obesity among adolescents, even after controlling for community, family, and individual level factors. This finding is consistent with previous studies that have linked physical activity and inactivity to obesity in adolescents (Gordon-Larson et al., 2002). In fact, the results show that physical inactivity is a stronger predictor of adolescent obesity than physical activity. Future research should thoroughly address potential reasons in which physical inactivity may be a stronger predictor of obesity than physical activity. In this particular study, we can speculate that there is measurement error associated with this finding, in that when you examine a construct such as one’s activity, it is much harder to assess than inactivity, because you must consider frequency, caloric expenditure, etc. In addition, there is also the possibility that there is a reciprocal influence between obesity and physical inactivity, in which obesity may actually predict inactivity. The results also show that African American adolescents have a higher level of physical inactivity than Whites. This supports previous findings in that minority adolescents have lower physical activity and higher inactivity patterns than Whites (Gordon-
Larsen, McMurray, & Popkin, 1999). In addition, males have a higher level of physical activity and inactivity than females. This finding suggests that adolescent males tend to participate more in daily exercise activities, but also are more likely to watch television and videos and play more video games than females. As a result, this study shows that males are more likely to be obese than females, possibly suggesting that increased physical inactivity among males is a much stronger predictor of obesity than is increased physical activity. Not only were physical activity and inactivity patterns examined in this study, but adolescent eating patterns were also investigated.

Findings also suggest that eating breakfast decreases the risk of obesity among adolescents. This supports prior research which linked no breakfast consumption with a heightened risk of obesity (Ma et al., 2003). This may be due to the fact that individuals who eat breakfast are less likely to be hungry later in the morning or afternoon, and thus overcompensate for their hunger by overeating (Hunt & Groff, 1990). Adolescents who reported consuming milk, fruit, eggs, and cereal for breakfast did not have a lower likelihood of being obese than those not consuming these foods. These findings were not anticipated, however, the minimal number of items in this measure may be partly due to this finding. More specific questions concerning breakfast eating patterns may be needed in order to provide more insight into specific breakfast consumption patterns that increase the risk of obesity among adolescents.

This study suggests that being a minority (in the case of this particular study African American, Hispanic, and Native American) increases the likelihood of adolescent obesity even after controlling for community and family factors as well as other individual
characteristics. This association among ethnicity may be attributed to genetic factors, cultural differences in how acceptable obesity may be in some ethnic groups, differences in eating pattern beliefs or attitudes. In addition, historical disadvantage among minorities, not captured by variables in this study may explain an increase in the likelihood of obesity among adolescents. Future research should carefully examine the relation between ethnicity and obesity in order to better understand potential factors underlying this finding.

The results of this study also provide us with valuable information regarding the role of race/ethnicity in the problem of parental and adolescent physical health. In particular, minority status predicts both poor parental and adolescent health. The influence of race remained significant, even after controlling for community, family, and individual factors. This is important in that the additive effect of race/ethnicity on parental physical health and adolescent obesity can not be reduced or explained by socioeconomic variables. Instead, the effect of race/ethnicity may be explained by a higher degree of stress, as a result of being more susceptible to racial discrimination, due to their minority status in this country. An elevated level of stress in turn may have a negative effect on an individuals' overall mental and physical health (Wickrama & Bryant, 2003). The additive influence of race/ethnicity may also be due to underlying genetic or cultural factors as well. Social learning theory may explain why race/ethnicity has a unique additive affect on obesity as adolescents may emulate cultural beliefs and practices of family members in things such as poor eating habits and leisure activity.

In addition to examining the additive effects of variables in this study, interactions among community, family, and individual level variables were also examined. There were no
significant interactions found between family/individual and community factors. That is, there is no joint influence of community and family adversities. However, structural community adversity interacts with parental ethnicity when predicting parental physical health. With regard to the influence of structural community adversity on parental general physical health, this relationship varies by ethnicity. Living in an adverse community has a much more detrimental effect on the physical health of Whites, compared to any of the other ethnic groups, particularly African Americans. This finding is consistent with previous work that has suggested that the impact of community adversity on mental health is greater for Whites than for African Americans (McLeod & Nonnemaker, 2000; Chase-Lansdale, Gordon, Brooks-Gunn, & Klebanov, 1997). This current study finds evidence that supports the same pattern in terms of physical health for White and African American adults. This finding may be explained by the higher level of resilience that minorities may have compared to Whites in terms of coping with living in adverse community conditions. Research suggests that a higher number of minorities tend to live in adverse communities (McLoyd & Steinberg, 1998) therefore they may be less sensitive to the effects of an adverse community than Whites, as stress may become the norm for many of these minorities. As a result, Whites may not be as comfortable in such conditions (Welch, Sigelman, Bledsoe, & Combs, 2001) and may in turn experience a decrease in their overall physical health.

The current study also sheds light on potential theoretical implications regarding future research in the area of adolescent obesity and parental health. Careful consideration should be given to each ethnic group when running statistical analyses. Whites may comprise a different sub-population than African Americans or Hispanics. Future research should aim
to examine intra-racial models, in hopes of gaining a clearer and deeper understanding of specific factors related to both parental and adolescent physical health that may be more evident among specific racial/ethnic groups.

The analyses used in this study were based on adolescent and parent reports from a large, nationally representative sample of adolescents together with census data. Despite the empirical support for the hypotheses in this study, several limitations in the study must be noted. First, this study used self-report data to determine an adolescent’s body mass index. However, because individuals’ assessment of their weight may be biased, there may be an even greater number of individuals in the sample to be obese. Second, families with low levels of socioeconomic conditions may have self-selected into disadvantaged communities, in contrast to the study’s emphasis on community effects. Third, instead of the census tract as a spatial unit, it should be examined what may be gained from the use of smaller units such as census blocks or larger units such as counties. By necessity, the analyses in this study look at communities at an earlier point in time (1990 Census) and yet it is understood that communities are undergoing change. Such change may influence physical health outcomes. Lastly, the analyses in this study were based largely on cross-sectional data; thus issues regarding causality cannot be fully addressed.

Despite these limitations, this study provided important new information about the (a) unique influence of structural community adversity on parental health status and adolescent obesity (b) unique influence of parental health status on adolescent obesity and (c) moderating effect of race/ethnicity on the relationship between community adversity and parental physical health.
Adolescents’ primary role models remain their parents, thus it is critical that parents provide a positive learning environment for their adolescents. Intervention strategies for obesity among children and adolescents need to continue to develop in the homes of these children as well as at the community level. As a result, strategies should emphasize a social learning perspective and recognize that adolescents not only emulate behaviors of their parents and family, but also recognize the importance of peers in the pursuit of acquiring the tools for a physically healthy lifestyle. Future research should take a closer look at the home environment, particularly with adolescents that are home schooled. These individuals spend the most time in the home environment with their parent(s), therefore it becomes vitally important that parents of these adolescents are creating an environment that is conducive towards minimizing the risk of poor physical health among their adolescents.

In addition to the more proximal affects that structural community adversity and parental physical health may have on adolescent physical health, there may be additional, more distal detrimental effects that may surface as adolescents move into young adulthood. In addition to the physical consequences that obese adolescents may experience, there may also be social consequences associated with having been obese during adolescence. These social consequences of obesity in adolescence will be explored in the second paper of this dissertation.

References


http://children.metrotor.on.ca/task/force/must.htm


*Science, 280,* 1371-1374.


Figure 1. Theoretical Model

- Community Poverty
- Parental Health Status
- Family Economic Hardship
- Adolescent Eating Behaviors
- Adolescent Physical Activity/Inactivity
- Adolescent Obesity

1. Race/Ethnicity
2. Gender
<table>
<thead>
<tr>
<th>Variable</th>
<th>M</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community adversity</td>
<td>0.94</td>
<td>0.28</td>
<td>0.27-2.82</td>
</tr>
<tr>
<td>Family economic hardship</td>
<td>0.31</td>
<td>0.80</td>
<td>0.00-3.00</td>
</tr>
<tr>
<td>Parental education</td>
<td>1.70</td>
<td>1.07</td>
<td>0.00-4.00</td>
</tr>
<tr>
<td>Single parenthood</td>
<td>0.30</td>
<td>0.46</td>
<td>0.00-1.00</td>
</tr>
<tr>
<td>Adolescent BMI</td>
<td>22.49</td>
<td>4.42</td>
<td>11.21-56.38</td>
</tr>
<tr>
<td>Parental general physical health</td>
<td>3.57</td>
<td>1.03</td>
<td>1.00-5.00</td>
</tr>
<tr>
<td>Parental disability</td>
<td>0.11</td>
<td>0.31</td>
<td>0.00-1.00</td>
</tr>
<tr>
<td>Parental obesity</td>
<td>0.22</td>
<td>0.42</td>
<td>0.00-1.00</td>
</tr>
<tr>
<td>Physical inactivity</td>
<td>1.01</td>
<td>0.82</td>
<td>0.00-2.00</td>
</tr>
<tr>
<td>Physical activity</td>
<td>0.87</td>
<td>0.66</td>
<td>0.00-2.00</td>
</tr>
<tr>
<td>Breakfast consumption</td>
<td>0.80</td>
<td>0.40</td>
<td>0.00-1.00</td>
</tr>
<tr>
<td>Breakfast quality</td>
<td>1.60</td>
<td>1.20</td>
<td>0.00-4.00</td>
</tr>
</tbody>
</table>

