

ABSTRACT

Title of Dissertation: THE ROLE OF PARENTAL EMPLOYMENT
 IN CHILDHOOD OBESITY

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Degree and year: Doctor of Philosophy, 2010

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Childhood obesity is a major public health concern, as it has been shown to lead to increased health care costs, reduced quality of life and significant morbidity and mortality. Childhood obesity has been linked to numerous environmental, genetic, and behavioral risk factors. Maternal employment has been shown to exert considerable influence on childhood obesity, however little is known about the role of paternal behaviors in children's overweight and obesity. The current study addresses this important knowledge gap by examining the joint impact of parental influences on children's overweight and obesity as measured by body mass index (BMI). The Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID) was used to explore the potential pathways by which maternal and paternal behaviors impact children's health. In particular, this study investigated whether father involvement as measured by paternal weekly work hours plays a significant role in the onset of childhood obesity, while taking into account the influence of maternal weekly work hours on child weight.

This study found a significant relationship between maternal employment and child BMI, but found that paternal employment plays a significant role as well. The relative importance of parents' work hours on child body mass outcomes varied with child age, younger children being more affected by maternal work hours and older children impacted more by paternal work hours. This investigation revealed that parental work hours may impact both the quantity and quality of time spent with one's child. Shared parent-child activities found to have an impact on childhood obesity included yard work, laundry, shopping, building or repair work, food preparation, talking and reading.

Additionally, this study found that the relative influence of maternal and paternal employment hours on child BMI differed, with paternal work hours associated with lower child body mass outcomes, and maternal employment predictive of increased risk of childhood obesity. These findings point to a complex dynamic between parental employment and child weight.

This study's finding that the impact of father's hours of work on childhood obesity is significant indicates that ignoring this factor may potentially lead to biased and inconsistent findings. Thus, results of studies that omit paternal employment hours from their modeling, estimation, and inference must be interpreted with a degree of caution.

Given parents' mutual interest in efficiently providing for the health and well-being of their children in terms of relative investments of time and other resources, the findings of this research provide theoretical support for the observed asymmetries in parental contributions to child health production. The results of this study point to the need for programs and policies that support parents in their individual and shared contributions to maintaining healthy weight outcomes in children.

THE ROLE OF PARENTAL EMPLOYMENT IN CHILDHOOD OBESITY

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements of the degree of
Doctor of Philosophy
2010

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DEDICATION

To mom for being my exemplar, my rock, and my friend

ACKNOWLEDGMENTS

This dissertation would not have been possible without the assistance of my adviser, Dr. Manouchehr “Mitch” Mokhtari. His expertise and experience paved the way for tremendous professional development, learning, and personal growth. I could not ask for a more capable and dedicated mentor. Mitch’s sense of humor lightened my load on numerous occasions. I owe Dr. Mokhtari my sincerest gratitude for his unfailing encouragement and support throughout this process.

I would also like to thank my committee for their thoughtful service. My department chair, Dr. Elaine A. Anderson, for her professionalism, warmth, and upbeat disposition. Her insightful questions and advice contributed greatly to the quality of this dissertation research. Dr. Samuel “Woodie” Kessel for being not only an example of excellence, but also one of my biggest cheerleaders and supports. I would like to thank Dr. Lis Fost Maring for her friendship and mentoring in both my teaching and research endeavors. I am also profoundly grateful to Dr. Sharon Desmond for her contributions to this research. Her cowboy boots and quick wit kept me on my toes and her high expectations pushed me to do my best.

Finally, I would like to recognize my parents for the all the love and guidance they have provided over the course of my educational career. Their support has been a source of encouragement and strength. I never could have reached this milestone without the many sacrifices they have made on my behalf.

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CHAPTER I: INTRODUCTION

The prevalence of overweight and obesity among children and adolescents has increased dramatically over the last four decades. Since the 1970s, childhood obesity rates have more than tripled in the United States (CDC, 2009). Increases in overweight status have been observed across all ages, ethnic groups, and both genders, with children from minority and low socioeconomic backgrounds disproportionately affected (Lin, Huang, & French, 2004; Wang & Beydoun, 2007). Although similar patterns of increasing childhood overweight and obesity have emerged worldwide, childhood obesity in the United States persists at a level nearly double that observed among other industrialized nations (Sassi, Devaux, Cecchini, & Rusticelli, 2009). Global and national trends toward increasing childhood obesity and overweight are disconcerting given the pervasiveness of the disorder and its attendant comorbidities.

In addition to environmental, psychosocial and genetic factors that may contribute to rising childhood obesity rates, parental choices and constraints also exert considerable influence on child weight outcomes. Dramatic changes in family structure and labor force participation over the past half century coincide with rising childhood obesity. Specifically, increased labor force participation rates may be contributing to increasingly obesogenic home environments. Hence, parental employment status and work schedules may be important contributing factors to the current epidemic of obesity (Haslam & James, 2005; Sassi, Devaux, Cecchini, & Rusticelli, 2009).

The worldwide rise in childhood overweight and obesity is anticipated to have long-term health implications. According to recent Surgeon General estimates, approximately seventy percent of obese adolescents will remain obese as adults (U.S.

Surgeon General, 2007). Overweight youth therefore face elevated risk for numerous weight-related chronic conditions including cardiovascular disease, type 2 diabetes, pulmonary disease, psychosocial disorders and certain cancers (Daniels, 2006; Haslam & James, 2005). The early onset of overweight is expected to exacerbate systemic damage inflicted by chronic obesity-related disorders and may decrease life expectancies among this generation (Daniels, 2006; Olshansky, Passaro, & Hershow et al., 2005).

In addition to elevated risk for many weight-related chronic conditions, prevalent overweight and obesity also impose numerous direct and indirect costs. Direct costs include preventive, diagnostic, and treatment services. Indirect costs encompass the value of income lost from decreased productivity, loss of utility from restricted activity, increased absenteeism at work, downtime, and loss of future income because of premature death, as well as other losses that the family and the society may incur because of premature death (Wolf, 1998; Wolf & Colditz, 1998). Given the long-term social, health, and economic costs associated with obesity, the epidemic rise in childhood overweight and obesity has been identified as a critical public health concern (Koplan, Liverman, & Kraak, 2005).

While accelerating childhood obesity incidence and prevalence rates have increasingly become the focus of public health research, the etiology of overweight and obesity remains poorly understood. It has long been acknowledged that genes play a role in the onset of obesity, but genetic factors do not operate independently of behavior and the environment (Coady et al., 2002). Analysis of extant literature indicates that in addition to genetic influences, shared environmental factors have a substantial effect on observed familial patterns of obesity (Silventoinen et al., 2010). In rare cases, metabolic

or hormonal disorders such as hypothyroidism, Prader-Willi syndrome, or Bardet-Biedl syndrome may drastically alter energy expenditure or intake rates, but the vast majority of early onset obesity is not attributable to simple Mendelian disorders (Chung, 2007). Consequently, behavioral and environmental factors are emphasized in childhood obesity research.

Fundamentally, obesity is a problem of energy imbalance. Caloric consumption that outpaces energy expenditure results in the deposition of unused energy as fat. Thus, a key behavioral risk factor for childhood obesity involves excess caloric intake.

Previous research findings indicate that dietary patterns which include frequent meals away from home, omitting breakfast, large portion sizes, consumption of pre-prepared and pre-packaged food, sugar-sweetened beverage consumption and frequent snacking are associated with increased rates of child and adolescent overweight (Anderson & Butcher, 2006; French et al., 2001; Haines et al., 2007; Ludwig, Peterson, & Gortmaker, 2001).

In addition to high caloric intake, low levels of physical activity may also constitute obesogenic behavior. An estimated fifty-eight percent of American children ages 6-11 do not engage in the recommended amount of daily physical activity and by adolescence the proportion jumps to ninety-two percent (Troiano et al., 2008). Sedentary behavior related to media consumption has been shown to be a significant contributing factor to increased obesity rates among children and adolescents (Crespo et al., 2001; Dennison & Edmunds, 2008). Reports indicate that the average child spends 5.5 hours per day using some form of media (CDC, 2005). Media use has been associated with a reduction in metabolic rate, increased snacking during media use, increased exposure to

food marketing, and a reduction in discretionary time that may have been allotted to physical activity (Coon & Tucker, 2002; IOM, 2005; Lowry et al., 2002).

Environmental factors may also place children at greater risk for developing obesity and overweight. A number of key environmental settings have been highlighted in the current literature as potential contributors to childhood and adolescent obesity including communities, school, and family contexts (IOM, 2005; Story et al., 2006).

The community environment in which a child resides may encourage or discourage healthy dietary and physical activity practices. It is well documented that low-income neighborhoods have fewer supermarkets, more small grocery stores, and higher per capita fast food establishments (Chung & Myers, 1999; Morland et al., 2002; Swinburn et al., 2004). Such communities have been referred to as “food deserts” where residents face restricted access to fresh fruits and vegetables and are at increased risk of developing obesity and overweight (Cummins & McIntyre, 2002; Pearson et al., 2005). Children living in neighborhoods that lack affordable fresh produce have been shown to experience elevated overweight compared to children living in neighborhoods where fruits and vegetables are more affordable (Sturm & Datar, 2005). Built environment features within a community such as sidewalks, bike paths and parks also affect children’s ability to engage in safe recreational activities and therefore may impact child weight outcomes (IOM, 2005).

Given that ninety-five percent of children aged 5-17 in this country are enrolled in school, educational settings represent another key influence on childhood obesity rates (Story, Kaphingst, & French, 2006). Lee et al., (2007) argue that school environments are becoming increasingly obesogenic due to widespread reductions in physical education

and recess. Only 3.8 percent of all elementary schools, 7.9 percent of middle schools and 2.1 percent of high schools provide daily physical education for students (Lee et al., 2007).

Schools are also the site of a substantial portion of children's daily caloric intake. According to the third School Nutrition Dietary Assessment (SNDA-III), more than one-fourth of the average American child's daily food is both acquired and consumed at school (Story, 2009). For children participating in the School Breakfast Program (SBP) and National School Lunch Program (NSLP), this proportion may be as high as half of a child's daily food consumption (Gleason & Dodd, 2009). Several studies have indicated that school environments that include competitive food sales, school stores, and vending machines may negatively impact child weight status (Anderson, Butcher & Levine, 2003; Kubik et al., 2003)

Environmental factors likely to exert the greatest influence on childhood obesity outcomes are those found within the family context. According to the Ecological Model of Development, proximal processes have the greatest impact on children (Bronfenbrenner, 1994). Changes in family structure that have occurred over the past half century, namely the dramatic rise in dual-earner families and working single parent families, represent an important family level factor that may be contributing to childhood and adolescent obesity rates (Haslam & James, 2005).

Rising childhood obesity rates observed over the last four decades coincide with pronounced increases in maternal labor force participation, especially among women with young children (Hoffman & Averett, 2010; U.S. Census Bureau, 2009). Poverty reduction policies such as the 1996 Personal Responsibility and Work Opportunity

Reconciliation Act (PRWORA) have led to a marked increase in labor force participation by women with young children, with the number of employed mothers with children under 18 increasing from forty-seven percent in 1975 to seventy-one percent in 2008 (U.S. Department of Labor, Bureau of Labor Statistics, 2009).

Observation of concurrent expansions in childhood obesity and maternal employment has led researchers to explore a link between maternal workforce participation and childhood overweight. Recent studies have reported a positive association between maternal employment and rising childhood obesity rates (Anderson, Butcher, & Levine, 2003; Cawley & Liu, 2007; Fertig, Glomm, & Tchernis; 2009). Scholars have largely ignored the role of fathers in child weight outcomes, however. This relative lack of attention to paternal contributions is surprising given that parental behaviors related to diet, exercise, and leisure activity selection modeled by either parent is likely to influence child behavior (Bronfenbrenner, 1994; Bandura, 2004).

The convergence in male and female labor force participation rates has precipitated a measure of convergence in housework participation rates as well. Bianchi et al., (2000) show that the female housework hours have decreased by half over the past 40 years while male housework hours have doubled. Although employed women still perform a larger share of the housework than employed fathers, that gap has been consistently narrowing in recent years, suggesting that paternal contributions to household functioning and child health production may become increasingly relevant (Kroska, 2004). At present it is estimated that women perform approximately 60% of household duties, whereas men perform 40% of domestic chores, with both partners overestimating their relative contribution to household work (Lee & Waite, 2005).

Housework is defined here as the unpaid labor which contributes to the well-being of family members (Shelton & John, 1996). Such labor would include meal preparation, the cleaning of clothes, home and yard maintenance, child care, emotional support, and household management (Coltrane, 2000). While some of this labor may be outsourced via services such as childcare, dry cleaning, and take out food, the majority of housework is completed by household members (Bianchi et al., 2000). Time invested in domestic labor by mothers and fathers is anticipated to have an impact on the health and well-being of household members, particularly children.

In recent decades, however, the total amount of time allotted by parents to domestic tasks has decreased (Tijdens & Ruijter, 2004). As women have steadily moved into the paid labor force, men have increased their contributions to housework, but not sufficiently to compensate for the decrease in women's time spent on domestic labor (Gershuny, Godwin, & Jones, 1994). It has been hypothesized that decreased time spent by parents on household responsibilities could negatively impact children's health due to poorer dietary and physical activity related behaviors associated with lack of supervision (Andersen et al., 2003, Ruhm, 2008). Given that mothers and fathers relative contributions to the unpaid domestic work and paid labor force participation are converging, it is imperative that contemporary childhood obesity research take into account both maternal and paternal contributions to child health outcomes.

Purpose of Study

The purpose of this study was to investigate the significance of parental employment in child weight outcomes. Participation in the paid labor force reduces

discretionary time available for direct contact with one's child and involvement in child-rearing activities. Previous studies have found that maternal employment reduces maternal time investments into child health production, thus leading to elevated childhood obesity rates (Anderson, Butcher, & Levine, 2003; Cawley & Liu, 2007; Fertig, Glomm, & Tchernis, 2009). The current study examined the importance of paternal employment relative to that of maternal employment in childhood obesity, as well as the variations in that influence related to child age and other factors. Moreover, potential behavioral pathways by which parents influenced child weight outcomes were explored and their significance evaluated. This research adds to current knowledge by examining the joint impact of parental behaviors on children's body mass indices (BMIs).