Note: $N = 17,600$. Data are from Wave 1 of the National Longitudinal Study of Adolescent Health.
<table>
<thead>
<tr>
<th>Parent Ethnicity</th>
<th>Poor</th>
<th>Fair</th>
<th>Good</th>
<th>Very Good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>White (N = 10,140)</td>
<td>2.37%</td>
<td>8.79%</td>
<td>28.78%</td>
<td>36.03%</td>
<td>24.03%</td>
</tr>
<tr>
<td>African American (N = 3,711)</td>
<td>4.07%</td>
<td>15.55%</td>
<td>35.92%</td>
<td>28.67%</td>
<td>15.79%</td>
</tr>
<tr>
<td>Hispanic (N = 2,587)</td>
<td>4.25%</td>
<td>19.33%</td>
<td>34.63%</td>
<td>24.24%</td>
<td>17.55%</td>
</tr>
<tr>
<td>Asian (N = 941)</td>
<td>2.23%</td>
<td>8.60%</td>
<td>31.46%</td>
<td>35.39%</td>
<td>22.32%</td>
</tr>
<tr>
<td>Native American (N = 149)</td>
<td>6.04%</td>
<td>20.81%</td>
<td>28.19%</td>
<td>30.20%</td>
<td>14.76%</td>
</tr>
<tr>
<td>Total (N=17,528)</td>
<td>3.79%</td>
<td>14.62%</td>
<td>31.80%</td>
<td>30.90%</td>
<td>18.89%</td>
</tr>
</tbody>
</table>
Table 3. Percentage of adolescents with at least one obese biological parent, by ethnicity

<table>
<thead>
<tr>
<th>Parent Ethnicity</th>
<th>Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>White (<em>N</em> = 9,709)</td>
<td>24.55%</td>
</tr>
<tr>
<td>African American (<em>N</em> = 3,515)</td>
<td>20.80%</td>
</tr>
<tr>
<td>Hispanic (<em>N</em> = 2,468)</td>
<td>18.92%</td>
</tr>
<tr>
<td>Asian (<em>N</em> = 895)</td>
<td>8.72%</td>
</tr>
<tr>
<td>Native American (<em>N</em> = 144)</td>
<td>40.28%</td>
</tr>
<tr>
<td>Total (<em>N</em> = 16,731)</td>
<td>22.66%</td>
</tr>
</tbody>
</table>
Table 4. *Percentage of obese and overweight adolescents defined by CDC growth chart (age and gender specific), by ethnicity*

<table>
<thead>
<tr>
<th>Adolescent Ethnicity</th>
<th>Overweight <em>a</em></th>
<th>Obese (only)</th>
<th>Overweight or Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>White (N = 9,409)</td>
<td>14.28%</td>
<td>10.14%</td>
<td>24.42%</td>
</tr>
<tr>
<td>African American (N = 3,653)</td>
<td>17.68%</td>
<td>14.00%</td>
<td>31.68%</td>
</tr>
<tr>
<td>Hispanic (N = 2,783)</td>
<td>17.79%</td>
<td>13.51%</td>
<td>31.30%</td>
</tr>
<tr>
<td>Asian (N = 894)</td>
<td>11.97%</td>
<td>8.72%</td>
<td>20.69%</td>
</tr>
<tr>
<td>Native American (N = 153)</td>
<td>13.07%</td>
<td>25.49%</td>
<td>38.56%</td>
</tr>
<tr>
<td>Total (N = 16,892)</td>
<td>14.96%</td>
<td>14.37%</td>
<td>29.33%</td>
</tr>
</tbody>
</table>

*a Adolescents are overweight, but not obese.*
Table 5. Percentage of obese and overweight adolescents defined strictly by BMI, by ethnicity

<table>
<thead>
<tr>
<th>Adolescent Ethnicity</th>
<th>BMI 25-30 Overweight</th>
<th>BMI 30+ Obese (only)</th>
<th>Overweight or Obese</th>
</tr>
</thead>
<tbody>
<tr>
<td>White (N = 9,409)</td>
<td>13.83%</td>
<td>5.63%</td>
<td>19.46%</td>
</tr>
<tr>
<td>African American (N = 3,653)</td>
<td>16.71%</td>
<td>8.42%</td>
<td>25.13%</td>
</tr>
<tr>
<td>Hispanic (N = 2,783)</td>
<td>17.55%</td>
<td>8.54%</td>
<td>26.09%</td>
</tr>
<tr>
<td>Asian (N = 894)</td>
<td>11.51%</td>
<td>5.59%</td>
<td>17.10%</td>
</tr>
<tr>
<td>Native American (N = 153)</td>
<td>20.26%</td>
<td>15.03%</td>
<td>35.29%</td>
</tr>
<tr>
<td>Total (N = 16,892)</td>
<td>15.97%</td>
<td>8.64%</td>
<td>24.61%</td>
</tr>
</tbody>
</table>

*a* Adolescents are overweight, but not obese.
Table 6. *Unstandardized multi-level regression coefficients (t-values) for the effects of community, family characteristics, and race/ethnicity on parent general physical health*

<table>
<thead>
<tr>
<th>Independent Variables</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Community Adversity</strong></td>
<td>-0.22*** (-5.32)</td>
<td>-0.27*** (-6.27)</td>
</tr>
<tr>
<td><strong>Family Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Economic Hardship</td>
<td>-0.17*** (-15.44)</td>
<td>-0.17*** (-15.52)</td>
</tr>
<tr>
<td>Parental Education</td>
<td>0.20*** (24.05)</td>
<td>0.19*** (23.96)</td>
</tr>
<tr>
<td>Single Parenthood</td>
<td>-0.14*** (-7.65)</td>
<td>-0.14*** (-7.61)</td>
</tr>
<tr>
<td><strong>Parental Characteristics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>0.13*** (6.61)</td>
<td>0.13*** (6.55)</td>
</tr>
<tr>
<td>African American</td>
<td>-0.14*** (-5.65)</td>
<td>-0.15*** (-5.80)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>-0.11*** (-4.26)</td>
<td>-0.11*** (-4.08)</td>
</tr>
<tr>
<td>Asian</td>
<td>-0.12** (-3.06)</td>
<td>-0.08* (-2.10)</td>
</tr>
<tr>
<td>Native American</td>
<td>-0.19* (-2.07)</td>
<td>-0.03 (-0.27)</td>
</tr>
<tr>
<td>Gender (male)</td>
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<td>0.05 (1.50)</td>
</tr>
<tr>
<td><strong>Interaction</strong></td>
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<td></td>
</tr>
<tr>
<td>Comm. Disadvantage*White</td>
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*p < .05.  **p < .01.  ***p < .001.
Table 7. Multi-level logistic regression coefficients (odds ratios) for the effects of community, family characteristics, parental health status, and race/ethnicity on adolescent obesity

<table>
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<tr>
<th>Independent Variables</th>
<th>Model 1</th>
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<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
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<tr>
<td></td>
<td>(1.54)</td>
<td>(1.46)</td>
<td>(1.49)</td>
<td>(1.42)</td>
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<td>Family Characteristics</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Family Economic Hard.</td>
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<td>(0.98)</td>
<td>(0.99)</td>
<td>(0.99)</td>
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</tr>
<tr>
<td>Single Parenthood</td>
<td>0.12*</td>
<td>0.10*</td>
<td>0.13*</td>
<td>0.10*</td>
<td>0.07</td>
</tr>
<tr>
<td></td>
<td>(1.13)</td>
<td>(1.11)</td>
<td>(1.14)</td>
<td>(1.11)</td>
<td>(1.07)</td>
</tr>
<tr>
<td>Parental Education</td>
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<td>-0.11***</td>
<td>-0.11***</td>
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<tr>
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<td>(0.91)</td>
<td>(0.89)</td>
<td>(0.90)</td>
<td>(0.90)</td>
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<td>Parental Health Status</td>
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</tr>
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<td>-0.16***</td>
<td>-0.16***</td>
<td>-0.16***</td>
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<td>(1.09)</td>
<td>(1.09)</td>
<td>(1.09)</td>
<td>(1.08)</td>
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<td>0.90***</td>
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<td>(2.48)</td>
<td>(2.46)</td>
<td>(2.46)</td>
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<td>Individual Characteristics</td>
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<tr>
<td>Physical Activity</td>
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<td>-0.13***</td>
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<td></td>
<td></td>
<td>(0.92)</td>
<td>(0.88)</td>
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</tr>
<tr>
<td>Physical Inactivity</td>
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<td>0.20***</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>(1.27)</td>
<td>(1.22)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakfast Consumption</td>
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<td>-0.25***</td>
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</tr>
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<td>(0.78)</td>
<td>(0.78)</td>
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<td>Breakfast Quality</td>
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<td>(0.95)</td>
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<tr>
<td>African American</td>
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<td>0.26***</td>
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<td>(1.30)</td>
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<tr>
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<td></td>
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<td>(1.31)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td></td>
<td></td>
<td></td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.05)</td>
<td></td>
</tr>
<tr>
<td>Native American</td>
<td></td>
<td></td>
<td></td>
<td>0.46*</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(1.58)</td>
<td></td>
</tr>
<tr>
<td>Gender (male)</td>
<td></td>
<td></td>
<td></td>
<td>0.44***</td>
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</tr>
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<td>80,003</td>
<td>76,859</td>
<td>77,030</td>
<td>76,134</td>
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</table>

*p < .05.  **p < .01.  ***p < .001.
Table 8. *Unstandardized multi-level regression coefficients (t-values) for the effects of community, family characteristics, and parental health status on adolescent mediating variables*

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Adolescent Physical Activity</th>
<th>Adolescent Physical Inactivity</th>
<th>Adolescent Breakfast Consumption</th>
<th>Adolescent Breakfast Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Adversity</td>
<td>-0.11***</td>
<td>0.25***</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>(-4.85)</td>
<td>(7.88)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family Economic Hardship</td>
<td>-0.01</td>
<td>0.06***</td>
<td>0.01</td>
<td>-0.06***</td>
</tr>
<tr>
<td></td>
<td>(-1.61)</td>
<td>(6.95)</td>
<td>(0.93)</td>
<td>(-4.85)</td>
</tr>
<tr>
<td>Parental General Physical Health</td>
<td>0.03***</td>
<td>-0.03***</td>
<td>0.03**</td>
<td>0.02*</td>
</tr>
<tr>
<td></td>
<td>(6.45)</td>
<td>(-5.10)</td>
<td>(3.00)</td>
<td>(2.52)</td>
</tr>
<tr>
<td>Parental Disability</td>
<td>-0.04**</td>
<td>0.06**</td>
<td>-0.02*</td>
<td>-0.01</td>
</tr>
<tr>
<td></td>
<td>(-2.68)</td>
<td>(2.83)</td>
<td>(-1.97)</td>
<td>(-0.60)</td>
</tr>
<tr>
<td>Parental Obesity</td>
<td>-0.03*</td>
<td>0.01</td>
<td>-0.04***</td>
<td>-0.10***</td>
</tr>
<tr>
<td></td>
<td>(-2.32)</td>
<td>(0.90)</td>
<td>(-4.04)</td>
<td>(-4.09)</td>
</tr>
<tr>
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<td>0.01</td>
<td>0.26***</td>
<td>0.03**</td>
<td>0.16***</td>
</tr>
<tr>
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<td>(0.38)</td>
<td>(15.16)</td>
<td>(2.98)</td>
<td>(6.34)</td>
</tr>
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<td>Hispanic</td>
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<td>0.01</td>
<td>-0.01</td>
<td>-0.01</td>
</tr>
<tr>
<td></td>
<td>(-3.50)</td>
<td>(0.45)</td>
<td>(-0.83)</td>
<td>(-0.42)</td>
</tr>
<tr>
<td>Gender (male)</td>
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<td>0.22***</td>
<td>0.09***</td>
<td>0.32***</td>
</tr>
<tr>
<td></td>
<td>(24.29)</td>
<td>(17.93)</td>
<td>(11.80)</td>
<td>(18.08)</td>
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<tr>
<td>AIC</td>
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<td>37,526</td>
<td>22,574</td>
<td>50,344</td>
</tr>
</tbody>
</table>

*p < .05.  **p < .01.  ***p < .001.
### Appendix. Zero order correlations among study variables

| Variables                  | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  | 12  | 13  | 14  | 15  | 16  | 17  |
|----------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1. Community adversity     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 2. Family economic hardship| .31**|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 3. Parental education      | -.29** | .29** |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 4. Single parenthood       | .20** | .33** | -.07 |     |     |     |     |     |     |     |     |     |     |     |     |     |
| 5. Parental physical health| -.21** | -.24** | .21** | -.12** |     |     |     |     |     |     |     |     |     |     |     |     |
| 6. Parental disability     | .11** | .21** | -.15** | .02** | -.33** |     |     |     |     |     |     |     |     |     |     |     |
| 7. Parental obesity        | .01  | .01  | .01  | -.08** | .06** |     |     |     |     |     |     |     |     |     |     |     |
| 8. Physical inactivity     | .11** | .08** | -.08** | .08** | -.04** | .03** | .02* |     |     |     |     |     |     |     |     |     |
| 9. Physical activity       | -.06** | -.02** | .08** | -.03** | .03** | -.03** | -.02* | .01  |     |     |     |     |     |     |     |     |
| 10. Breakfast consumption  | .01  | .01  | .02** | -.02* | .01  | -.01 | -.03** | .00  | .09** |     |     |     |     |     |     |     |
| 11. Breakfast quality      | .02** | -.04** | .02** | -.02* | .01  | -.01 | -.04** | .03** | .12** | .66** |     |     |     |     |     |     |
| 12. African American       | .33** | .18** | -.01 | .27** | -.07** | .06** | -.01 | .15** | -.01 | .03** | .06** |     |     |     |     |     |
| 13. Hispanic               | .12** | .07** | -.27** | .01  | -.10** | -.01 | -.03** | .00  | -.03** | -.01 | .01  | -.25** |     |     |     |     |
| 14. Asian                  | -.07** | -.06** | .11** | -.08** | .03** | -.02** | -.08** | .01  | .01  | -.01 | -.13** | -.12** |     |     |     |     |
| 15. Native American        | .06** | .02** | -.01 | .02** | -.02* | .01  | .03** | .01  | .02** | .00  | .01  | -.05** | -.04** | -.02** |     |     |
| 16. Male                   | -.02* | -.03** | .01  | -.02* | .01  | -.01 | -.01 | .13** | .18** | .09** | .14** | -.03** | .00  | .02** | .00  |     |
| 17. Obesity                | .08** | .04** | -.06** | .04** | -.15** | .05** | .17** | .08** | -.03** | -.06** | -.05** | .04** | .03** | -.02** | .04** | .07** |

*p < .05.  **p < .01.
CHAPTER 3. A LONGITUDINAL INVESTIGATION OF THE SOCIAL CONSEQUENCES OF ADOLESCENT OBESITY: IMPLICATIONS IN YOUNG ADULTHOOD

A paper to be submitted to Obesity Research.

Michael Merten

Abstract

This study investigates the seldom studied educational, economic, and social consequences that obese adolescents encounter as they become young adults. The findings generally support the notion that being obese/overweight during adolescence has a detrimental influence on a wide range of non-physical life domains. Obese/overweight adolescents are at an increased risk for a lower level of educational attainment and involvement in early sexual activities than normal weight adolescents. In addition, obese/overweight adolescents have higher levels of economic hardship and depressive symptoms in young adulthood. However, results indicate that the influence of adolescent obesity/overweight is moderated by gender. Specifically, males do not suffer the educational, economic, and social detrimental effects of obesity/overweight to the same degree as females. Obese/overweight females suffer much more than obese/overweight males in terms of societal outcomes. In addition, detrimental consequences of obesity on social outcomes also vary by ethnicity, with obese Whites being most susceptible.
Background

According to Rippe (1998), 54 percent of the United States population is overweight and even more alarming is that 31 percent are obese (Hill, Catenacci, & Wyatt, 2005). Cristol (2003) reports that 26 percent of men and 28 percent of women are obese by age 36. In addition, these rates of obesity vary by race/ethnicity as African American women become obese more than twice as fast as white women, while the rate for Hispanic women is midway in-between. Overweight and obesity prevalence among adolescents is 30.4 percent and 15.5 percent, respectively (American Obesity Association, 2002). The prevalence of persons in the United States with a body mass index greater than 30 (which is considered obese) has risen substantially in the last decade (Ferraro & Kelley-Moore, 2003). These high rates of obesity are particularly troublesome due to the fact that obesity is known to contribute to increased morbidity and/or mortality (Ferraro & Kelley-Moore, 2003). High rates of obesity have a detrimental influence on the physical health of individuals. In fact, obesity has been linked with numerous health problems, such as an increased risk for heart disease, diabetes, certain cancers, and psychological problems (The World Health Report, 2002). These health problems can affect children in both the short and long term (Must & Strauss, 1999). Excessive weight in childhood has been linked to increasing risk for adult mortality (Nieto, Szklo, & Comstock, 1992). Much attention has been devoted towards understanding the health consequences of obesity. An increasing volume of empirical studies examining consequences of obesity have documented the substantial effect of obesity on morbidity and mortality (Bender, Jockel, Trautner, Spraul, & Berger, 1999; Durazo-Arvizu, McGee, Cooper, Liao, & Luke, 1998). Ferraro and Kelley-Moore (2003) have investigated the long-
term risks of obesity on health inequality in adulthood. Their findings conclude that obesity, especially when experienced early in life, is strongly related to physical disabilities in adulthood. As such, obesity alters one’s life course in enduring and powerful ways. Recent research has begun to examine the consequences of obesity on other dimensions of health-related aspects of the quality of life (Crosnoe & Muller, 2004).

Much attention has been given to the physical consequences associated with obesity; however the social ramifications that obesity may bring to the surface may be just as damaging as the physical. In addition to the obvious physical consequences of obesity, of equal importance may be the potential psychological or social consequences of obesity. Obese children and adolescents suffer from a lowered self-esteem that affects their school performance and their peer relationships, leading to long term psychosocial effects (Tershakovec, Weller, & Gallagher, 1994; Hill, Draper, & Stack, 1994). Although not all overweight children become obese adults, the likelihood that childhood obesity will persist into adulthood increases with earlier onset and greater severity of the condition (Garn & LaVelle, 1985). Immediate psychosocial effects of childhood obesity may include social isolation, discrimination, and peer problems in childhood (Stunkard & Wadden, 1992). By adolescence the effects of obesity include lower self-esteem, (Dietz, 1998) which is associated with increased rates of sadness, loneliness, and nervousness (Strauss, 2000). Not only has obesity been linked to psychosocial functioning of individuals, the influence of obesity may also “spillover” into specific social domains of young adults.
Social Consequences of Obesity

Of particular concern in the obesity research is the lack of attention given to the social consequences of obesity in the lives of young adults in comparison to the physical consequences. Previous studies have documented obese individuals as being at a disadvantage in areas such as education, employment, income, as well as interpersonal and romantic relationships (Ball, Crawford, & Kenardy, 2004; Gortmaker, Must, Perrin, Sobol, & Dietz, 1993). However, many of these studies rely on a cross-sectional design to assess the relationship between obesity and social outcomes across the life-span (Braungart-Reiker & Bergeman, 1999; Pearce, Boergers, & Prinstein, 2002; Sarlio-Lahteenkorva & Lahelma, 1999). Few studies have implemented a longitudinal design to examine the detrimental social influences that obesity may have on young adults (Ball et al., 2004; Gortmaker et al., 1993). In fact, few studies have examined the long-term social consequences of obesity, by using a design that contains children who are in adolescence during initial data collection to predict social and psychological outcomes in the same individuals several years later when they have entered into a new stage of development, young adulthood.

The current study aims to build upon previous work in linking adolescent obesity to young adult social outcomes. In particular, this study will utilize a longitudinal design to assess obesity in adolescence (12-18) to predict social outcomes in young adulthood; seven years later (ages 19-26). This design will enable us to determine how the presence of obesity in one stage of life (adolescence) may have a detrimental influence on these adolescents as they proceed into the next phase of life, young adulthood. The young adulthood stage is characterized by expected life events primarily in the area of establishing employment,
interpersonal and intimate relationships, and increased academic opportunities. The purpose of this study is to examine whether obesity in adolescence has a unique detrimental influence on specific social domains of men and women in the United States as they reach young adulthood. In the current study I will examine how the presence of obesity in adolescence has detrimental effects on young adult outcomes. In particular, obesity in adolescence may predict educational attainment, economic status, sexual experiences, and depressive symptoms in young adulthood.