Previous American studies of associations between maternal employment and childhood obesity have primarily utilized child height, weight, and maternal employment data from the National Longitudinal Survey of Youth (NLSY). This research examines information from the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). The CDS is useful for studying childhood overweight, obesity and related health behaviors because in addition to child height and weight variables, it provides information on children's daily activities and interactions with their parents. The CDS can be linked to the main PSID household survey to examine mechanisms and pathways by which parental practices, particularly mothers' and fathers' employment and shared parent-child activities, may impact child health outcomes. The current investigation of both parental roles in childhood obesity using the CDS data enhances the knowledge of scholars, program planners and policy makers in relation to family dynamics and parental role in influencing this major public health issue.

CHAPTER II: REVIEW OF LITERATURE

Children have been identified as the fastest-growing demographic among the U.S. overweight population (Janssen et al., 2004). Almost one-third (31.9 percent) of children and adolescents in the United States have body mass indices that qualifies them as either overweight or obese (Ogden et al., 2008). This figure represents a three-fold increase in obesity rates for children aged two to nineteen over the past three decades (Andersen & Butcher, 2006). Research has shown that overweight children are likely to continue to be overweight as adults (Singh, 2008). Serdula, et al., (1993) report that half of obese children continue to be obese as adults. Elevated obesity rates lead to both health and economic consequences, imposing significant burden on individuals, families, and society. Overweight and obese individuals have higher risk of coronary heart disease, type 2 diabetes, certain cancers, and myriad additional health problems. (NIH, NHLBI Obesity Education Initiative). Economic costs of those who suffer for overweight and obesity are also substantive. A 1998 estimate shows that related medical costs for overweight and obesity is 9.1 percent of total U.S. medical expenditures, or roughly \$78.5 billion (Finkelstein, Fiebelkorn, & Wang, 2003).

Determinants of obesity operate at social, economic, environmental, family, and individual levels. While, social, economic, environment, and individual determinants are receiving significant attention in the current literature on obesity, pathways by which parents may influence child weight outcomes is yet to be fully explored.

The current chapter reviews the literature on the etiology of childhood obesity and highlights the important role parents play in child health outcomes. First, this chapter begins by defining overweight and obesity and exploring national and international

obesity trends. Second, contributors to child obesity, including those of genetic, behavioral, and environmental factors are presented. Third, the impacts of childhood obesity and related health burdens are briefly discussed. Fourth, a theoretical model of child health production, which is based on the rational choice model of health economics is presented and its implications considered. The chapter concludes by defining the main variables used in this study and specifying hypotheses about the various mechanisms by which parents may influence child body mass outcomes.

Defining Overweight and Obesity in Adults

Body mass index (BMI) is the most widely used measure of adiposity in children and adults. It is defined as weight in kilograms divided by height in meters squared (kg/m^2). Although BMI is an indirect measure of adiposity, it is correlated with direct measures such as dual energy X-ray absorptiometry (DEXA) and underwater weighing (Rothman 2008). Shortcomings of BMI as a measure of obesity include the fact that it does not take bone structure, age, gender, fat distribution or muscle mass into consideration (Cohn, 1987; Jackson, 2002; Rothman, 2008). Variations in adiposity related to age and gender have been addressed by the CDC for boys and girls. Age and sex specific growth charts have been developed which specify a child's BMI percentile ranking in comparison to a reference group of same-sex, same-age peers (see Appendices A and B). Despite the specified flaws in BMI as a measurement of obesity, other direct measures such as skin fold tests or bioelectrical impedance are cost-prohibitive and time intensive, therefore BMI remains the most practical measure of overweight and obesity for widespread epidemiological use (Cole, Bellizzi, Flegal, & Dietz, 2000; Himes, 2009).

According to National Institutes of Health guidelines for adults, a BMI score of less than 18.5 kg/m² is considered underweight (NIH, 1998). Adult BMI scores between 18.5 and 24.9 kg/m² comprise the healthy or normal weight range. A BMI score greater than or equal to 25 kg/m² but less than 30 kg/m² qualifies an individual as overweight. Finally, a BMI score of thirty or greater (BMI ≥30 kg/m²) meets the criteria for obesity in adults. Individuals with body mass indices greater than 40 kg/m² are classified as extremely obese. These BMI thresholds and obesity cutoffs represent the levels above which chronic diseases are expected to increase. Application of these thresholds to racial and ethnic minorities may not be appropriate, however, as some ethnic groups may have differing thresholds above which weight-related chronic conditions are more likely to develop (OECD, 2009).

Current national prevalence rates for each category of adult weight status are presented in Table 1. Less than 2% of U.S. adults have body mass indices that qualify as underweight. Approximately one-quarter of American adults have BMIs that fall within the normal or healthy range. The remaining 73.5% of U.S. adults are either overweight or obese according to the most recent National Health Examination Survey (NHES, 2006). Given that nearly three-quarters of the country's adult population belong to a weight status that is higher than is considered healthy, the health and economic costs associated with chronic, excess weight among Americans is substantial and increasing.

Table 1. Classification of Adult Overweight and Obesity by BMI

Category	BMI (kg/m ²)	U.S. Prevalence (Age 20-74)
Underweight	< 18.5	1.8%
Normal	18.5 – 24.9	24.7%
Overweight	25.0 – 29.9	32.2%
Obese	30.0 – 39.9	35.1%
Extremely Obese	≥40	6.2%

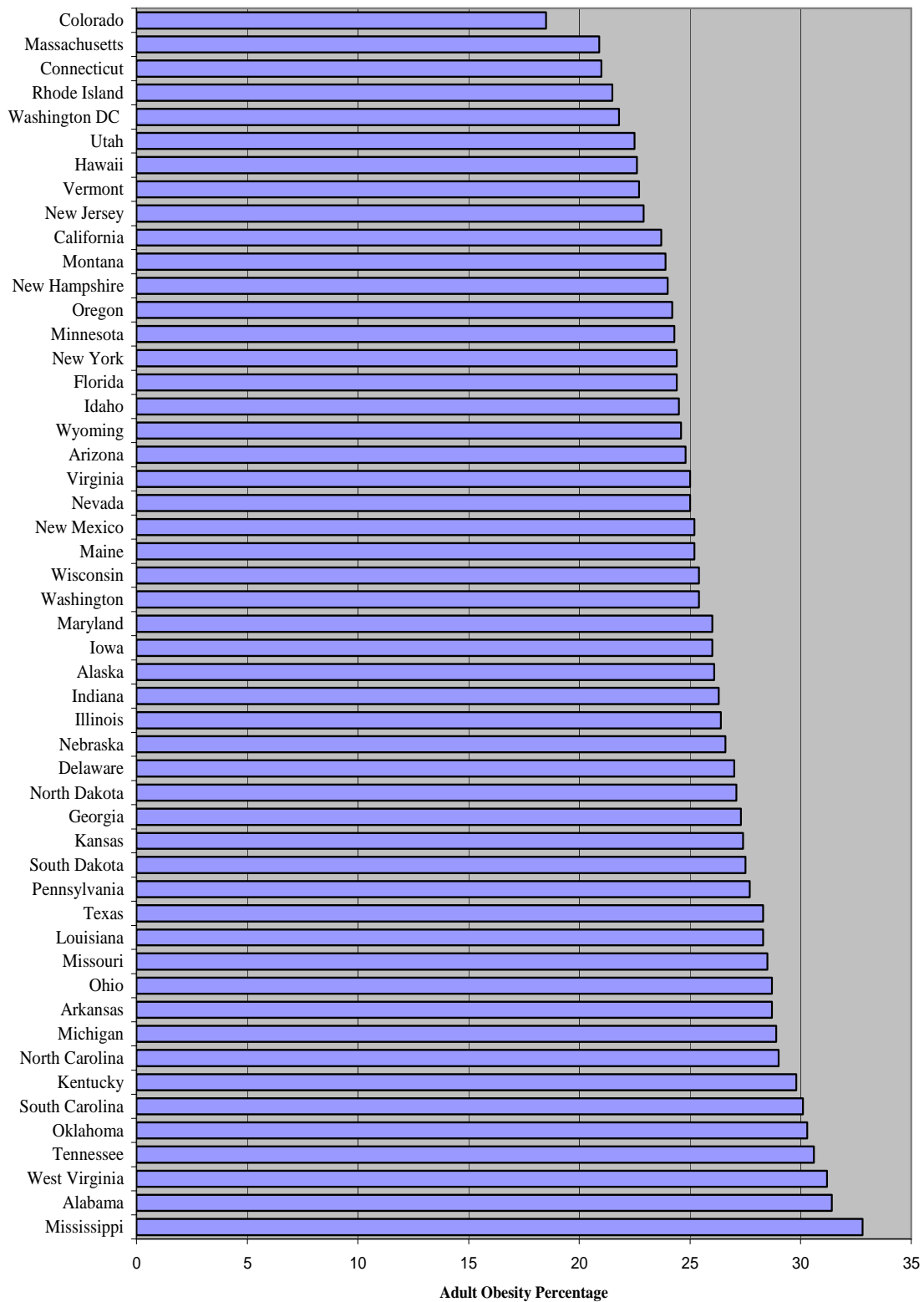
Source: NHES: National Health Examination Survey, 2003-06; Pregnant females excluded.

Within the United States, regional variations in obesity have a negative association with income (Baum, 2009; BRFSS, 2008). Figure 1 and Figure 2 provide an illustration of this inverse relationship that has been observed between adult obesity rates and socioeconomic level. Figure 1 provides obesity percentages by state as reported by the CDC's Behavioral Risk Factor Surveillance System (BRFSS), ranked from highest to lowest. Figure 2 provides a ranking from lowest to highest of median incomes by state, using data from the most recent U.S. Census. Side-by-side comparison of state rankings highlights the impact of socioeconomic status on obesity rates. States with the lowest median incomes tend to have the highest proportion of obese adults. Conversely, those states that reported the highest median incomes generally had the lowest obesity rates. These reported descriptions are also suggestive of the importance of regional factors (such as income, geographic, and environmental differences) as determinants of obesity

Defining Overweight and Obesity in Children

Applying the standard adult obesity cutoff values to children has proven problematic given that BMI varies considerably as children grow (Cole et al., 2000). Body composition among children and adolescents changes in relation to age and gender, thus BMI-for-age growth charts have been developed based on nationally representative National Health and Nutrition Examination Survey (NHANES) data from the 1960s-1980s (Bini et al., 2000). In contrast to crude anthropometric measures, percentile rankings provide relative estimates of child weight categories (underweight, normal, overweight, or obese) which take into account the child's sex and age. Based upon CDC definitions, children with relative BMI percentages below the 5th percentile are

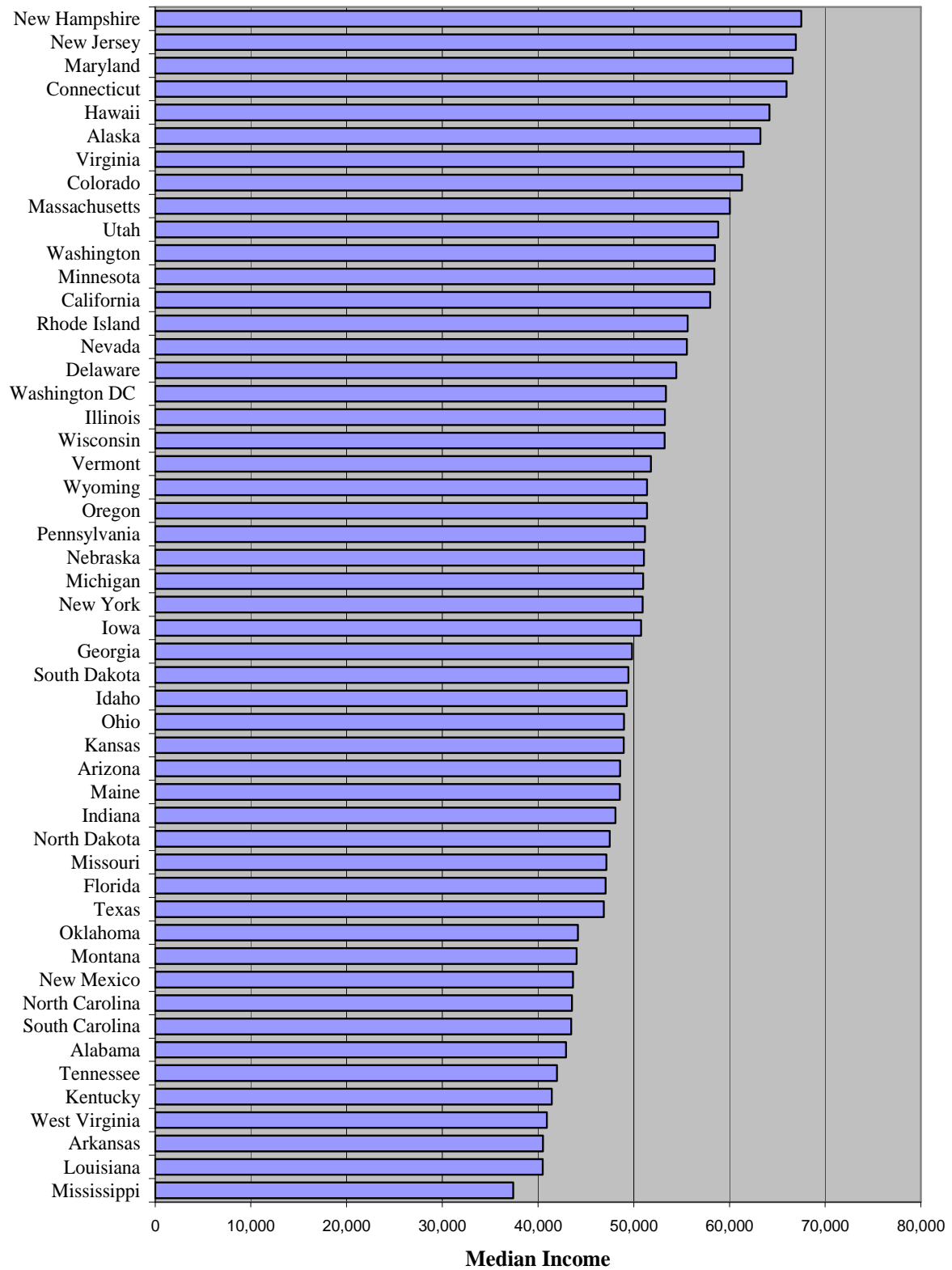
Figure 1. Percent of Obese Adults by State*



*Obesity is defined as having a BMI equal to or greater than 30.