**Obesity and Educational Attainment**

An important domain of a young adult’s life is their educational endeavors. For individuals between the ages of 18-23, going to college is a major transition into young adulthood. However, for many obese individuals the process of getting into college or aspiring to be in college may be a major challenge. For obese high school students, acceptance rates into college are lower, despite qualifications, high school performance or application rates (Wadden & Stunkard, 1985). Overweight adolescents have approximately one-half of college acceptance rates to elite universities as normal weight adolescents with similar achievement scores (Canning & Majer, 1966). In addition to lower acceptance rates, Ball et al. (2004) found that fewer overweight and obese women aspired to gain further education. The average obese woman has 4 months less schooling than a non-obese woman, and is 10 percent more apt to live in poverty (Wadden & Stunkard, 1985). Social pressures and prejudices can be so overwhelming as to push the obese individual out of public schooling (Flanagan, 1996). Obese adolescent girls complete less schooling and have lower household incomes as adults (Gortmaker et al., 1993).
Gortmaker et al. (1993) followed adolescents over a seven year period into young adulthood and found that women initially overweight completed 0.3 years less schooling, had lower household incomes ($6710 less annually), and had higher rates of poverty (10% higher) as those who were initially of normal weight. Similar findings were observed among males, but the impact of overweight was smaller. These differentials remained after adjusting for baseline family income, education, ethnicity, and self-esteem. The implications of a lower education level may be directly linked to a decrease in other areas of a young adult’s life, including their work experiences.

*Obesity and Economic Hardship*

Previous research has documented the link between obesity and individual income using both a cross-sectional (Sarlio-Lahteenkorva & Lahelma, 1999) and longitudinal research design (Gortmaker et al., 1993; Register & Williams, 1990; Sargent & Blachflower, 1994). Both overweight and obese individuals were more likely to have low individual earnings (Sarlio-Lahteenkorva & Lahelma, 1999). According to Zetlin (1988), a reason for obese individuals having lower incomes may be a direct result of employers feeling that they do not have to give good raises to obese persons, because they’ll have a hard time getting a job elsewhere. In fact, only 9% of executives with salaries of $25,000-$50,000 were more than 10 lbs. overweight, whereas 39% of those earning $10,000-$20,000 were comparably overweight. Thus, each pound of fat costs an executive $1000 a year (Zetlin, 1988).

Obesity has been shown to influence labor wages (Register & Williams, 1990). Loh (1993) found evidence of a significant wage penalty for obese employees. This takes several forms: lower wages of obese employees for the same job performed by non-obese
counterparts, fewer obese employees being hired in high-level positions, and denial of promotions to obese employees. Obese women are more likely than thin women to hold low-paying jobs (Pagan & Davila, 1997). Obese men are under-represented and paid less than non-obese men in managerial and professional occupations and are over-represented in transportation occupations (bus, taxi drivers) (Pagan & Davila, 1997).

Although a relationship has been found among obesity and lower income, this relationship has been consistent only among women. According to Sarlio-Lahteenkorva and Lahelma (1999) deviant body weight is related to social and economic disadvantage in a gender-specific and partly curvilinear way. For women, high BMI was associated with low income. In men, thinness was associated with lower income. A curvilinear relationship between weight and family income was also found for women (Jeffery, Forster, Folsom, Luepker, Jacobs, & Blackburn, 1989), as family income was at its lowest point for overweight and obese women. For men, however, lowest income was for thin persons. Longitudinal studies have also supported this pattern of gender differences among obesity and low income status. In a longitudinal study of men and women 18 to 25 years old, obese women earned 12 percent less income than non-obese women (Register & Williams, 1990). Gortmaker et al. (1993) examined the relationship between obesity and income among individuals 16-24 years of age, and found overweight women to have lower household incomes and higher rates of household poverty. No such evidence was found for men in the study. Sargent and Blachflower (1994) found that obese females at age 16, earned 10 percent less than their non-obese peers when they reached the age of 23. No such effect was found in men; males who were initially obese at age 16 had the same income as their non-obese peers.
Interestingly, the inverse relationship between obesity at 16 years old and earnings at 23 years of age among women, persisted whether the adolescent female remained obese or lost weight to move into the non-obese category by age 23. This finding illustrates the importance of obesity during adolescence, in that it may have a lasting influence on future income status of individuals, much more than current weight status. Not only has obesity been linked to education, economic, and work outcomes, but more recently it has been linked to other social domains, including involvement and satisfaction in young adult romantic relationships.

*Obesity and Depressive Symptoms*

The prevalence of obesity in this country continues to grow; as a result there may be a strong probability that obesity will co-occur with other physical or mental conditions, in particular major depression (Stunkard, Faith, & Allison, 2003). Immediate psychosocial effects of adolescent obesity may include social isolation, discrimination, and peer problems in childhood (Stunkard & Wadden, 1992). The association between obesity and various psychological states has been reported in the scientific literature over the last several decades (Friedman & Brownell, 1995). Many studies have examined the relationship between obesity and depression, but nearly all have been cross-sectional in design, and few have involved children or adolescents. Although there are plausible explanations of how obesity leads to depression, few longitudinal studies have assessed the obesity-depression relationship to help establish the casual direction of this association (Goodman & Whitaker, 2002). Several studies report that the relationship between obesity and depression differs for men and women (Carpenter, Hasin, Allison, & Faith, 2000; Faith, Berman, Heo, Pietrobelli, Gallagher, Epstein, Eiden, & Allison, 2001; Istvan, Zavela, & Weidner, 1992; Stunkard et al.,
2003), with an increase in weight being a strong predictor of depression for women only. In fact, in two of these studies, (Carpenter et al., 2000; Stunkard et al., 2003) an inverse relationship exists between obesity and depression. Only two studies have examined obesity as a risk factor for depression with a prospective design (Roberts, Kaplan, Shema, & Strawbridge, 2000; Roberts, Strawbridge, Deleger, & Kaplan, 2002). Roberts, Deleger, Strawbridge, and Kaplan (2003) examined the association between obesity and depression longitudinally, by testing whether there was a reciprocal association between the two variables. They found that obesity predicts depression, as the level of depression among obese adults increased five years after baseline.

*Obesity and Sexual Experience*

Interpersonal relationships in young adulthood are a critical and fundamental part of life for this group of individuals (Pearce et al., 2002). These relationships are increasingly important to young adults, as many of them are dating or becoming married in this phase of their life. As a result, I will examine whether obese adolescents will have different experiences during the period of young adulthood with romantic relationships than non-obese individuals. For obese individuals it may not only be more difficult to make friends but maybe even more difficult to establish a romantic relationship with a partner during young adulthood (Harris, 1990). Regarding consequences of obesity in terms of long term relationship status, both obese men and women are less likely to be married than non-obese men and women in young adulthood (Ball et al., 2004; Gortmaker et al., 1993).

However, the negative influence that obesity may have on romantic relationships may be particularly troublesome for females. Sarlio-Lahteenkorva and Lahelma (1999) found that
obesity among women is associated with an absence of close friends outside the family circle. This may suggest a family-oriented lifestyle among obese females and problems in making friends or uneasiness with unfamiliar people. In addition, Pearce et al. (2002) found that obese adolescent girls were less likely to date than their non-obese peers. However, obese boys did not report dating less than their overweight and average weight peers. In addition, 50 percent of obese female adolescents reported that they have never dated, whereas 17 percent overweight girls and 20 percent of average weight girls report never dating. No such differences were found among boys. Differences among men and women have also been identified in terms of marital status, with obese and overweight women being 20% less likely to be married (Associated Press, 1993). Pearce et al. (2002) found that both obese boys and girls reported being more dissatisfied with their dating status compared with average-weight peers. Ball et al. (2004) also found obese women to be less satisfied in close personal relationships than non-obese women.

In the current study, attention is given to an area that lacks substantial literature, sexual experience reported by young adults who reported being obese/overweight while in adolescence. Dating literature may suggest that obese men will report more sexual experiences, due to their increased likelihood to date compared to obese women (Associated Press, 1993). However, obese women may have lower levels of self-esteem, thus leading to potentially more involvement in sexual activity.

Summary

Figure 1 illustrates the proposed theoretical model, which contends that obesity in adolescence will have a detrimental influence on specific social outcomes in young
adulthood. It is hypothesized that adolescent obesity will predict lower levels of educational attainment and sexual experiences, and higher levels of economic hardship and depressive symptoms during young adulthood, after taking into account the association among all of these outcomes. Based on previous findings, these relationships may also be moderated by gender. In addition, racial differences will be explored.

Method

Sample

The data for this study were derived from the National Longitudinal Study of Adolescent Health, a nationally representative study of adolescents. Both adolescents and parents were interviewed at home, where an array of information was obtained on health and lifestyle. This study uses in-home interview data from adolescents and parents, collected in 1995 (Wave 1) and 2001 (Wave 3). The Adolescent Health Survey is comprised of data collected from a nationally representative sample of high school students; data collection was based on a complex cluster sampling frame. A sample of 134 middle and high schools was selected through stratified sampling. The total sample size was 20,745. To ensure diversity, the sample was stratified by region, urbanicity, school type (public vs. private), racial composition, and size. Sample weights were used to ensure the national representativeness of the sample. Further details regarding the data set are available at http://www.cpc.unc.edu/projects/adhealth.

During the time of initial data collection, adolescents ranged in age from 12 to 19 years. At the time of subsequent data collection (Wave 3) many of the initially interviewed adolescents were young adults as they ranged in age from 18-27. The median age of
respondents in wave 3 was 22 years of age. Interviews with 15,170 Wave 1 respondents were completed at Wave 3. The Wave 3 questionnaire was designed to obtain relationship, marital, childbearing, and educational histories, and to date key labor force events. Some questions were unchanged from earlier waves. To enhance longitudinal measures, new sections focus on topics more relevant to young adults. The Wave 1 sample included 55% Whites, 22% African Americans, 16% Hispanics, 6% Asians and approximately 1% Native Americans. About 51.1% of the adolescents were boys and 48.9% were girls. The total sample in Wave 3 that reported full information for the variables used in the current study was 11,391. This included Whites (54%), African Americans (22%), Hispanics (16%), Asians (7%), and Native Americans (1%). Of the young adults in the Wave 3 sample, 53% were female while 47% were male.

Measures

Adolescent Obesity/Overweight. In 1994, the International Obesity Task Force convened a workshop on pediatric obesity to determine the most appropriate measurement to assess overweight and obesity in children and adolescents around the world (Morgan, Tanofsky-Kraff, Wilfley, & Yanovski, 2002). It was agreed that the body mass index (BMI), calculated as weight in kilograms divided by height in meters squared (kg/m$^2$), provides a satisfactory measure with which to assess fatness in pediatric populations (Dietz & Bellizzi, 1999).

BMI has the advantage of being very reliable and easily calculated. BMI also correlates well with direct measures of fatness in children and adolescents (Deurenberg, Weststrate, & Seidell, 1991; Dietz & Robinson, 1998; Killeen, Vanderburg, & Harlan, 1978),
and is positively correlated with the prevalence of obesity-related conditions (Clarke, Woolson, & Lauer, 1986) and long-term mortality (Must, 1996). Importantly, BMI status also depends on age, gender, and race. These factors must be considered when assessing adiposity in youth (Troiano & Flegal, 1998). Reference BMI percentile curves that enable age and gender-specific percentiles to be determined have been published by the Centers for Disease Control (2000) and are used to define overweight and obesity. Children or adolescents with a BMI more than the 95th percentile for age and sex should be considered obese, whereas those with a BMI more than the 85th percentile but less than 95th percentile should be considered overweight. Obesity is not equivalent to overweight; obesity denotes excess body fat, whereas overweight might relate to fat or other tissue in excess with relation to height (Troiano & Flegal, 1999). In adults, presently a BMI of 25 is considered overweight and a BMI of more than 30 is considered obese (Drewnowski & Spector, 2004; Wardle, Waller, & Jarvis, 2002). These markers provide common benchmarks for assessment. The BMI is the preferred method of expressing body fat percentile from clinical measurements. The BMI better reflects the amount of body fat compared with the amount of muscle or bone and is used for a proxy for measurement of body fatness in adults in the absence of laboratory determinations. The BMI has good specificity so that it seems to exclude subjects who are not overweight or obese, but it misses some that are obese (poorer sensitivity) (Malina & Katzmarzyk, 1999). If BMI is calculated from self-report data the prevalence of obesity is clearly underestimated, overweight subjects tend to underreport their BMI whereas thin people do the reverse (Bostrom & Diderichsen, 1997; Kuskowska-Wolk, Bergstrom, & Bostrom, 1992).
The current study uses age and gender specific percentiles to categorize initial obesity/overweight in adolescents as 0 (obese or overweight) or 1 (normal weight). Adolescents with a BMI more than the 85th percentile for their age and sex during Wave 1 (during adolescence) were categorized as being obese or overweight. In addition, individuals with a BMI of less than 18.5 are considered underweight. These individuals were dropped from our sample, leaving them in the sample could confound our results if were group them in with “normal” weight individuals. A BMI of less than 18.5 is considered underweight and may indicate malnutrition, an eating disorder, or other health problem (Nutrition Database, 2005). Mean comparisons among three weight categories (obese, overweight, and normal) were also explored in this study. Obese individuals were those with a BMI more than the 95th percentile for their age and sex during Wave 1. Overweight individuals were those with a BMI between the 85th and 95th percentile. All other individuals were classified as normal weight.

*Educational Attainment.* Educational achievement was assessed by a single item asking respondents’ to indicate their level of education. Individuals enrolled in high school (less than 2 percent) were excluded from this particular analysis, due to the researcher’s interest in predicting young adults’ educational attainment beyond the high school level. Highest academic degree received was assessed by creating four categories of academic achievement: 0 = (not a high school graduate), 1 = (high school graduate or GED), 2 = (Junior College or vocational training degree) 3 = (four-year college or university graduate), and 4 = (advanced or professional degree). Scores ranged from 0 to 4 on this continuous scale. In addition, dichotomous categories of education were also analyzed; however the four
category continuous scale was a better indicator of educational attainment. This strategy was chosen because it also captures the primary educational benchmarks that provide the foundation for subsequent stratification processes by occupation and earnings (Marks & Shinberg, 1998).

Economic Hardship. The degree of individual economic hardship was assessed by using four items. Respondents were asked to answer (1 = yes or 0 = no) if during any part of the year they received income from the following sources: (1) food stamps (2) Aid to Families with Dependent Children (AFDC), public assistance, welfare, or state TANF program (3) housing assistance (4) unemployment insurance, disability, social security, or supplemental security income. An individual score was computed by summing the responses to each of the four items. The possible range of scores is 0 to 4; with a higher number indicating a higher level of economic hardship. The Cronbach’s alpha for this 4-item measure of economic hardship was .81.

Depressive symptoms. Depressive symptoms were measured both in 1995 and 2001 using 9 of the original 18 items of a depression scale (Center for Epidemiological Studies Depression Scale – CES-D; Radloff, 1977) tapping adolescents' feelings of distress (e.g., "bothered by things that usually don't bother him/her," "could not shake off the blues," "felt depressed, tired, and sad," “felt people disliked you,” “felt you were just as good as other people,” “trouble keeping your mind on things,” “enjoyed life”). These nine items were chosen because these particular questions were asked of respondents during both Wave 1 and Wave 3. As a result, I can control for Wave 1 (1995) depressive symptoms when predicting depressive symptoms in 2001. These items were rated on a scale ranging from 0
(never/rarely) to 3 (most/all of the time). Scores for items expressing positive affect were reverse-coded to make them consistent with the scores for items assessing depressive symptoms. Radloff’s research using the CES-D demonstrates that it is a psychometrically sound instrument for the measurement of adolescent depressive symptoms (Radloff, 1991). The internal consistency (Cronbach’s alpha) for the scale was .80 for the total sample.

Sexual Experience. The degree of sexual experience was assessed using four items. These items assessed the degree of experience and frequency young adults have in terms of sexual experience. A measure of sexual experience was created by using the following four items: (1) Have you ever had sexual intercourse? (2) Were you younger than 16 at time of first intercourse (3) Have you had more than 5 sexual partners (4) Have you had more than 2 sexual partners in the last 12 months. Responses were in the form of 1 = yes; 0 = no. A continuous scale was created by summing the responses of these four items together. Scores ranged from 0 to 4; with a higher number indicating a higher level of sexual experience. A score of zero indicates the respondent has never had sexual intercourse.

Race/Ethnicity. A set of five dichotomous variables (coded 0 and 1) were used to contrast race/ethnicity categories of White Caucasians, African Americans, Hispanics, Asians, and Native Americans against all other racial or ethnic groups.

Analytic Approach

The relationship between adolescent obesity and social outcomes in young adulthood was tested using a variety of methods. ANOVA’s were used to calculate mean comparisons across weight status groups (normal, overweight, and obese). In addition, the SAS PROC MIXED procedure was used to run a series of regressions to test the relationship between
obesity/overweight and social and economic factors. The SAS PROC MIXED procedure allows for the examination of the relationships between adolescent obesity and each of the outcomes in young adulthood, taking into account clustering (design effect).

Results

Zero-order correlations among all the major study variables were examined (Appendix). Adolescent obesity is significantly correlated with educational attainment ($p < .01$); with young adults that were obese during adolescence (Wave 1) having lower levels of educational attainment than young adults that reported normal weight in adolescence. Economic hardship and depressive symptoms are both significantly correlated with adolescent obesity and obesity in young adulthood.

Table 1 shows the means, standard deviations, and ranges of the major study variables. The mean body mass index (BMI) during adolescence for the study participants was 23.05, with a range from 12.21 to 49.80. The mean level of educational attainment is 1.23 and the mean level of economic hardship is 0.16. Initial level of depressive symptoms for the study participants during adolescence was 5.91; while this level has decreased to 4.57 as the individuals in this study have moved into young adulthood. Lastly, the mean BMI for young adults is 27.15; which by CDC guidelines is considered overweight. The range for BMI among young adults is 18.05 to 60.00. A total of 1,247 adolescents had a BMI of below 18.5 at Wave 1, therefore they were not included in this sample due to their status as "underweight". Being underweight may predict a different set of behaviors, such as eating disorders, therefore this sub-population should not included in our analyses with focuses on the comparison of obese/overweight and normal weight young adults.
Table 2 shows the mean level of educational attainment of males and females by weight category and ethnicity. Results show that among white males, normal weight individuals have a higher level of educational attainment than both overweight and obese young adults. A similar pattern exists among white females, with obese females having the lowest level of educational attainment among all Whites (M = 1.06). Differences among African American and Hispanic males are not significant in terms of educational attainment and weight categories. In contrast, obese African American and Hispanic females have a significantly lower level of attainment than normal weight individuals of the same ethnicity. Among both Asian males and females, there is a pattern similar to that of Whites in that normal weight young adults have a significantly higher level of educational attainment than obese Asians. Overweight and obese Native Americans report a significant decrease in the level of educational attainment in comparison to their normal weight counterparts. Regardless of ethnicity, obese males and females have a significantly lower level of educational attainment than normal weight males and females. There is little evidence to show that a significant difference is found in terms of the educational attainment of obese and overweight young adults.
Table 3 shows the mean level of economic hardship of males and females by weight category and ethnicity. Normal weight White males have one of the lowest levels of economic hardship ($M = 0.09$), whereas obese White females have a significantly higher level of economic hardship ($M = 0.23$). However, obese African American and Native American women have one of the highest levels of economic hardship of any gender or weight category ($M = 0.43$ and $M = 0.60$, respectively). Among males, there are no statistically significant differences in economic hardship among weight categories, however, among females there is more variation among weight categories. In fact, obese and overweight White females have a higher level of economic hardship than normal weight White females. Asians females also follow a similar pattern, with normal and overweight Asians both having a lower level of economic hardship (0.05 and 0.11, respectively) in comparison to obese Asian females (0.27).