Source: BRFSS, 2008

Figure 2. Median Income by State



Source: U.S. Census Bureau, Current Population Survey, 2006 to 2009 Annual Social and Economic Supplements.

considered underweight. Children in the 5th through 85th percentile are defined as having normal weight. A BMI score falling between the 85th and 95th percentile qualifies a child as overweight. Children with BMI percentiles in 95th to 97th percentile range are considered obese. Extreme obesity is defined as having a BMI percentile of 97 or greater (see table 2).

Table 2. Classification of Child Overweight and Obesity by BMI

Category	Percentile Rank	U.S. Prevalence (Ages 2-19)
Underweight	< 5 th	3.3%
Normal	5 th to 85 th	60.0%
Overweight (At risk of overweight)	85 th to 95 th	14.8%
Obese (Overweight)	95 th to 97 th	5.0%
Extremely Obese (Overweight)	≥ 97 th	11.9%

Source: CDC, 2009; Ogden et al., 2010.

While the recent trends indicate that overweight and obesity prevalence may be leveling off for most children except the heaviest boys, Ogden *et al.*, (2008) report that during 2007-2008 nearly one-third (31.7%) of American children and adolescents aged 2 through 19 years have body mass indices that qualify them as either overweight or obese, with 14.8 percent falling between the 85th and 95th percentile and 5.0 percent of American children falling between the 95th and 97th percentiles. An additional 11.9 percent of US children had BMI percentiles at or above the 97th percentile, the cutoff for extreme obesity.

The phrase “at risk of overweight” is sometimes substituted for overweight when referring to child weight status. Similarly, some researchers prefer to use the term overweight in place of obese. Though the terms have been used interchangeably in the past, recent expert panels have advocated the use of the terms overweight and obese as standard nomenclature for references to high body mass categories among children (Krebs et al., 2007). In the interest of conciseness and in order to be consistent with adult

terminology, the child weight status categories between the 85th and 95th percentile is referred to here as overweight. Body mass index percentiles at or above the 95th percentile are designated as obese.

Contributing Factors to Childhood Obesity

As with obesity in adults, the causal pathway of childhood obesity is complex and multi-factorial. While no single factor has been isolated as the unique predetermining cause of childhood obesity, the fundamental cause of the disorder is a pattern of caloric imbalance (Butte, Christiansen, & Sørensen, 2007). The physiological consequence of consuming more calories than are expended is the storage of excess energy as fat. Dietary thermogenesis, basal metabolic activity, and physical exertion, constantly expend energy, but for many individuals caloric intake outpaces biological requirements. Over time, such energy dysregulation gives rise to overweight and obesity. Although energy imbalance is the underlying cause of overweight and obesity, a number of factors have been identified as contributing to an individual's level of caloric intake and expenditure, including genetics, behavioral practices, and environmental characteristics.

Genetic Factors

One predisposing factor for obesity in children and adults is genetic vulnerability. It has been estimated that hereditary factors may account for 25-40 percent of the observed variation in obesity phenotypes (Bouchard, 1997). Twin studies have repeatedly indicated that Body Mass Indices of identical twins are more similar than those of fraternal twins (Dubois et al., 2007; Rasmussen et al., 2005; Wardle, Carnell, Haworth, & Plomin, 2008). Adoption studies have also supported a link between genetics and

susceptibility to overweight and obesity (Johansson-Kark et al., 2002). In addition to genetic influences observed in previous twin and adoption studies, shared environmental factors have also been found to give rise to correlations in obesity rates between unrelated adoptive parents and their adoptive children (Silventoinen et al, 2010).

Although a genetic propensity for obesity may exist, biological susceptibility alone cannot explain the dramatic rise in obesity rates observed in recent years. Thus, modifiable behavior and environmental risk factors have increasingly become the focus of childhood obesity interventions and research (Brown & Summerbell, 2009; Domínguez-Vásquez, Olivares, & Santos, 2008; Mayer, 2009; Mitchell et al., 2009).

Behavioral Factors

In addition to genetic vulnerability, numerous other factors have been shown to contribute to overweight and obesity. Previous research has indicated that eating patterns that include frequent meals away from home, large portions, consumption of pre-prepared and pre-packaged food, the consumption of sugar-sweetened beverages and frequent snacking have all been linked to increased rates of overweight (Ludwig, Peterson, & Gortmaker, 2001). Beverages containing high fructose corn syrup have increasingly become an target of concern because they are high in calories, and tend to be the least satiating form of caloric intake (DiMeglio & Mattes, 2000; Sherry, 2005).

In Healthy People 2010 (HP 2010), seventeen objectives highlight the negative impact of poor nutrition on health and weight status. HP 2010 calls for a reduction in the proportion of obese American children and adults and sets forth numerous dietary goals

related to weight status and growth, food and nutrient composition, iron deficiencies, and the availability of nutrition counseling.

In terms of food and nutritional composition, HP 2010 seeks to increase the daily servings of fruits and vegetables, particularly orange and dark green vegetables, and grain products. Limits on sodium intake and calories from fat and saturated fat are specified along with a prescribed minimum calcium intake for children. The objective of reducing iron deficiency among young children is also set forward.

Finally, HP 2010 calls for improvements to school and work place environments that would foster better nutrition. It is emphasized that school snacks and meals should contribute to children's good overall dietary quality. The publication also sets a goal for higher participation in worksite health and nutrition classes as well as increased physician office visits for individuals with diabetes, cardiovascular disease, or hyperlipidemia (see Appendix C).

The Healthy People 2020 nutrition and weight status draft objectives retain previous objectives related to reducing obesity rates among both children and adults. Objectives addressing the need for increased fruit and vegetable consumption while limiting fat and sodium intake are also retained. Additionally, new objectives related to preventing inappropriate weight gain, increasing monitoring of patient BMIs by physicians, and limiting the intake of calories derived from added fats and sugars reflect concern among policy makers and government officials regarding growing obesity rates and unhealthy dietary patterns (see Appendix D).

A widespread reduction in physical activity has also been linked to increases in child and adolescent obesity rates. In 1996 the Surgeon General released its' first report

on physical activity and health indicating the significant role that inactivity plays in the development of obesity and overweight. Despite Surgeon General Warnings, it is estimated that over 50% of all Americans do not engage in the recommended amount of physical activity (CDC, 2005). The most recent iteration of Healthy People contains fifteen objectives related to this growing trend toward a sedentary lifestyle and highlights the need for greater physical activity in order to improve health outcomes for all Americans. In particular, participation in moderate to vigorous physical activity is recommended for both children and adults at least 3 days per week. Among adults, emphasis is placed on maintaining flexibility and strength through regular stretching and weight training. HP 2010 also recommends an increase in worksite physical fitness and activity programs. For children, greater emphasis is placed on participation in daily physical education within schools and a reduction in television viewing hours. For both children and adults HP 2010 recommends increasing the proportion of travel that is done by walking or biking. Finally, HP 2010 calls for greater access to school facilities outside of school hours and during vacations in order to augment the physical fitness resources available to community residents (see Appendix E).

Increased media consumption has been shown to be a significant contributing factor to both physical inactivity and increased overweight status among children and adolescents (Crespo et al., 2001). Reports indicate that the average child spends 5.5 hours per day using some form of media (CDC, 2005). Media use has been associated with a reduction in metabolic rate, increased snacking during media use, increased exposure to food marketing, and a reduction in discretionary time that may have been allotted to physical activity (Coon & Tucker, 2002; Lowry et al., 2002; IOM, 2005).

Mounting concern over the impact of sedentary behaviors and excessive media consumption among children and adolescents is evident in several of the new and modified goals included in the Healthy People 2020 physical activity and fitness draft objectives (see Appendix F).

Environmental Factors: School, Child Care, and Household Influences

Change in environmental risk factors, such as increased availability of convenience or fast foods, has improved the efficiency of caloric consumption (Chou et al., 2004). Fast food restaurants have become ubiquitous (Cutler, Glaeser, & Shapiro, 2003). Technological advances and declining relative food prices have also contributed to an increased demand for calorie-rich foods (Lakdawalla & Philipson, 2002; Philipson & Posner, 1999).

Within the food market, portion sizes have also increased dramatically in recent decades, as have marketing expenditures for carbonated soft drinks (Young & Nestle, 2002). Advertising expenses for soft drinks have significantly outpaced that of other food-related advertising, and children's food preferences and consumption patterns have been found to be influenced by such marketing (Borzekowski & Robinson, 2001; Harris et al., 2002).

The school environment has been identified by some researchers as a contributor to the observed increase in children's body mass indices in recent years. Potential reasons for the observed untoward health outcomes include increased access to 'junk' foods, vending machines, school stores, and increased soda pop sales (Anderson & Butcher, 2006; Kubik et al., 2003). It has also been argued that pressure to perform well

on standardized tests has also led schools to cut physical education and recess time (Story, Kaphingst, & French, 2006a). Indeed, fewer than ten percent of all elementary, middle school and high school children receive the recommended daily amount of physical activity (Lee et al., 2007). Ironically, weight problems have been negatively associated with academic performance, suggesting that the practice of reducing physical education may not improve overall test scores (Schwimmer, Burwinkle, & Varni, 2003; Tershakovec, Weller, & Gallagher, 1994).

Given that child care participation rates have risen consistently over the past few decades, this setting is having an increasing influence on developmental trajectories of children in this country (Blank, 2005). It has been asserted in the current literature that uniform standards have not been widely applied to the nutritional or physical activity quality provided in child care facilities (Story, Kaphingst, & French, 2006b). Regulation of child care centers occurs on a state level, thus standards may vary widely (Hofferth, 1996). Some researchers assume that child care providers will have less of a vested interest in the long-term health and well-being of children in their care than would the child's parents, resulting in increased television viewing, less time in outside activities, and a greater quantity of unhealthy snacks than would be observed under parental supervision (Fertig, Glomm, & Tchernis, 2009).

Recent literature has also reported that shared household level behaviors, particularly those related to dietary consumption and physical activity levels, significantly predict overweight and obesity in children (Sassi, Devaux, Cecchini, & Rusticelli, 2009). Although the contribution of fathers has not been adequately explored in the current research, a growing number of studies have begun to investigate the impact

of weekly maternal hours worked on child nutrition and physical activity. (Anderson, Butcher, & Levine, 2003; Cawley & Liu, 2007; Fertig, Glomm, & Tchernis; 2009; Lamerz et al., 2005; Ruhm, 2008). For example, one proposed mechanism by which maternal employment may impact child nutrition is a reduction in the initiation and or duration of breastfeeding. From infancy it is expected that newborns of employed mothers are less likely to have been breastfed or will have terminated breastfeeding earlier than the children of non-employed mothers. Associations between being bottle fed and being overweight as a child and adult have been reported in the current literature (Lucas et al., 1980, Lucas et al 1981). Thus, it may be that a mothers' average work hours are correlated with children's BMI because they are a good indicator of the probability that children were bottle fed.

Another proposed explanation for the positive association between maternal employment and increasing child body mass is related to time constraints. Maternal hours dedicated to external workforce participation reduces the amount of time women have available for the preparation of nutritionally balanced meals, and foster greater reliance on convenience or fast food (Anderson, Butcher, & Levine. 2003; Cawley & Liu, 2007).

Additionally, it has been asserted that children of working mothers are more likely to engage in sedentary afterschool behaviors, such as T.V. viewing or gaming, and these children are also more likely to choose unhealthy snacks when left unsupervised (Aizer, 2004; Fertig, Glomm, & Tchernis 2009). The impact of paternal work hours on child nutrition and physical activity has been largely ignored in the extant literature and requires further attention.

Impact of Childhood Obesity

Childhood obesity places young people at risk for numerous physical and emotional problems. Myriad health complications have been linked to childhood obesity in the current literature including cardiovascular risk factors such as type 2 diabetes, high blood pressure, high cholesterol, and dyslipidemia (Baker, Olsen, & Sørensen, 2007; Mokdad et al., 2003; Muntner et al., 2004; Weiss, Shaw, Savoye, Caprio, 2009). Excess weight during childhood has also been associated with pulmonary complications such as asthma and sleep apnea (Fiorino & Brooks, 2009). Childhood obesity has also been linked to liver disease, orthopedic problems and negative psychological outcomes (Libbey, et al., 2008; Mathur, Das, & Arora, 2007; Taylor et al., 2007).

Increasing rates of childhood obesity are of particular concern given the numerous health implications associated with excess weight gain during youth. The body of extant research suggests that overweight and obesity in youth are likely to carry over into the adult years (Singh, 2008). Thus, obese children are exposed to health problems that once afflicted only adults are also at elevated risk for long-term exposure to the chronic diseases associated with adult obesity (Paxson, Donahue, Orleans, & Grisso, 2006).

The economic burden of childhood obesity is also substantial. Recent research has indicated obesity-related health care costs among children age 6-17 years more than tripled from \$35 million in 1979-1981 to \$127 million from 1997-1999 (Wang & Dietz, 2002). More recently it has been reported that between 2001 and 2005 annual expenditures on obesity-related hospitalizations had increased further from \$125.9 to \$237.6 million dollars among children aged 2-19 (Trasande, Liu, Fryer, & Weitzman, 2009). Over this same time period, Medicaid spending on obesity-related

hospitalizations increased 120 percent, from \$53.6 million in 2001 to \$118.1 million in 2005, contributing to tax-payer burden and increased health care costs (Borger, Smith, Keehan, Sisko, Poisal, et al., 2006; Trasande, Liu, Fryer, & Weitzman, 2009).