Insert Table 3 about here

Table 4 presents the mean level of depressive symptoms among male and female young adults by weight category and ethnicity. Results indicate that most of the variation in depressive symptoms as a result of weight status occurs among females. Among White females, there is a significant increase in depressive symptoms at all levels, that is, depressive symptoms increase significantly as the weight status of a young adult increases. Among African American females there is a significant increase in depressive symptoms when comparing overweight and obese with normal weight African Americans. However, there is not a significant difference between obese and overweight African American
females. The same pattern holds true when looking at differences among Hispanic females.

Only one significant difference is found among men in regards to weight status and depressive symptoms. Native American obese males have a significantly greater mean level of depressive symptoms than normal weight Native Americans (M = 6.74 vs. M = 3.04). Overall, obese females have a significantly higher level of depressive symptoms than both normal and overweight females.

Table 5 shows the mean level of sexual experience among males and females by weight category and ethnicity. Among White males, the lowest level of sexual experience is reported by obese young adults (M = 1.34); this is significantly lower than the sexual experience reported by normal weight young adults (M = 1.44). Similarly, among White females obese young adults have a significantly lower level of sexual experience compared to both normal weight and overweight White females. There are no significant differences in sexual experience among the three weight categories for African American males and females. Also, obese Hispanic males have a lower level of sexual experience than normal weight and overweight Hispanic males. No significant differences are found among Hispanic females. Obese or overweight Asian and Native American have no significant increase in sexual experience in comparison to their normal weight counterparts.

Insert Table 4 about here

Insert Table 5 about here
Table 6 presents the unstandardized regression coefficients predicting educational attainment, economic hardship, depressive symptoms, and sexual experience of young adults. Results indicate that obesity/overweight in adolescence significantly predicts educational attainment in young adulthood (B = 0.13, p < .001), with obesity/overweight in adolescence decreasing the level of educational attainment in young adulthood, even after controlling for additional outcome and demographic variables. Economic hardship is significantly associated with a decrease in educational attainment (B = -0.16, p < .001), with a higher level of hardship decreasing the level of educational attainment. Current depressive symptoms as well as depressive symptoms in adolescence are significantly related to educational attainment (B = -0.02, p < .001 and B = -0.01, p < .001, respectively). An increase in depressive symptoms lowers educational attainment. Also, sexual experience significantly lowers the level of educational attainment (B = -0.07, p < .001). Results also show that males have a significantly lower level of educational attainment than females, even after controlling for economic, social, and demographic variables (B = -0.19, p < .001). African American and Hispanic young adults have a lower level of educational attainment than Whites (B = -0.05; p < .001 and B = -0.11, p < .001, respectively), while Asians have the highest level of educational attainment (B = 0.18, p < .001). There is a significant adolescent obesity/overweight by gender interaction (B = 0.12, p < .001). This indicates that for males the influence of obesity on educational attainment is weaker than for females. The initial effect of adolescent obesity/overweight on educational status is 0.13, however, for obese males this effect is reduced to 0.01.
Obesity/overweight in adolescence also significantly predicts economic hardship in young adulthood, even after controlling for the other economic and social outcomes as well as individual level variables ($B = 0.03, p < .05$). In addition, there is an interaction between adolescent obesity/overweight and gender ($B = -0.05, p < .01$). This means that obesity significantly increases the level of economic hardship only among females. Educational attainment ($B = -0.06, p < .001$), depressive symptoms ($0.01, p < .001$), and sexual experience ($B = 0.03, p < .001$) are all significantly associated with economic hardship. In addition, females have a higher level of economic hardship than males ($B = -.10, p < .001$) while African Americans have a significantly higher level of economic hardship than Whites ($B = 0.09, p < .001$).

In regards to depressive symptoms of young adults, individuals that were classified as obese or overweight during adolescence have a higher level of depressive symptoms than young adults who were normal weight during their adolescence ($B = 0.25, p < .01$). This relationship remained significant, even after controlling for depressive symptoms during adolescence, as well as the other social, educational, and economic outcome variables. A lower level of educational attainment is significantly associated with an increase in depressive symptoms ($B = -0.48, p < .001$). Also, depressive symptoms in adolescence significantly predicted the continuation of depressive symptoms in young adulthood ($B = 0.28, p < .001$). Females had a significantly higher level of depressive symptoms than males ($B = -0.48, p < .001$). Young adult minorities all have a higher level of depressive symptoms than Whites. The adolescent obesity/overweight by gender interaction is not statistically significant.
Young adults that report being obese or overweight during adolescence have a lower level of sexual experience than young adults that were at normal weight during adolescence ($B = -0.08$, $p < .001$). Educational attainment ($B = 0.08$, $p < .001$) and economic hardship ($B = 0.07$, $p < .001$) are both significantly associated with sexual experience. Males report a higher level of sexual experience than females ($B = 0.08$, $p < .001$). African Americans have a higher level of sexual experience than do Whites ($B = 0.14$, $p < .001$), whereas Asians have the lowest level of sexual experiences among all ethnicities in this study ($B = -0.30$, $p < .001$). There is a significant interaction between adolescent obesity/overweight and gender ($B = 0.07$, $p < .05$). This indicates that the influence of obesity/overweight on sexual experiences is much lower for males than for females. Being an obese/overweight male will not decrease the level of sexual experience nearly as much as it would for a female that was obese/overweight during adolescence.

The results yielded from the regression model are consistent with the results using an ANOVA to compute the mean comparisons among weight status and the outcome variables in this study.

Discussion

The findings in this study add important new information to the area of obesity research, unrelated to the physical consequences of the epidemic. Instead, uncovered are psychological, educational, economic, and relational aspects of young adults’ lives in an
effort to illustrate the detrimental effects of obesity beyond the obvious physical consequences.

The findings suggest that among gender and ethnic groups, there is a difference in the degree to which weight status affects specific social domains. For instance, when assessing the effect of weight status on educational attainment, there is a minimal decrease in educational attainment for African American males as weight status increases. In fact, the mean level of educational attainment among normal weight African Americans starts at a much lower level than that of White or Asian men. As the weight status increases from normal to obese, African American males decrease only slightly in terms of educational attainment. In contrast, obese Asian and Whites males have a significant decrease in their level of educational attainment in comparison to a normal weight individual of the same race. This would suggest that Asian and White men are affected to a much larger degree than African Americans by increased body weight and the educational consequences. The influence of weight status on educational attainment is also clearly evident when looking at the degree in which educational attainment decreases among White females by weight status. Perhaps obese Whites and Asians suffer from a lowered self-esteem or perhaps lack opportunities to advance in their educational endeavors, thus leading to a lower level of educational attainment.

This study also found that being obese/overweight during adolescence has a much more detrimental effect on the educational attainment of females than it does for young adult males (Gortmaker et al., 1993). A similar pattern is also supported in regards to economic hardship (Wadden & Stunkard, 1985). In addition, young adults that were obese/overweight
during adolescence were found to have a higher level of depressive symptoms than 
adolescents that were normal weight. In particular, results of this study indicate that White 
females have the highest increase in the level of depressive symptoms among the three 
weight categories. This can be explained by Ge, Elder, Regnerus, and Cox (2001) who found 
that white adolescent girls experience the highest levels of perception of being overweight. In 
addition, these perceptions increased the risk of depressed mood. It is generally believed that 
young women are particularly vulnerable to psychosocial distress due to their obesity since 
societal pressures against obesity are especially focused during adolescence and young 
adulthood, particularly among women (Larsson, Karlsson, & Sullivan, 2002). A sense of 
being obese/overweight has more negative effects on white adolescents’ emotional health 
than on that of African American and Hispanic youths (Ge et al., 2001).

Obese females have a significantly lower level of sexual experience than obese males. 
In fact, among all females, the highest level of sexual experience is reported by obese 
African Americans. Among White females, an increase in weight leads to a decrease in 
sexual experience. Among Whites, there is a significant decrease in the level of sexual 
experience for obese males compared to normal weight males. Future research will explore 
potential factors that may help to explain these observed racial differences in terms of sexual 
experience and weight status.

The analyses used in this study were based on adolescent and parent reports from a 
large, nationally representative sample of adolescents. Despite the empirical support for the 
hypotheses in this study, several limitations in the study must be noted. First, this study used 
self-report data to determine an adolescent’s body mass index. Because individuals’
assessment of their weight may be biased, there may be an even greater number of individuals in the sample that are obese. Second, some of the outcome variables used in this study (depressive symptoms) were able to be controlled for at an earlier time point as this measure was available during both Wave 3 and Wave 1 of the data collection. Additional outcome variables such as educational attainment and individual economic hardship were not asked of the participants prior to Wave 3; therefore these outcomes were not able to be controlled for at a prior time.

In addition to the direct effect of obesity on social outcomes, research has identified potential mediating factors that may help explain the relationship between adolescent obesity and social outcomes in young adulthood. The influence of obesity on the previously discussed domains of education attainment, economic hardship, depressive symptoms, and sexual experience may be mediated by a number of potential factors, including: (1) the perceived discrimination, prejudice, or stigma aimed at an obese individual, (2) self-esteem, (3) self image or perception of being overweight and/or obese. The current study does not examine these potential mediating variables, but does recognize their potential influence in predicting social outcomes in young adulthood. Identifying various mediating mechanisms linking adolescent obesity to social outcomes in young adulthood will be explored in future research.

The results of this study indicate that the detrimental effects of obesity/overweight are not simply confined to the physical realm of one's body. Instead, this study has provided important new information concerning the negative consequences of obesity by
implementing a longitudinal model that predicts educational, economic, and social outcomes of young adults that reported being either obese or overweight during adolescence.

References


Nutrition Database. (2005). Body mass index information. Assessed from

http://www.nutri.info


Figure 1. Theoretical Model

Adolescence (1995)

Gender & Race

Young Adulthood (2001)

Educational Attainment

Economic Hardship

Depressive Symptoms

Sexual Experience

Controls:

Adolescent Depressive Symptoms (1995)
Table 1. Descriptive statistics of study variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>$M$</th>
<th>$SD$</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (1995)</td>
<td>23.05</td>
<td>4.24</td>
<td>12.21-49.80</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>1.23</td>
<td>0.79</td>
<td>0.00-4.00</td>
</tr>
<tr>
<td>Economic hardship</td>
<td>0.16</td>
<td>0.50</td>
<td>0.00-4.00</td>
</tr>
<tr>
<td>Depressive symptoms (2001)</td>
<td>4.57</td>
<td>4.06</td>
<td>0.00-26.00</td>
</tr>
<tr>
<td>Depressive symptoms (1995)</td>
<td>5.91</td>
<td>4.30</td>
<td>0.00-27.00</td>
</tr>
<tr>
<td>Sexual experience</td>
<td>1.44</td>
<td>0.78</td>
<td>0.00-3.00</td>
</tr>
<tr>
<td>BMI (2001)</td>
<td>27.15</td>
<td>6.23</td>
<td>18.05*-60.00</td>
</tr>
</tbody>
</table>

*Individuals with a BMI less than 18.5 were excluded from the analysis, as they are classified as underweight.

Note: $N = 11,391$. Data are from Wave 1 and Wave 3 of the National Longitudinal Study of Adolescent Health.
Table 2. Mean educational attainment of males and females by weight category and ethnicity

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th></th>
<th></th>
<th>Females</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Overweight</td>
<td>Obese</td>
<td>Normal</td>
<td>Overweight</td>
<td>Obese</td>
</tr>
<tr>
<td>White (N = 6,283)</td>
<td>1.24</td>
<td>1.15</td>
<td>1.12  $^{1,2}$</td>
<td>1.41</td>
<td>1.17</td>
<td>1.06  $^{1,2}$</td>
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<tr>
<td>African American  (N = 2,432)</td>
<td>1.07</td>
<td>1.06</td>
<td>1.01</td>
<td>1.26</td>
<td>1.15</td>
<td>1.08  $^{2}$</td>
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<tr>
<td>Hispanic (N = 1,811)</td>
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<td>1.04</td>
<td>0.96</td>
<td>1.30</td>
<td>1.06</td>
<td>0.97  $^{1,2}$</td>
</tr>
<tr>
<td>Asian (N = 625)</td>
<td>1.35</td>
<td>1.07</td>
<td>1.10  $^{1,2}$</td>
<td>1.67</td>
<td>1.11</td>
<td>1.20  $^{1,2}$</td>
</tr>
<tr>
<td>Native American (N = 104)</td>
<td>1.13</td>
<td>1.00</td>
<td>0.89</td>
<td>0.97</td>
<td>0.75</td>
<td>0.73  $^{1,2}$</td>
</tr>
<tr>
<td>Total (N = 11,255)</td>
<td>1.17</td>
<td>1.06</td>
<td>1.02  $^{1,2}$</td>
<td>1.32</td>
<td>1.05</td>
<td>1.01  $^{1,2}$</td>
</tr>
</tbody>
</table>

$^1$ Indicates significant difference between normal and overweight

$^2$ Indicates significant difference between normal and obese

Note: Mean differences are statistically significant at (p < .01)
Table 3. *Mean level of economic hardship of males and females by weight category and ethnicity*

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Males</th>
<th></th>
<th></th>
<th></th>
<th>Females</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Overweight</td>
<td>Obese</td>
<td>Normal</td>
<td>Overweight</td>
<td>Obese</td>
<td></td>
</tr>
<tr>
<td>White (N = 6,275)</td>
<td>0.09</td>
<td>0.10</td>
<td>0.12</td>
<td>0.14</td>
<td>0.22</td>
<td>0.23 *1,2</td>
<td></td>
</tr>
<tr>
<td>African American (N = 2,429)</td>
<td>0.11</td>
<td>0.11</td>
<td>0.09</td>
<td>0.32</td>
<td>0.42</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>Hispanic (N = 1,811)</td>
<td>0.11</td>
<td>0.12</td>
<td>0.11</td>
<td>0.21</td>
<td>0.21</td>
<td>0.22</td>
<td></td>
</tr>
<tr>
<td>Asian (N = 624)</td>
<td>0.10</td>
<td>0.08</td>
<td>0.08</td>
<td>0.05</td>
<td>0.11</td>
<td>0.27 *2,3</td>
<td></td>
</tr>
<tr>
<td>Native American (N = 104)</td>
<td>0.08</td>
<td>0.13</td>
<td>0.13</td>
<td>0.45</td>
<td>0.63</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Total (N = 11,243)</td>
<td>0.10</td>
<td>0.11</td>
<td>0.11</td>
<td>0.23</td>
<td>0.32</td>
<td>0.35 *1,2</td>
<td></td>
</tr>
</tbody>
</table>

1 Indicates significant difference between normal and overweight
2 Indicates significant difference between normal and obese
3 Indicates significant difference between overweight and obese

Note: Mean differences are statistically significant at (p < .01)
Table 4. Mean level of depressive symptoms (2001) among males and females by weight category and ethnicity

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th></th>
<th></th>
<th>Females</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Overweight</td>
<td>Obese</td>
<td>Normal</td>
<td>Overweight</td>
<td>Obese</td>
</tr>
<tr>
<td>White (N = 6,287)</td>
<td>3.79</td>
<td>3.65</td>
<td>3.98</td>
<td>4.42</td>
<td>5.00</td>
<td>5.70 (^1,2,3)</td>
</tr>
<tr>
<td>African American (N = 2,435)</td>
<td>4.48</td>
<td>4.79</td>
<td>4.87</td>
<td>5.06</td>
<td>5.76</td>
<td>5.79 (^1,2)</td>
</tr>
<tr>
<td>Hispanic (N = 1,811)</td>
<td>4.57</td>
<td>4.38</td>
<td>4.44</td>
<td>5.08</td>
<td>5.92</td>
<td>6.03 (^1,2)</td>
</tr>
<tr>
<td>Asian (N = 625)</td>
<td>4.91</td>
<td>4.80</td>
<td>5.19</td>
<td>5.37</td>
<td>5.56</td>
<td>6.33</td>
</tr>
<tr>
<td>Native American (N = 104)</td>
<td>3.04</td>
<td>4.25</td>
<td>6.74 (^2)</td>
<td>7.19</td>
<td>4.88</td>
<td>5.54</td>
</tr>
<tr>
<td>Total (N = 11,262)</td>
<td>4.16</td>
<td>4.37</td>
<td>5.04</td>
<td>5.42</td>
<td>5.42</td>
<td>5.88 (^2,3)</td>
</tr>
</tbody>
</table>

\(^1\) Indicates significant difference between normal and overweight
\(^2\) Indicates significant difference between normal and obese
\(^3\) Indicates significant difference between overweight and obese

Note: Mean differences are statistically significant at (p < .01)
Table 5. Mean level of sexual experience among males and females by weight category and ethnicity

<table>
<thead>
<tr>
<th></th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal</td>
<td>Overweight</td>
</tr>
<tr>
<td>White (N = 6,200)</td>
<td>1.44</td>
<td>1.44</td>
</tr>
<tr>
<td>African American (N = 2,366)</td>
<td>1.69</td>
<td>1.72</td>
</tr>
<tr>
<td>Hispanic (N = 1,775)</td>
<td>1.45</td>
<td>1.55</td>
</tr>
<tr>
<td>Asian (N = 613)</td>
<td>1.09</td>
<td>0.98</td>
</tr>
<tr>
<td>Native American (N = 103)</td>
<td>1.68</td>
<td>1.88</td>
</tr>
<tr>
<td>Total (N = 11,057)</td>
<td>1.47</td>
<td>1.49</td>
</tr>
</tbody>
</table>

² Indicates significant mean difference between normal and obese
³ Indicates significant mean difference between overweight and obese
Note: Mean differences are statistically significant at (p < .01)
Table 6. Unstandardized regression coefficients (t-values) predicting educational attainment, economic hardship, depressive symptoms, and sexual experience in young adulthood