Theoretical Framework

The empirical relationship between parental employment and childhood obesity is examined in this study using a rational choice theory of microeconomics. Rational choice theory has been utilized by economists to study a wide variety of social phenomenon (Becker, 1965). In general terms, rational choice theory posits that individuals behave in ways that maximize benefits while minimizing costs (Friedman, 1953). The basic premise of the theory is that people make choices that help them achieve their objectives according to individual preferences and constraints (Green, 2002). Choices are constrained by time and money, and resources are allocated such that satisfaction, happiness, or well-being are optimized (Easterlin, 2003; Lovett, 2006). Hence, rational agents weigh the costs and benefits of their actions in order to achieve the maximum pleasure or utility available under their particular set of circumstances (Friedman, 1953; Green, 2002).

The household production model is an application of rational choice theory and provides a way to account for the production of commodities within households. Becker (1965) postulates that households efficiently allocate time and market goods in order to carry out commodity producing activities within the home that contribute to the utility, or satisfaction and well-being of household members. Applying the household production model to child health, parents must decide the relative amount of time and other

resources each will invest in child health production as opposed to other goods or services (Green, 2002). For example, parents must weigh the value of time spent reading with children, or taking children to the dentist, against alternative household, labor market, or leisure activities.

According to Grossman's model, each child is endowed at birth with a certain level of health which varies from individual to individual based on genetics, prenatal care, and other factors (Grossman, 1972). While normal depreciation of one's health endowment eventually leads to aging and death, investments in health during the life-cycle serve to improve one's health subject to underlying biological, medical, and social parameters. Parental inputs of time, material, and efforts are strategically invested in order to maximize the health of their children (Datar, Kilburn, & Loughran, 2010). For the purposes of this research, child health, measured inversely as obesity, is identified as the household production output, and parental time spent with the child considered the primary exogenous input of interest (Grossman, 1972).

The rationale underlying this theoretical approach is the assumption that production of child health contributes to parental satisfaction. Therefore, investments into child health, such as time, attention, food and medicine, enhance overall parental satisfaction (Grossman, 1972). Production of child's health is an important consideration in parents' joint decision-making process about allocation of valuable time and resources (Behrman, 1997). Hypothetical production functions of child health generally show child health as a function of parental input hours. However, joint decision making by parents about time spent with a child does not necessarily result in equal input of hours by each parent in order to produce a specified level of child health.

The household production model specifies that efficient households specialize in those tasks for which individuals possess a comparative advantage. Division of labor according to opportunity costs ensures that the total output for a two person household will exceed the sum of production for two separate single person households (Chung, 2009). Ongoing and pervasive male and female market wage differentials provide an explanation for the household production model assumption that women generally face a lower opportunity cost than men in terms of household production, whereas men have greater incentive to specialize in the labor market production (Becker, 1991)

In addition to considerations of comparative advantage, parental characteristics may also influence one's abilities or skills related to child health production. Previous research indicates that parental education, nutritional knowledge, income and personal health may all play a role in child health outcomes (Fertig, Glomm, & Tchernis, 2009; Case, Lubotsky, & Paxson, 2002). Therefore, quantitatively similar input hours by each parent may yield different levels of child health. For example, a maternal hour spent on food preparation and child feeding may be more conducive to child health production than a meal provided by the child's father during the same one hour period. Household production models allow for consideration and analysis of the skewed, or asymmetric, number of hours that mothers typically invest in child health production.

Economic theory suggests a number of mechanisms by which parental employment could contribute to childhood overweight. As mentioned previously, time constraints may increase the dependence of working parents on processed foods. Research has indicated that processed and fast foods are higher in calories than meals

prepared at home, resulting in increased caloric consumption and weight gain among household members (Cutler, Glaeser, & Shapiro, 2003; Paeratakul et al., 2003).

Time constraints related to parental employment may also reduce the total number of meals eaten within the household, with breakfast the meal most commonly skipped by household members. It has been demonstrated that overall daily caloric consumption increases when breakfast is omitted and that 24 hour insulin concentration levels are elevated, leading to greater storage of excess calories as fat (Mokdad et al., 2003; Morgan et al., 1986; Siega-Riz, Popkin, & Carson, 1998; Stauton & Keast, 1989).

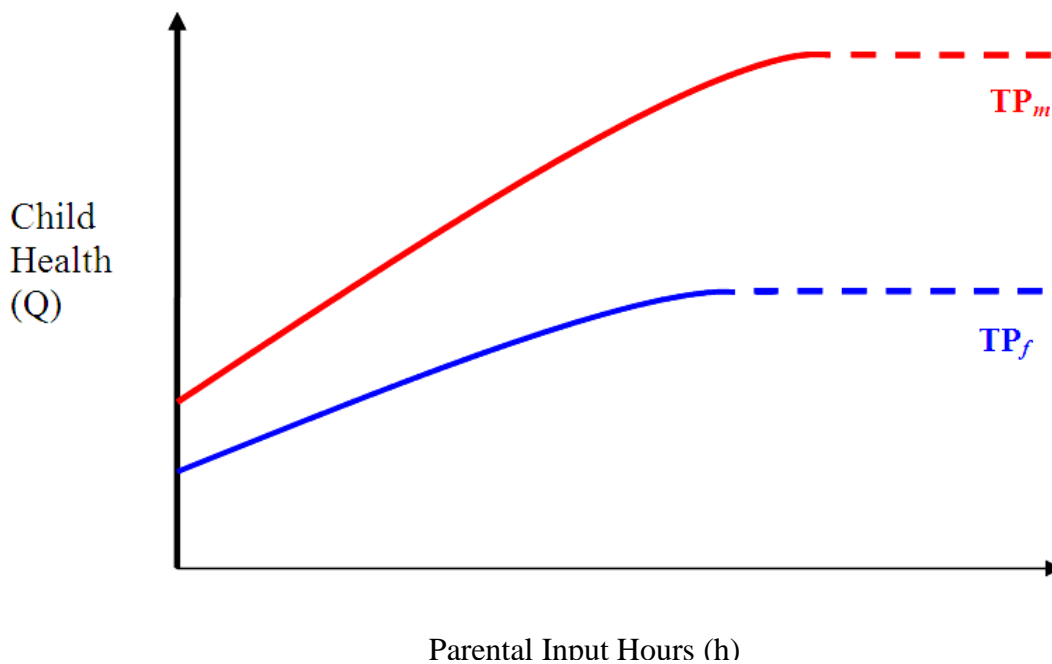
It has also been asserted that employed parents may have less discretionary time to supervise child activities. Lack of parental involvement and participation in child activities may lead to an increased amount of solitary and sedentary activity, as well as increased consumption of unhealthy snack foods (Azier, 2004; Fertig, Glomm, & Tchernis 2009).

A point of ambiguity exists within economic theory relating to the relationship between increased household incomes derived from parental employment and child obesity. Gordon-Larsen et al., (2003) and Zhang and Wang (2004a, 2004b) suggest an inverse relationship exists between income and body mass index. Hypothesized reasons for the observed negative association include the ability of more affluent individuals to purchase higher quality foods, including fresh fruits and vegetables, as well as financial resources to engage in more extracurricular activities, especially athletic pursuits. Higher incomes, however, may also increase the demand for high quality restaurant foods (assuming restaurant meals are a normal good) which might therefore predict higher body

mass. Thus, the implications of increased income associated with parental employment are mixed according to economic theory.

Figure 3 depicts child health as production process in which parental inputs yield positive child health outputs. Just as a firm may use land, labor and capital to manufacture a product, numerous biological, social, lifestyle and environmental factors interact to produce child health. The figure demonstrates that the hypothetical level of child health output varies with the level of certain key inputs contributed (in this case,

Figure 3.Theoretical Total Child Health Production Curves for Parental Input Hours*



*Note: TP_m and TP_f denote total child health produced by maternal and paternal inputs, respectively

parental time investment, in hours). The two product curves represent the total health production curves for mothers (TP_m) and the total health production curve for fathers (TP_f). The curve for mother's health production is shifted up to indicate that variations may exist in the effectiveness between mothers and fathers in terms of producing

children's health. For example, mothers may have a greater knowledge base or experience in terms of caring for children's health needs. Also, traditional divisions of household labor and family processes such as maternal gatekeeping may limit men's effective participation in child health producing activities (Allen & Hawkins, 1999).

In terms of parental hours, the graph shows that parental inputs, measured as hours spent with the child, lead to increases in child health production up to a point. It is important to note, however, that with increasing hours of parental input the slope of the total product curve begins to level off, indicating diminishing marginal productivity. Diminishing marginal returns for non-market production have been established in the literature, such that "the marginal value of the 1,000th hour of non-market work ...is about 65% of the value of the first hour (Kiker, & Mendes de Oliveira, 1992, p. 464)." This principle is illustrated in the example of reading bedtime stories with one's child. The first or second story may be much more enjoyable and interesting to the parent and child as compared to the fourteenth or fifteenth story read. Similarly, it is assumed here that the initial hours of parental input into child health will yield the greatest benefits, whereas additional parental hours inputted toward child health will yield successively smaller benefits.

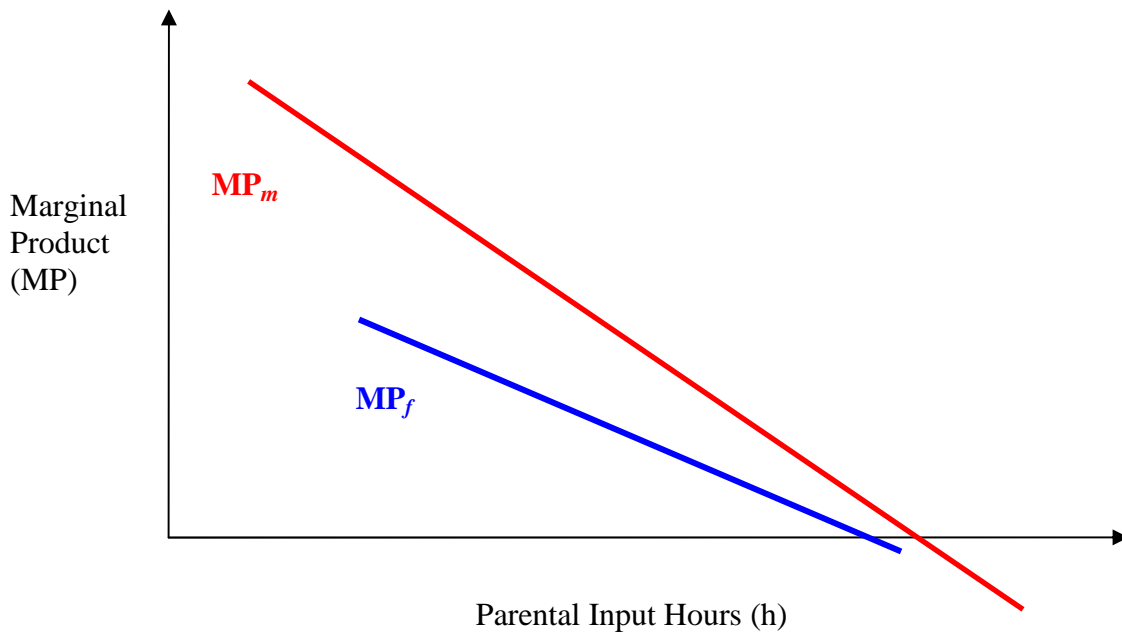
Figure 3b depicts the marginal product curve for maternal and paternal inputs into child health. Marginal product (MP) for each parental input is given by the following equations:

$$MP_m = \Delta Q / \Delta h_m \quad (\text{for mother})$$

$$MP_f = \Delta Q / \Delta h_f \quad (\text{for father})$$

Where ΔQ is equal to the additional quantity of child health produced by each parent for each additional hour, h , that parents invest in activities related to child health production.

Figure 3b. Marginal Product Curves for Parental Hours



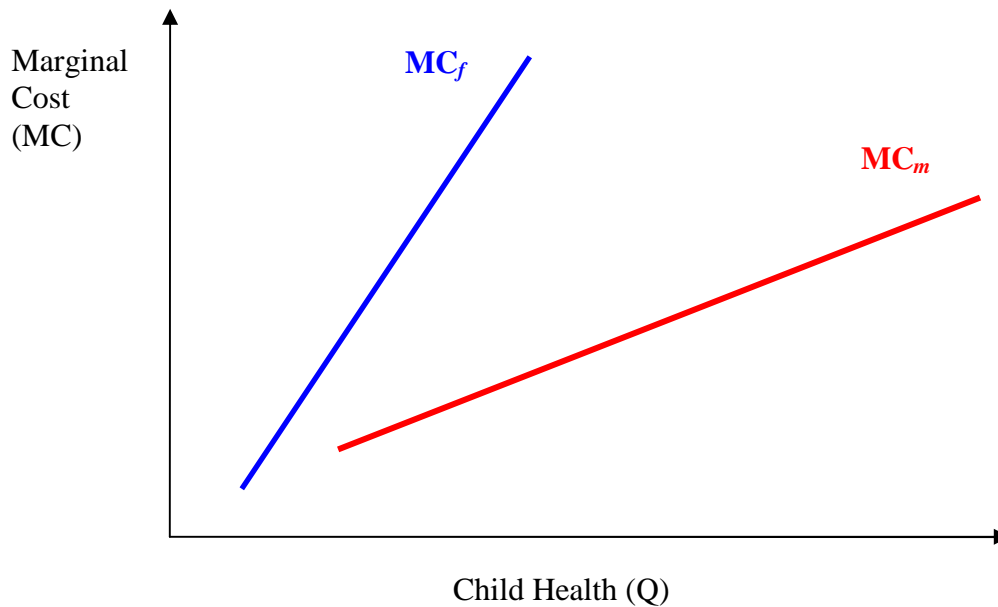
*Note: MP_m and MP_f denote marginal product (the incremental addition to child health) due to increased maternal and paternal input hours, respectively.

Negatively sloped curves are depicted for both maternal and paternal inputs based on the law of diminishing marginal productivity described previously, that is, the marginal product of parental inputs diminishes with the quantity of hours inputted.

Similar to the argument presented above, Figure 4 illustrates that each parent has different incremental or marginal costs associated with providing child health inputs. Differences in marginal products and market wages for males and females lead to increasing marginal child health production costs for each parent. Figure 4 depicts the expected raising marginal cost (MC) of producing child health.