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Adolescent obesity/overweight</td>
<td>-0.13***</td>
<td>0.03*</td>
<td>0.25**</td>
<td>-0.08***</td>
</tr>
<tr>
<td></td>
<td>(-7.91)</td>
<td>(2.45)</td>
<td>(3.07)</td>
<td>(-4.68)</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>-0.06***</td>
<td>-0.06***</td>
<td>-0.48***</td>
<td>-0.08***</td>
</tr>
<tr>
<td></td>
<td>(-10.69)</td>
<td>(-10.05)</td>
<td>(-8.03)</td>
<td></td>
</tr>
<tr>
<td>Economic hardship</td>
<td>-0.16***</td>
<td>---</td>
<td>0.41***</td>
<td>0.07***</td>
</tr>
<tr>
<td></td>
<td>(-10.33)</td>
<td></td>
<td>(5.37)</td>
<td>(4.69)</td>
</tr>
<tr>
<td>Depressive symptoms (2001)</td>
<td>-0.02***</td>
<td>0.01***</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(-10.06)</td>
<td>(5.35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depressive symptoms (1995)</td>
<td>-0.01***</td>
<td>0.01***</td>
<td>0.28***</td>
<td>0.01***</td>
</tr>
<tr>
<td></td>
<td>(-5.07)</td>
<td>(7.36)</td>
<td>(31.77)</td>
<td>(8.05)</td>
</tr>
<tr>
<td>Sexual experience</td>
<td>-0.07***</td>
<td>0.03***</td>
<td>0.07</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>(7.92)</td>
<td>(4.62)</td>
<td>(1.62)</td>
<td></td>
</tr>
<tr>
<td>Gender (male)</td>
<td>-0.19***</td>
<td>-0.10***</td>
<td>-0.48***</td>
<td>0.08***</td>
</tr>
<tr>
<td></td>
<td>(-12.61)</td>
<td>(-10.87)</td>
<td>(-6.44)</td>
<td>(5.04)</td>
</tr>
<tr>
<td>African American</td>
<td>-0.05***</td>
<td>0.09***</td>
<td>0.41***</td>
<td>0.14***</td>
</tr>
<tr>
<td></td>
<td>(-2.44)</td>
<td>(6.65)</td>
<td>(4.13)</td>
<td>(6.51)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>-0.11***</td>
<td>0.01</td>
<td>0.33**</td>
<td>-0.05</td>
</tr>
<tr>
<td></td>
<td>(-4.48)</td>
<td>(0.29)</td>
<td>(3.08)</td>
<td>(-2.13)</td>
</tr>
<tr>
<td>Asian</td>
<td>0.18***</td>
<td>-0.04</td>
<td>0.68***</td>
<td>-0.30***</td>
</tr>
<tr>
<td></td>
<td>(4.77)</td>
<td>(-1.85)</td>
<td>(4.00)</td>
<td>(-8.60)</td>
</tr>
<tr>
<td>Obesity/overweight*Gender (male)</td>
<td>0.12***</td>
<td>-0.05**</td>
<td>0.02</td>
<td>0.07*</td>
</tr>
<tr>
<td></td>
<td>(3.89)</td>
<td>(2.62)</td>
<td>(1.41)</td>
<td>(2.05)</td>
</tr>
<tr>
<td>AIC</td>
<td>21,231</td>
<td>21,003</td>
<td>22,030</td>
<td>25,390</td>
</tr>
</tbody>
</table>

*p < .05.  **p < .01.  ***p < .001.
**Appendix. Zero order correlations among study variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Adolescent obesity (Wave 1)</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2. Educational attainment</td>
<td>-.06**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Economic hardship</td>
<td>.05** -13***</td>
<td>---</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Young adult obesity (Wave 3)</td>
<td>.72** -08** .08**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5. Depressive symptoms (2001)</td>
<td>.06** -13** .11** .04**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Depressive symptoms (1995)</td>
<td>.06** -09** .12** .05** .33**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Sexual experience</td>
<td>-.02* -10** .07** -.03** .05** .09**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Male</td>
<td>.06** -09** -.11** .01 -10** -.16*** .03**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. African American</td>
<td>.07** -06** .09** .05** .06** .04** .09** -.04**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Hispanic</td>
<td>.05** -06** .01 .04** .04** .06** -03** .01 -.23**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Asian</td>
<td>-.03** .06** -.04** -.05** .04** .06** -10** .03** .13** -11**</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Native American</td>
<td>.05** -.03** .01 .05** .02* .02* .02 .01 -.05** -.04** -.02*</td>
<td>---</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*p < .05.  **p < .01.
CHAPTER 4: SUMMARY

The findings in this study generally support the proposed hypotheses, which emphasize the importance of community, family, and individual factors in predicting parental and adolescent physical health outcomes. The influence of structural community adversity directly contributes to the increased likelihood of obesity among adolescents, even after controlling for family and individual characteristics. Structural community adversity also significantly decreases the level of parental physical health, even after taking into account family and individual factors. Therefore, the effect of community on parental and adolescent health is not dependent upon family and individual factors; instead it provides its own unique and powerful effect on the health status of both parents and their children.

In addition to the direct influence of structural community adversity on parental physical health and adolescent obesity, there is also a strong additive effect of family economic hardship on parental physical health. Parents that have a higher level of economic hardship will have a lower level of general physical health. In addition, low parental education and single parenthood significantly predict parental physical health. Of significant importance is that these family characteristics significantly predict poor parental health even after controlling for community and individual level factors.

This study provides strong support that parental general physical health is an important predictor of obesity among adolescents. Parental physical health significantly predicts adolescent obesity, even after controlling for community, family, individual, and other parental health factors. Of equal importance is that parental physical health remains statistically significant even after parental obesity (a genetic indicator of obesity) is taken
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into account. Therefore we must recognize the importance of parental health as we continue to move ahead in our struggle with obesity. Not only has this study shed new light on the importance of parental physical health on adolescent obesity, this study also provides evidence for the intergenerational transmission of poor physical health. Impoverished communities and adverse family conditions decrease the level of physical health among adults. As a result, a decrease in physical health status among adults is then transmitted to their children. This pattern may continue for several generations as adults are unable to escape community or family poverty. The potential end result is a continuing pattern of poor physical health among adults and their children. As a result, it is critical that the focus of our intervention and preventive measures be both at the community and family levels, due to the interconnectedness of structural community adversity, parental physical health, and adolescent obesity.

This study suggests that being a minority (in the case of this particular study African American, Hispanic, and Native American) increases the likelihood of adolescent obesity even after controlling for community and family factors as well as other individual characteristics. This association among ethnicity may be attributed to genetic factors, but also cultural differences in how acceptable obesity may be in some ethnic groups, as well as ethnic eating behaviors. Future research should carefully examine the relation between ethnicity and obesity in order to better understand potential factors underlying this finding.

The results of this study also provide us with valuable information regarding the role of race/ethnicity in the problem of parental and adolescent physical health. In particular, minority status predicts both poor parental and adolescent health. The influence of race
remained significant, even after controlling for community, family, and individual factors. This is important in that the additive effect of race/ethnicity on parental physical health and adolescent obesity can not be reduced or explained by socioeconomic variables. Instead, the effect of race/ethnicity may be explained by a higher degree of stress, as a result of being more susceptible to racial discrimination, due to their minority status in this country. An elevated level of stress in turn may have a negative effect on an individuals’ overall mental and physical health (Wickrama & Bryant, 2003). The additive influence of race/ethnicity may also be due to underlying genetic or cultural factors as well. Social learning theory may explain why race/ethnicity has a unique additive affect on obesity as adolescents may emulate cultural beliefs and practices of family members in things such as poor eating habits and leisure activity.

Adolescents’ primary role models remain their parents, thus it is critical that parents provide a positive learning environment for their adolescents. Intervention strategies for obesity among children and adolescents need to continue to develop in the homes of these children as well as at the community level. Future research should take a closer look at the home environment, particularly with adolescents that are home schooled. These individuals spend the most time in the home environment with their parent(s), therefore it becomes vitally important that parents of these adolescents are creating an environment that is conducive towards minimizing the risk of poor physical health among their adolescents.

In addition to the more proximal affects that structural community adversity and parental physical health may have on adolescent physical health, there are additional, more distal detrimental effects that surface as adolescents move into young adulthood. In addition
to the physical consequences that obese adolescents may experience, there are also social consequences associated with having been obese during adolescence.

The findings regarding the consequences of adolescent obesity add important new information to the area of obesity research, unrelated to the physical consequences of the epidemic. Instead, uncovered are psychological, educational, economic, and relational aspects of young adults' lives in an effort to illustrate the detrimental effects of obesity beyond the obvious physical consequences.

The findings suggest that among gender and ethnic groups, there is a difference in the degree to which weight status affects specific social domains. For instance, when assessing the effect of weight status on educational attainment, there is a minimal decrease in educational attainment for African American males as weight status increases. In fact, the mean level of educational attainment among normal weight African Americans starts at a much lower level than that of White or Asian men. As the weight status increases from normal to obese, African American males decrease only slightly in terms of educational attainment. In contrast, obese Asian and White males have a significant decrease in their level of educational attainment in comparison to normal weight individuals of the same race. This would suggest that Asian and White men are affected to a much larger degree than African Americans by increased body weight and the educational consequences. The influence of weight status on educational attainment is also clearly evident when looking at the degree in which educational attainment decreases among White females by weight status. Perhaps obese Whites and Asians suffer from a lowered self-esteem or perhaps lack
opportunities to advance in their educational endeavors, thus leading to a lower level of educational attainment.

This study also found that being obese/overweight during adolescence has a much more detrimental effect on the educational attainment of females than it does for young adult males (Gortmaker et al., 1993). A similar pattern is also supported in regards to economic hardship (Wadden & Stunkard, 1985). In addition, young adults that were obese/overweight during adolescence were found to have a higher level of depressive symptoms than adolescents that were normal weight. In particular, results of this study indicate that White females have the highest increase in the level of depressive symptoms among the three weight categories. This can be explained by Ge et al. (2001) who found that white adolescent girls experience the highest levels of perception of being overweight. In addition, these perceptions increased the risk of depressed mood. It is generally believed that young women are particularly vulnerable to psychosocial distress due to their obesity since societal pressures against obesity are especially focused during adolescence and young adulthood, particularly among women (Larsson, Karlsson, & Sullivan, 2002). A sense of being obese/overweight has more negative effects on white adolescents’ emotional health than on that of African American and Hispanic youths (Ge et al., 2001).

Obese females have a significantly lower level of sexual experience than obese males. In fact, among all females, the highest level of sexual experience is reported by obese African Americans. Among White females, an increase in weight leads to a decrease in sexual experience. Among Whites, there is a significant decrease in the level of sexual experience for obese males compared to normal weight males. Future research will explore
potential factors that may help to explain these observed racial differences in terms of sexual experience and weight status.

The results of this study indicate that the detrimental effects of obesity/overweight are not simply confined to the physical realm of one's body. Instead, this study has provided important new information concerning both the predictors of obesity, both proximal and distal as well as the negative long-term educational, economic, and social consequences of obesity by implementing design that focuses on both ends of the obesity epidemic.
REFERENCES


http://children.metrotor.on.ca/task/force/must.htm