It is possible that the joint decision-making process of mothers and fathers regarding child health production may take a two step approach. In the first step, given their opportunity costs, parents determine the optimum level, or quantity (Q^*), of child health that can reasonably be produced. In the second step, based on their marginal costs of producing child health, an efficient allocation of efforts to the production of Q^* will be decided. Figure 4b depicts this allocation of resources.

Figure 4. Marginal Cost Curves of Child Health Production

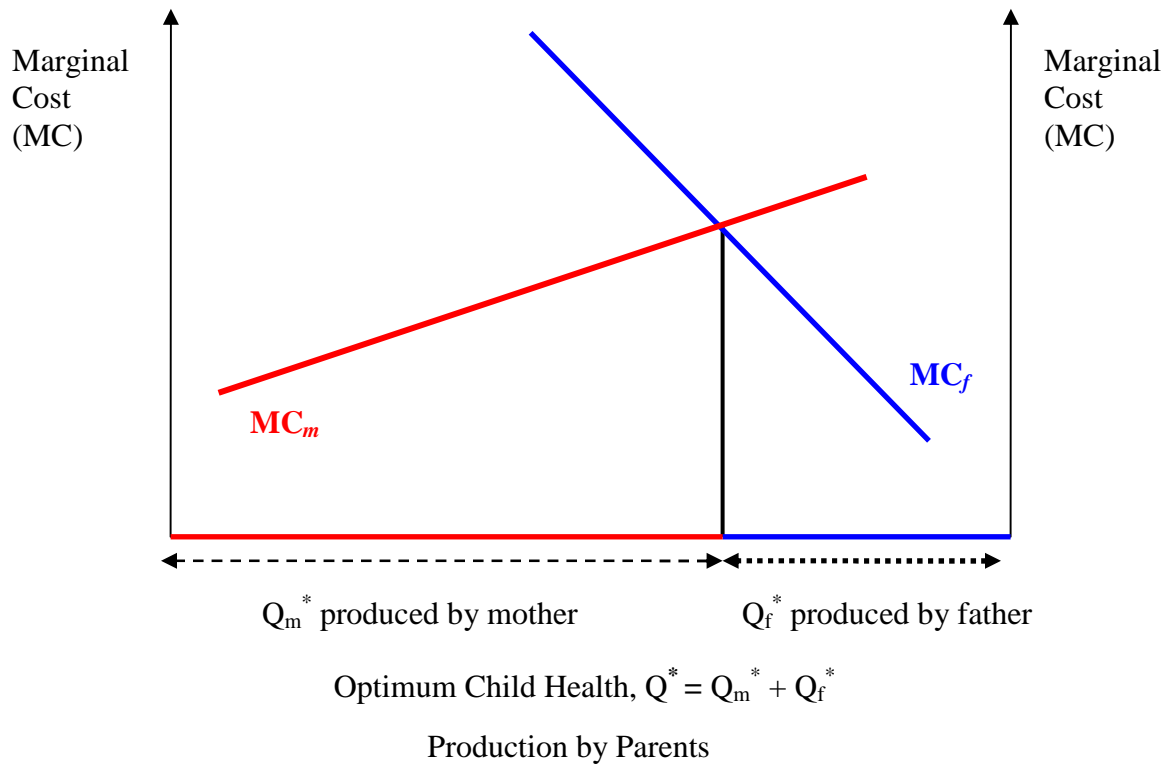


*Note: MC_m and MC_f denote marginal or incremental costs of additional contributions to child health by mothers and fathers, respectively.

Based on heterogeneously rising marginal cost curves presented in Figure 4b, the mother in this example produces Q_m^* of the optimum level of child health (Q^*) and the father produces the remainder $Q_f^* = Q^* - Q_m^*$. A mirror image of the father's marginal

cost is presented in Figure 4b. The graph in Figure 4b does not imply that father's marginal cost is negative. The mirror image of father's marginal cost curve is presented in order to identify the intercept with mother's marginal cost curve, indicating the point at which the optimum level of child health is likely to occur. Transposing father's marginal cost curve also provides a graphical representation, as seen on the x-axis, of the level of child health input hours by each parent that would allow the household to most efficiently attain the desired level of child health production in this hypothetical example.

Figure 4b. Optimum Level of Child Health



*Note: MC_m and MC_f denote marginal or incremental costs of additional contributions to child health by mothers and fathers, respectively. The mirror image of father's marginal cost curve is presented for ease of comparison and evaluation.

Given hypothetical differences in abilities, skills, and wages, Figure 4b shows that the father in this example produces a smaller share of the child's total optimum health

than the mother. The marginal cost curves presented take into account the various factors that may influence opportunity cost for each parent in terms of child health production including economic factors, institutions, gender, and skills. Figure 4b suggests such factors should be considered in determining the specific roles and responsibilities of each parent in producing child health.

Overall, the household production model provides a strong theoretical underpinning for evaluating household members' behaviors in relation to child health production, measured here inversely as childhood obesity (Becker, 1965; Lancaster, 1996). Efficient allocation of time and resources maximizes commodity production within households thus contributing to the overall satisfaction and well-being of household members, including children. Application of the household production model to research on parental role in childhood obesity allows for an accounting of the impact of parent inputs, such as quantity and quality of time spent with a child, on child weight outcomes. Considerations of comparative advantage provide researchers with a framework for understanding and interpreting observed differences in patterns of maternal and paternal investments in child health production. A rational choice approach takes into account factors affecting opportunity costs for parents and allows for the determination of the relative parental inputs needed to most efficiently attain the desired level of child health.

Definition of the Variables

The key dependent variable in this study was children's percentile Body Mass Index (pBMI). BMI percentiles were utilized because child BMI scores are highly

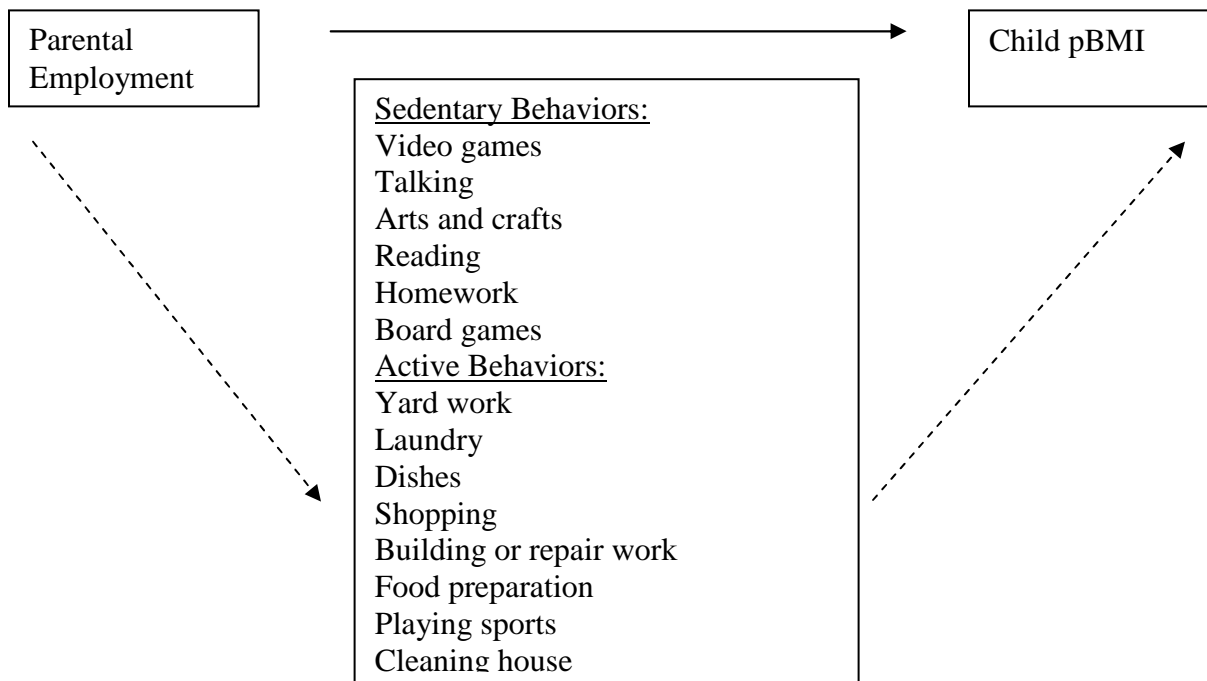
dependent on age and gender. BMI percentiles were therefore used as a continuous dependent outcome, with children in the 85th through 95th percentile defined as overweight and children with a pBMI in the 95th percentile or above classified as obese.

The other main variables of interest in this investigation were maternal and paternal employment, measured in term of weekly work hours (MWH) and (PWH), respectively. The influence of numbers of weekly hours worked by each parent on child percentile BMI was investigated. For parents who did not work, zero hours were assigned, however for analytic purposes, parents working one or zero hours per week were grouped with parents working one hour per week, in order to avoid computations that would involve setting natural logarithm. functions equal to zero. ($\ln MWH=0$ or $\ln PWH=0$). Reported hours of maternal and paternal work took into account weekly hours spent on all jobs worked during a representative week.

In addition to maternal and paternal weekly work hours, current research indicates that elevated parental BMI is also a significant predictor of childhood obesity (Semmler, Ashcroft, van Jaarsveld, Carnell, & Wardle, 2009), potentially due to shared patterns of eating and physical activity observed within families (Gillman, 2003; McGuire et al., 2002; Moore et al., 1991). Hence parental BMI was included in our model. Case, Lubotsky, and Paxson (2002) also suggest that parental education and income may affect child health outcomes, therefore parental hourly wage, which may serve as a proxy for education, and household income variables were considered. Additional demographic and residential variables of child race and region of residence were also controlled for in this analysis.

Figure 5 presents the conceptual model that was used for this study. The primary objective of this study was to investigate the significance of parental employment in child health, measured here inversely as child percentile BMI. A second major objective of this research was to examine the pathways by which parents influence child weight outcomes. Information contained in the Child Development Supplement of the PSID related to joint parent-child activities that may impact child body weight outcomes was utilized to investigate the potentially relevant pathways depicted in Figure 5.

Figure 5. Conceptual Model of Parental Employment Effects on Children's pBMI



Hypotheses

Given variation in abilities, skills, education, and experience among parents, some households are more effective than others at child health production, measured here as the inverse of percentile body mass index (pBMI).

Similarly, parental employment, measured in weekly hours, may give rise to differential patterns in children's energy consumption and expenditures.

In line with previous research (Anderson, Butcher, & Levine et al., 2003; Cawley & Liu, 2007; Fertig et al., 2009), it was anticipated that maternal employment would be associated with higher body mass percentiles among children. Maternal employment may affect the frequency and composition of meals consumed by family members, impacting the total caloric intake of each member. However, to fill the current void in the literature, an investigation of the impact of paternal employment on the same variable of interest (pBMI) was conducted. Paternal employment may also affect the frequency and composition of family meals, impacting each family member's total caloric consumption. Maternal and paternal employment may also have an influence on children's time use, physical activity level, and the average number of calories expended during daily activities.

Given the natural heterogeneities that exist between parents, it was anticipated that maternal health inputs, such as hours spent with the child, would make a greater relative contribution to healthy child outcomes than would an equivalent input of paternal hours. Over time, the effect of maternal and paternal employment, or their individual impact on child health (pBMI) could vary with the age and gender of the child.

Based on previous research (Anderson, Butcher, & Levine et al., 2003; Cawley & Liu, 2007; Fertig et al., 2009), the present study proposed the following hypotheses:

1. An increase in the number of weekly maternal hours worked (MWH) will be associated with higher pBMI scores among children.
2. An increase in the number of weekly paternal hours worked (PWH) will be associated with higher pBMI scores among children.
3. The relative contribution of weekly maternal work hours (MWH) to children's pBMI scores will be greater than the contribution observed for an equivalent number of weekly paternal work hours (PWH).
4. The impact of maternal work hours (MWH) on child pBMI will decrease with increasing child age.
5. The impact of paternal work hours (PWH) on child pBMI will decrease with increasing child age.
6. Parental participation in sedentary activity with a child will predict higher child pBMI.
7. Parental participation in physical activity with a child will predict lower child pBMI.

The above hypotheses allow for investigation into the significance of parental employment in childhood obesity. Additionally, testing these hypotheses will determine the relative importance of paternal employment compared to that of maternal employment in childhood obesity, and whether this importance changes by the child's age. Moreover, the above hypotheses allow for the consideration of the potential pathways by which parents may influence child weight outcomes.

CHAPTER III: METHODOLOGY

Sample

The goal of this research was to fill an important knowledge gap by examining the joint impact of parental employment status and hours of work on children's body mass index (pBMI). This research also explored the shared parent-child activities by which parental inputs affect child body mass index (a measure of child health outcomes). The Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID) contains information on children's daily activities and the potential parent-child activities that may affect parental inputs into child health and was therefore utilized for this research. This secondary data analysis of the CDS of the PSID was approved by the University of Maryland Institutional Review Board (see Appendix H).

The PSID began in 1968 with interviews of approximately 5,000 families. The preliminary sample involved two subsamples: an equal probability national sample of approximately 3,000 households, designated as the Survey Research Center (SRC) sample, and an additional subsample of 2,000 low-income families designated as the Survey of Economic Opportunity (SEO) sample. Throughout the course of the project, natural sample growth has occurred through the formation of 'split-off' households, as members of the original PSID families have branched out and formed new households, bringing the total number of PSID families to 8,041 in 2005.

This research utilized the 2007 wave of the Child Development Supplement of the PSID. At present, the CDS is comprised of three waves. The first wave consists of approximately 3,500 children aged 0-12 in 1997, belonging to PSID families. The second wave, is a 2002-2003 follow-up which involved approximately 2,900 children

aged 5-17, many of whom had been interviewed during the first wave. The final wave, a 2007-2008 follow-up, consists of 1,506 children now aged 10-19 (Insolera, 2010). Due to differential sampling rates for the SRC and SEO samples, compensatory weights have been developed to account for unequal selection probabilities.

The current analysis examines observations drawn from approximately 2,500 children living in 1,100 PSID families (siblings have been included in the sample, but no more than two children are included from a single PSID household). Children with missing height or weight data were excluded from the present analyses. Children with incomplete or missing data related to parental work hours were also omitted. Thus, the final sample for the current analysis included 1425 children.

Constructs and Measures

In contrast to previous studies that have focused primarily on maternal contributions to child body mass outcomes (Anderson, Butcher, & Levine, 2003; Liu, Hsiao, Matsumoto, & Chou, 2008; Miller & Han, 2008; Ruhm, 2008), a unique feature of this research was the exploration of pathways by which both maternal and paternal inputs affect child weight outcomes. Energy imbalance may result from numerous behavioral and environmental factors. Obesogenic factors such as declining relative food prices (Lakdawalla & Philipson, 2002; Gelbach, Klick, & Stratmann, 2007), technological changes (Philipson & Posner, 1999; Cutler, Glaeser, & Shapiro, 2003), increased sedentary lifestyle (Philipson, 2001), and the availability of calorie-rich fast food (Chou, Grossman, & Saffer, 2004) have all received increasing attention in childhood obesity

research. The use of CDS data allowed for consideration of relevant behavioral and environmental factors that may be contributing to childhood obesity outcomes.

The CDS of the PSID contains comprehensive data on family economics, child development, health status and behaviors, family processes, as well as aspects of the home, school, and neighborhood environments (Insolera, 2010). The CDS also contains information on household dietary behaviors related to the number of meals eaten at home or in restaurants. One potential confound in the data, however, is an inability to determine whether meals eaten at home were prepared in a restaurant setting (such as delivery or take out). Data on breastfeeding was also collected as part of the PSID, but was not used as a variable in these analyses. Finally, the CDS parent interview contains quantitative data regarding whether or not children received an allowance from their parents. These data were included in this study because previous research has asserted that receiving an allowance may affect a child's nutritional intake (Fertig, Glomm, Tchernis, 2009).

Procedure

Data on the potential joint parent-child activities, as well as the height and weight of each child, were obtained through information from the CDS of the PSID. In addition to CDS data on child activities, linkage with the main PSID interview also provides information on the child's household. The main household survey provides information on the height and weight of the head of household and his/her partner, which may also impact children's body weight. Parental BMI was therefore included in the analyses.

In addition to considering the paternal role in determining child pBMI, an important objective of this study was to explore the pathways by which parental inputs affect child health outcomes, measured here as the inverse of child body mass index. Given that objective, this research investigated the effect of parental inputs on child's percentile BMI while controlling for a number of potential joint parent-child activities. Apart from descriptive analysis of the data, multiple equations were estimated in order to determine if the potential mediators significantly impacted the effect of parental influence on children's body weight. Potential mediators drawn from the CDS were treated as omitted variables in this research. The inclusion of each parent-child behavior was tested in order to determine whether it significantly changed the estimated effect of maternal and paternal inputs on child pBMI. Moreover, the joint impact of all included variables was considered at every stage of investigation to ensure the robustness of the reported results to underlying potential misspecifications of the estimated model.

Data Analyses

The empirical strategy employed the use of multiple regression analyses to explore the relationship between paternal inputs and child percentile BMI (pBMI) while controlling for the numerous potential parent-child activities contained in the PSID Child Development Supplement data. Controls were also included for the number of children in the household, maternal and paternal hourly wage, annual household income, and region of residence. Finally, parental BMI was also used as a control in the regression analyses. This strategy was suitable because the objective of this research was to study the impact of parental employment, as well as the pathways by which parental inputs, such as work

hours and income, affect child body mass outcomes. For example, parental employment may have an impact on children's diet and activities, thereby contributing to pBMI scores. Hence, a two-pronged strategy for estimation of the impact of parental employment on children's pBMI was introduced. Following the recent literature, a 'specific to general' approach was followed. In this case, separate regression equations were used to estimate each of the potential parent-child activities specified by the study hypotheses. Such an approach has been used in previous research by Baum and Ruhm (2009) , Fertig, Glomm, and Tchernis (2009), and Levine and Rothman (2006).

It is worth noting that the separate regression equation estimation technique, which leads to the inclusion of a single variable in an 'under-specified' model, does not necessarily provide a robust environment for inference and may lead to biased and inconsistent estimates. Second, a 'general to specific' modeling strategy, which closely corresponded to the underlying theoretical framework, was also employed. In this case, all relevant explanatory variables were included to explain pBMI, and tests of hypotheses were used to select the model that best explained the dependent variable (pBMI). Subsequently, results based on this model were compared with other recent findings based on the first approach found in the empirical literature.

A Specific to General Approach

Using maternal working hours (MWH) and paternal working hours (PWH) as examples, the basic specifications are:

$$pBMI_i = \alpha_{0m} + \alpha_{1m} \ln(MWH)_i + \alpha_{2m} X_i + \varepsilon_i , \quad (1)$$

$$pBMI_i = \alpha_{0p} + \alpha_{1p} \ln(PWH)_i + \alpha_{2p} X_i + v_i , \quad (2)$$

where ε_i and v_i are, *a priori*, error terms with zero mean and constant variance.

This initial equation did not take into account any of the potential parent-child activities, which were addressed in subsequent models. It did, however, contain control variables for characteristics of the family and child, X . The Ordinary Least Square (OLS) estimation technique was employed to regress a single health outcome, child pBMI, on a number of observed input choices. The log of parental work hours was used in this equation to reduce the effect of a small number of parents who work extensive hours during the week. For analytic purposes, parents working one or zero hours per week were grouped together as working one hour per week, such that $\ln MWH=0$ or $\ln PWH=0$.

Equations (3) and (4) include one of the potential joint parent-child activities, playing video games. Thus the equations are:

$$pBMI_i = \beta_{0m} + \beta_{1m}\ln(MWH)_i + \beta_{2m}video\ games_i + \beta_{3m}X_i + v_i, \quad (3)$$

$$pBMI_i = \beta_{0p} + \beta_{1p}\ln(PWH)_i + \beta_{2p}video\ games_i + \beta_{3p}X_i + \mu_i, \quad (4)$$

where v_i and μ_i are, *a priori*, error terms with zero mean and constant variance.

If the marginal effect of maternal or paternal employment on the child's pBMI changes as a result of including this joint parent-child behavior (video games), it is inferred that the part of the effect of parental employment operates through this shared behavior. As mentioned previously, potential parent-child activities are treated as omitted variables. The equation for omitted variables is given by:

$$\alpha_1 \approx \beta_1 + \beta_2 \rho \quad (5)$$

where α_1 , β_1 , and β_2 are the coefficients from equations (1) through (4). ρ represents the correlation between maternal working hours and the proposed parent-child behavior, here playing video games.

A value of $\beta_2 \rho$ greater than zero in equation (3) suggests that the effect of the potential parent-child behavior (ρ) on child's pBMI (β_2) and the correlation between maternal work hours (MWH) and the parent-child behavior (ρ) share the same sign. Similarly, A value of $\beta_2 \rho$ greater than zero in equation (4) indicates that the correlation between paternal work hours (PWH) and the parent-child behavior (ρ) share the same sign. In other words, if $\alpha_1 - \beta_1$ is greater than zero when video games is incorporated into the equation, it can be assumed that the effect of computer/video games on child's pBMI is positive and that video game use increases with parental work hours.

Conversely, if the incorporation of a potential shared behavior (ρ) into equation (3) or (4) leads to lower pBMI and additional hours of maternal or paternal employment decrease the child's time spent in that activity, both β_2 and ρ could be negative. Such an observation would indicate that the direct effect of maternal or paternal working hours on the child's pBMI is reduced when video games is included as a mediating variable.

A General to Specific Approach

Application of child health production theory and the ecological model of development provides a useful framework for understanding relevant variables that may influence child health (as approximated by the inverse of pBMI). Moreover, these theories allow researchers to consider other behavioral variables that may otherwise be confounding factors in determining pBMI. However, intentional or inadvertent exclusion of potential explanatory variables in a model leads to the omitted variable problem, which may cause

estimated (OLS) coefficients to be biased and/or inconsistent estimates of some or all of the true parameters they are intended to estimate. If the excluded variables are correlated with the included variables, then the estimates of intercept and other parameters will be biased and inconsistent. In repeated samples, a biased estimate does not, on average, equate to the true parameter it is estimating. In terms of probability, an inconsistent estimate does not approach the true parameter it is estimating no matter how large the sample becomes. This leads to an acute estimation problem if the excluded variables are correlated with the included variables, a problem that is common in health and social science research. A general to specific methodology allows for (OLS) estimators to be unbiased and consistent. Although they will have larger variances than those of the true parameters, within a general model hypothesis testing remains valid. Thus, a general to specific methodology has significant advantages over the specific, under-parameterized model commonly used in the current literature.

Therefore, rather than estimating a model such as those of (1) and (2) and then proceeding to estimation of (3) or (4), a general model that included all important and auxiliary explanatory variables and relevant interaction terms was estimated as follows:

$$\begin{aligned}
 pBMI_i = & \beta_{0m} + \beta_{0f} + \beta_{1m} \ln(MWH)_i + \beta_{1p} \ln(PWH)_i + \beta_{2m} \ln(MWH^2)_i \\
 & + \beta_{2p} \ln(PWH^2)_i + \beta_3 (\text{birth weight}) + \beta_4 (\text{mother's hourly wage}) \\
 & + \beta_5 (\text{father's hourly wage}) + \beta_6 (\text{annual household income}) + \beta_7 (\text{maternal BMI}) \\
 & + \beta_8 (\text{paternal BMI}) + \beta_9 (\text{yard work}) + \beta_{10} (\text{laundry}) + \beta_{11} (\text{dishes}) \\
 & + \beta_{12} (\text{shopping}) + \beta_{13} (\text{building/repairs}) + \beta_{14} (\text{preparing food}) \\
 & + \beta_{15} (\text{playing sports}) + \beta_{16} (\text{cleaning house}) + \beta_{17} (\text{video games}) + \beta_{18} (\text{talking}) \\
 & + \beta_{19} (\text{crafts}) + \beta_{20} (\text{reading}) + \beta_{21} (\text{homework}) + \beta_{22} (\text{board games}) + \varepsilon_i
 \end{aligned}$$

Based on attributes that define a good model (i.e., theoretical consistency, identifiability of parameters, parsimony, goodness of fit, and predictive power), a proper model was selected for further inference and analysis. In this study, the above methodologies were used to provide the proper framework for carrying out modeling, estimation, and inference using the CDS component of the PSID. After extensive data cleaning was done, graphical techniques, descriptive statistics, modeling, and inferential methods yielded important evidence about the role of parents in influencing their children's obesity.

CHAPTER IV: RESULTS

Descriptive Statistics of the Data

The descriptive statistics, including socio-economic and demographic characteristics, for children living with both parents are presented in Table 3. Descriptive statistics for the full sample (n=1425) are presented in Appendix G, but given that the role of parental employment and shared parent-child behaviors are the focus of this study, the demographics for children residing with one or both parents are emphasized here.

Due to the oversampling of certain subpopulations specified in the design of the PSID, weighted means are reported in Table 3. The target sample used in this analysis consisted of 1099 children, including 526 females and 573 males. Children's age ranged from 10.38 to 18.87 years, with an overall average of 14.53 years. The key outcome variable in our analyses was child BMI percentile. BMI percentile was used because children's BMI scores are highly dependent upon the sex and age of a child, thus those characteristic have been taken into account in reporting the child's percentile ranking.

Figures 6 and 7 provide representations of percentile BMI distributions for the boys and girls in the sample, and Figure 8 presents a comparison of pBMI curves for both boys and girls. Overall, the figures indicate that the distribution of pBMI scores for boys and girls are fairly similar. Nonetheless, a close inspection may reveal that the distribution of pBMI scores for boys is denser in the middle BMI percentile ranges than that of girls. The distribution of pBMI scores for females is more uniform than boys, with a larger proportion of females extending into the upper tail of their distribution. Thus, a larger percentage of the females in the sample fall into the range that is designated as overweight or obese.

Table 3. Descriptive Statistics for target sample (N=1099)

	Mean
Child BMI percentile ¹	67.90
Child is overweight	39.22%
Child is obese	22.54%
Weekly hours worked by mother in 2006	20.50
Weekly hours worked by father in 2006	33.90
Age of child	14.53
Black	17.39%
Hispanic	23.12%
Female	47.86%
Birth weight (pounds)	7.28
Breastfed	61.72%
Number of children in household	2.30
Hourly wage of mother	\$10.16
Hourly wage of father	\$20.45
Annual family labor income in 2006 (thousands)	\$80.96
Receives an allowance	26.74%
Amount of allowance per week	\$6.42
BMI of mother	27.18
BMI of father	27.38
Northeast	16.37%
North Central	21.77%
South	31.03%
West	30.83%

1 Percentiles based on 2000 CDC Growth Charts by gender and child's age in months

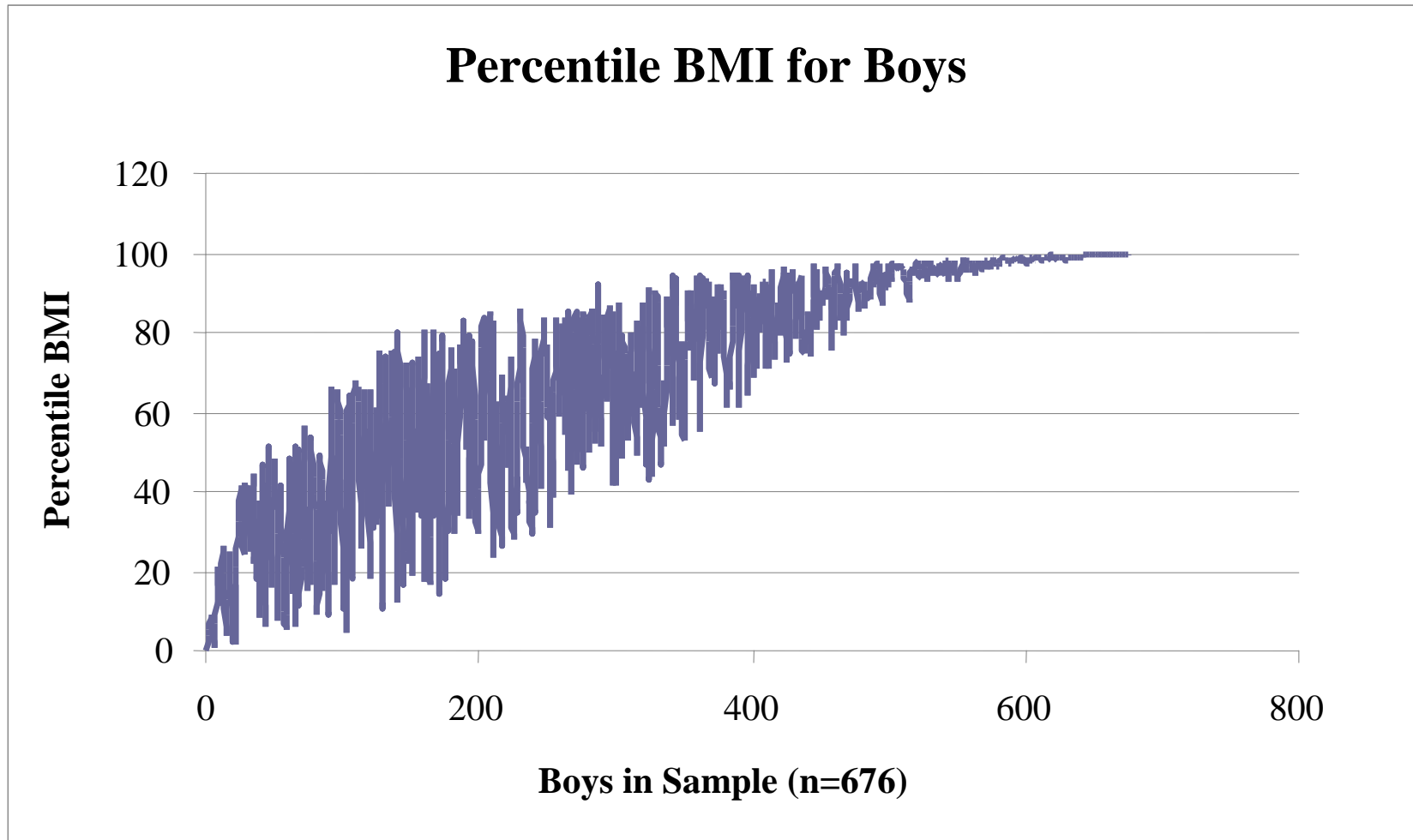


Figure 6. Percentile Body Mass Index Rankings for Boys

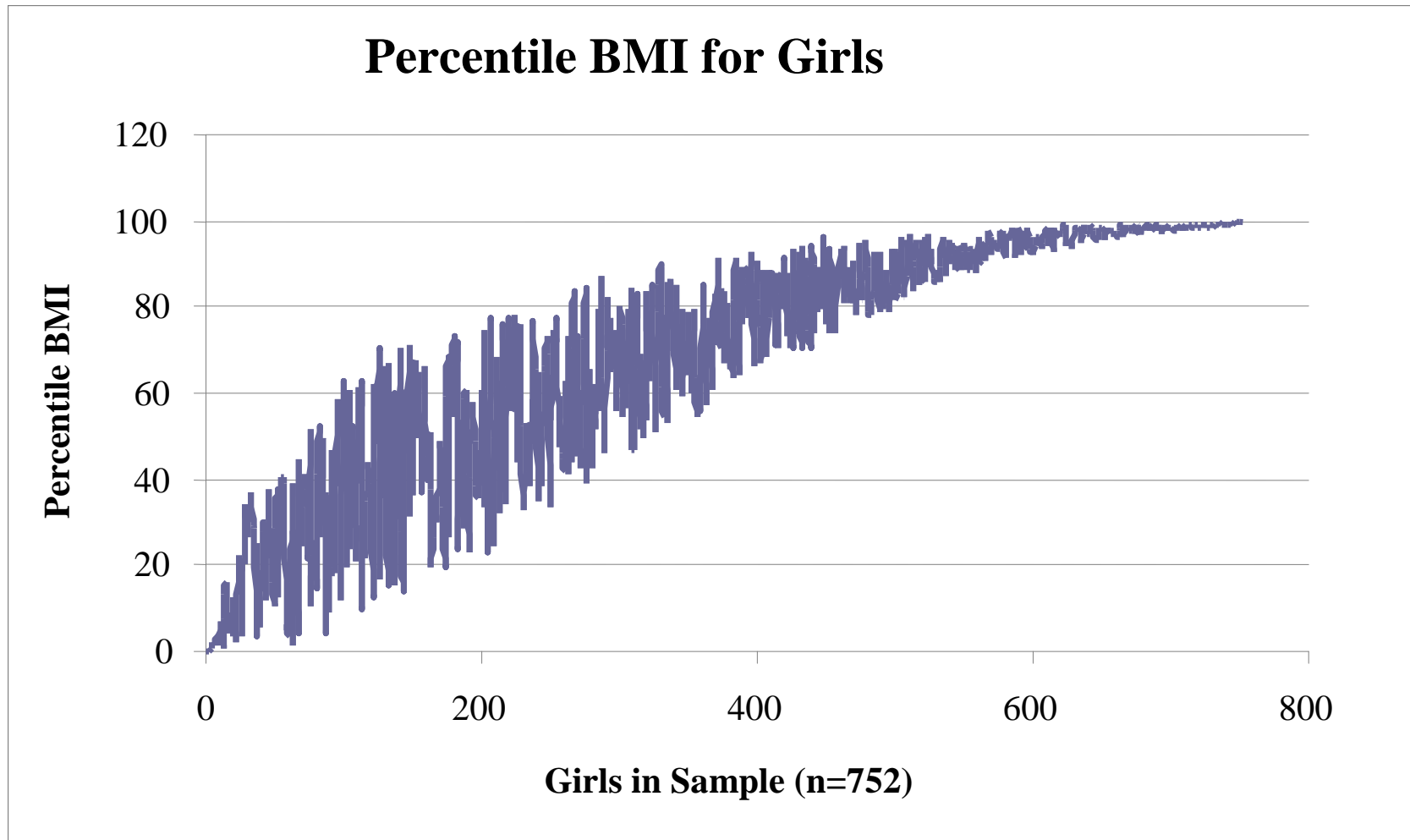


Figure 7. Percentile Body Mass Index Rankings for Girls

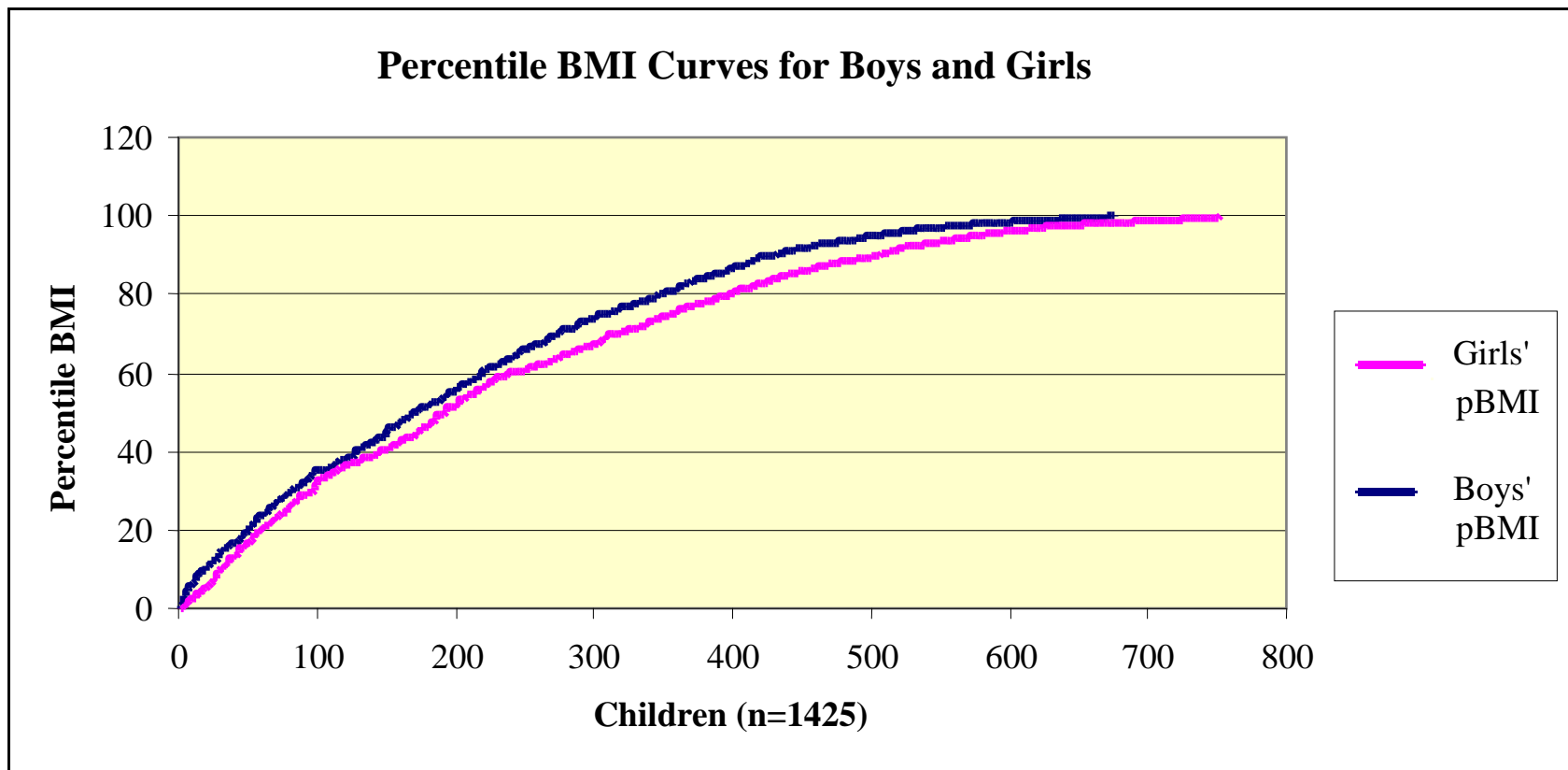


Figure 8. Percentile Body Mass Index Curves for all Boys and Girls in Sample

Figures 9 and 10 present BMI percentiles plotted against raw BMI scores for boys and girls, respectively. The figures indicate that the distribution of boys' BMI scores and percentiles is more concentrated in the mid and lower regions of the curve. The female distribution, on the other hand, is sparse throughout the lower half of the BMI percentile range, with a higher density of female children concentrated toward the upper tail of the BMI scores and percentiles. The figures also depict graphically that across the age range of the sample (10-19 years), the BMI percentiles of boys and girls with identical BMI scores may differ based upon the child's sex. The thresholds for body mass index scores that qualify as either overweight (85th percentile) or obese (95th percentile) tend to be lower for boys than for girls as children move through this age range.

In addition to information on child BMI percentiles, Table 3 also presents descriptive statistics for the sample related to child race and region of residence. Overall, 17.39% of children in the sampled were Black and 23.12% were Hispanic. In terms of geographical distribution, 16.37% of the sample resided in the Northeast, an additional 21.77% was from the North Central portion of the United States, 31.03% of children sampled lived in the South, and 30.83% of participant children resided in the West.

Table 3 shows that, in 2006, the average household income for the sample was \$80,960.00, Fathers in the sample worked an average of 33.90 hours per week and mothers engaged in 20.50 weekly hours of paid labor. The hourly wages of mothers during 2006 was lower than that of fathers, with the former earning \$10.16 per hour and the latter \$20.45 per hour.

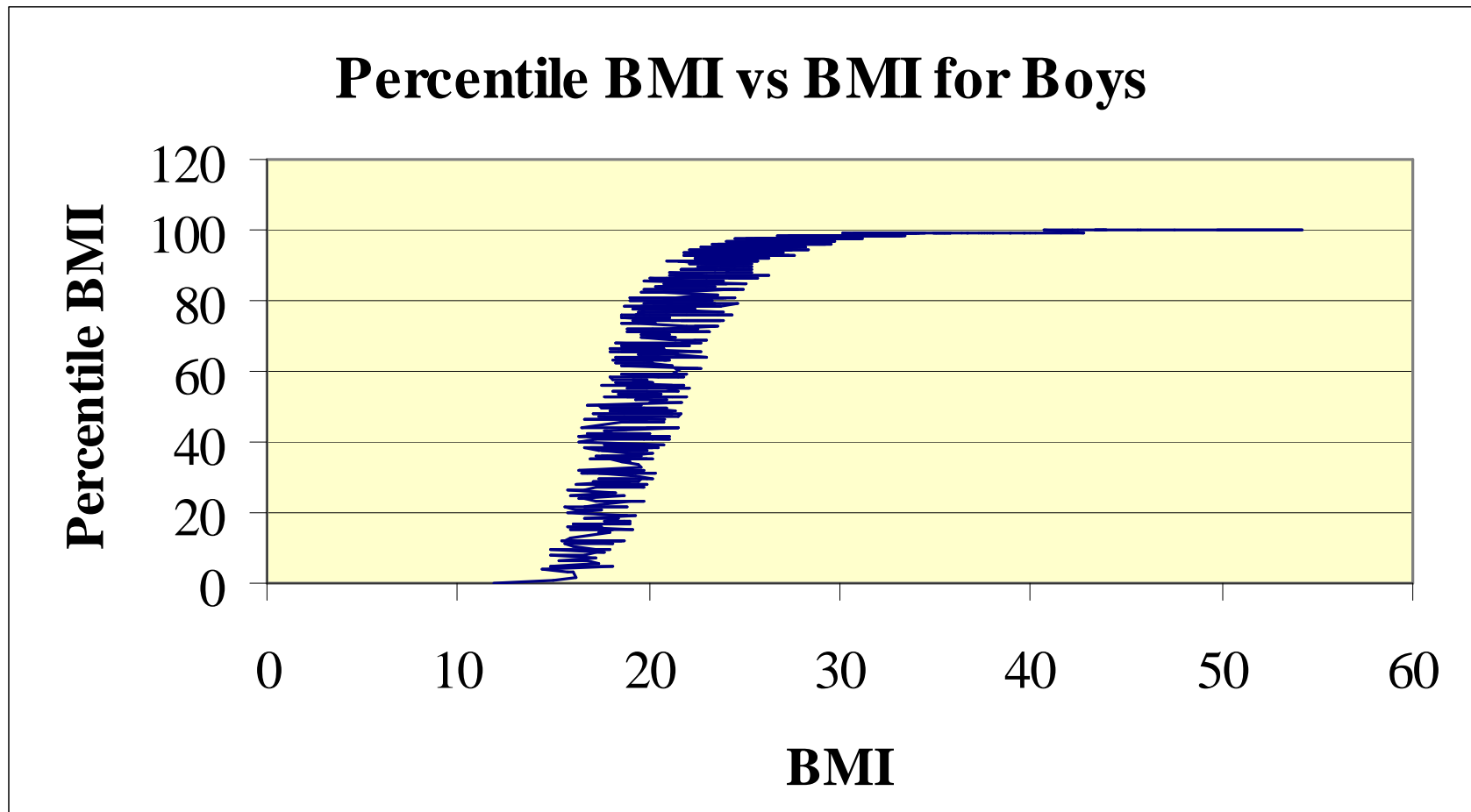


Figure 9. Percentile Body Mass Index Plotted against Body Mass Index for Boys (n=676)

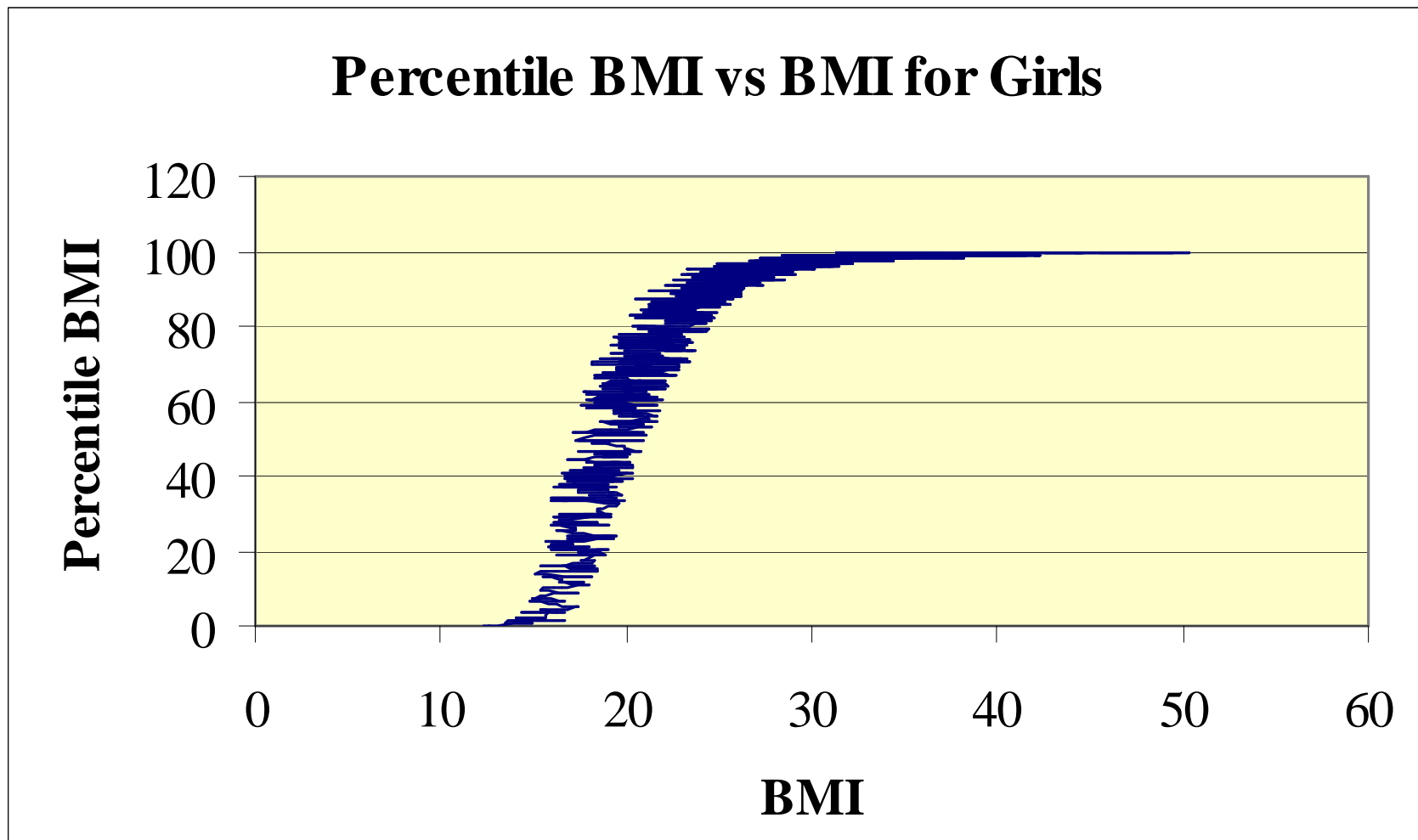


Figure 10. Percentile Body Mass Index Plotted against Body Mass Index for Girls (n=752)

Approximately one-quarter of the children in the full CDS sample (26.74%) received a weekly allowance, averaging \$6.42. Most households had more than one child present, with a mean of 2.30 children per household. The mean birth weight of participating children was 7.28 pounds and the average rate of breastfeeding during infancy was 61.72%.

BMI rankings are used as the key outcome variable of interest in our analyses. Child BMI percentiles take into account the age and sex of a child, providing a ranking of children against a reference group of same age and same sex peers. The average percentile BMI for children in the sample placed them in approximately the 68th percentile for body mass. Based on the observed BMI percentiles of the current study, over 39% of children sampled qualify as overweight, defined as having a percentile BMI of 85 or greater. Among the overweight group, over half of the children had BMIs in the 95th percentile or above. Thus, nearly one-quarter of the total sample (22.54%) met the criteria for childhood obesity.

Descriptive Statistics by Living Arrangement

Table 4 presents descriptive statistics by children's living arrangement. Of the overall sample of 1,425 children, 542 children lived with both parents, 519 lived with their mothers only and 38 children lived with their fathers only. An additional 326 children resided with caretakers other than their biological parents, such as grandparents, siblings, or other individuals. Descriptive statistics by child age and sex for the full sample is presented in Appendix E, but given that the primary objective of this study is to examine parental influences on child body mass, descriptive statistics for children living with both parents are highlighted.

Table 4 Weighted Means by age and sex for children living with one or both parents (n=1099)

	10-13 (n=501)	14-19 (n=598)	Boys (n=573)	Girls (n=526)
Child BMI percentile ¹	69.00	67.03	66.60	69.42
Overweight	42.60%	36.58%	38.85%	39.66%
Obese	23.31%	21.94%	22.17%	22.99%
Weekly hours worked by mother in 2006	19.72	21.11	20.50	20.49
Weekly hours worked by father in 2006	34.53	33.41	32.94	35.04
Age of child	12.38	16.22	14.63	14.43
Black	17.84%	17.04%	16.63%	18.29%
Hispanic	25.72%	21.01%	22.63%	23.70%
Female	49.92%	42.93%	0.00%	100.00%
Birth weight (pounds)	7.39	7.19	7.30	7.25
Breastfed	63.47%	60.26%	61.24%	62.17%
Number of children in household	2.50	2.15	2.24	2.37
Hourly wage of mother	\$10.03	\$10.27	\$9.86	\$10.52
Hourly wage of father	\$19.82	\$20.95	\$20.56	\$20.33
Annual family income in 2006 ('000)	\$72.71	\$87.42	\$79.08	\$83.17
Receives an allowance	21.05%	31.19%	24.65%	29.19%
Amount of allowance per week	\$3.25	\$8.90	\$6.54	\$6.28
BMI of mother	27.55	26.89	27.34	26.98
BMI of father	27.52	27.28	27.26	27.52
Northeast	12.15%	19.68%	17.65%	14.87%
North Central	21.13%	22.28%	19.91%	23.95%
South	32.39%	29.96%	31.83%	30.07%
West	34.34%	28.08%	30.59%	31.10%

Among children residing with at least one biological parent, the highest BMI percentiles were observed among children living with their mothers only (69.55), while children living with their fathers only had a slightly lower average BMI percentile of 69.10. The lowest BMI percentiles were observed among children living with both parents, who reported an average BMI percentile of 67.06.

Weekly hours of paid labor among mothers in the sample were highest for mothers who lived with both the biological father of their children. Children living with both biological parents had mothers who worked an average of 26.35 hours per week, which is nearly 40% more hours than the overall sample mean of 19.00 hours of weekly work. Women who did not live with the biological father of their children worked an average of 9.27 hours per week, whether or not children were present. Fathers who resided with both their biological children and the children's mother reported the highest weekly hours of paid labor, with an average of 43.64 hours per week. Fathers residing away from their biological children worked an average of 12.49 hours per week, and fathers living with their biological children, but not with the children's biological mother, worked an average of 36.10 hours weekly.

Table 4 shows that children living in the sole custody of their fathers tended to be younger than children living with both parents, with a mean age of 13.54 years versus the mean of 14.50 years, and 14.74 years for children living with their biological mothers... Just under half of all children living in either two-parent or female headed families were girls (45.56% and 45.03%, respectively). Girls made up a larger proportion (60.67%) of the children living in single-parent male-headed households.

Black children in the sample were more likely than other racial or ethnic groups to live solely with their biological mothers rather than with their biological fathers or both parents. Only 6.55% of children living with both their parents were Black, whereas 42.43% of the female headed families in the sample were headed by Black mothers. Thus, Black children, who make up only 21.86% of the overall sample, are mainly found in families where only the biological mother is present. Of children living in families headed by single fathers, 6.04% were Black.

Hispanic children make up 19.88% of the full sample. Table 4 shows that 27.06% of children living with both parents were Hispanic. Among children residing in female headed families 17.61% were Hispanic. None of the children in the sample living solely with their biological father were Hispanic.

With respect to birth weights, children living with both parents reported the highest mean birth weights (7.44 pounds), and children residing with their mothers only had the lowest (6.96 pounds). Children living solely with their biological fathers had a mean weight of 7.10 pounds.

Breastfeeding rates were also highest among two parent families, with 68.38% of children living with both parents having been breastfed as infants. Children living with their mothers only were less likely to be breastfed during infancy (48.90%) The lowest breastfeeding rates were observed among children living in single-parent households headed by their father, with only 48.04% of these children being breastfed as infants.

The density of children per household was lowest among father-headed single-parent families with an average of 2.06 children per family. Households with two parents averaged 2.23 children per family, and the greatest numbers of children were observed in

single-parent female headed households (2.39 children on average).

Hourly wages were highest among families that had both a mother and a father present, with hourly wages of \$13.19 and \$27.27 observed, respectively. The lowest mean paternal wages were observed among non-residential fathers (\$5.97 per hour). Non-residential mothers were lowest earners among the maternal counterparts, earning \$4.15 per hour. Single mothers living with their children and single fathers who lived their children reported intermediate average wages of \$4.38 and \$18.10, respectively.

Annual family incomes were highest for two parent families which reported mean yearly incomes of \$98, 650. Female headed households averaged less than half that reporting incomes of \$44, 620 per year. Male headed single parent families fared better with an average income of \$65, 380 per year.

Children living with their biological mothers only were most likely to receive an allowance, with 29.98% of these children reporting weekly allowances of \$8.27 on average. On the other hand, 26.02% of children living with both parents received average weekly allowances of \$5.70, and only 14.64% of children living with single parent fathers received weekly allowances of \$4.24 on average.

Maternal body mass indices were highest among single heads of household who reported mean BMIs of 27.41 kg/m². Mothers in two-parent families had the next highest BMIs averaging 27.11 kg/m². The lowest maternal body mass indices were observed among non-residential mothers who had average BMIS of 26.5 kg/m².

Paternal body mass indices ranged from 27.13 kg/m² for fathers in two-parent families to 28.29 kg/m² for single fathers. Paternal BMIs for non-residential fathers fell within this range at 27.8 kg/m² on average.

In terms of regional distribution, children living in two parent families were most likely to reside in the Western U.S. (36.23%), followed by the South (27.78%), the North Central states (20.67%), and finally the Northeast (15.33%). Children living in female headed households were most often found in the South (36.29%), the North Central region (22.93%), the Northeast (20.79%), and least frequently in the West (19.99%). The greatest proportion of children living in the male-headed single-parent households were found in the South (44.69%), followed by the North Central states (31.19%) and the West (24.12%), with none in the sample residing in the Northeast.

Descriptive Statistics by Age

Table 4 presents descriptive statistics for the sample based on child age and sex. Of children living with either one or both parents, 501 were between the ages of 10 and 13. Their average reported BMI percentile was 69.00. Based on reported BMI percentiles 42.60% of the 10-13 children in the sample qualify as overweight and nearly one-quarter (23.31%) are obese.

The weekly paid labor hours for the mothers and fathers of children in this group were 19.72 hours and 34.53 hours per week, respectively. The mean age of children in this group was 12.38 years. In terms of racial and ethnic status 17.84% were Black and 25.72% were Hispanic, and approximately half were female (49.92%). The mean birth weight for this group was 7.39 pounds. Among children age 10-13, 63.47% were breastfed during infancy, which was slightly higher than the overall rate for the sample. An average of 2.5 children resided in the household of children in the younger group compared to a lower overall mean of 2.15 children per household among all children in the sample.

Mothers of children in the 10-13 year old group reported an average hourly wage of \$10.03, while their fathers earned almost twice as much, i.e., fathers earned \$19.82 per hour, on average. Approximately one fifth of this group (21.05%) received a weekly allowance of \$3.25 on average, which is approximately one-third of the allowance earned among the older group.

Geographically speaking, the greatest proportion of the sample's 10-13 year olds resided in the Western U.S. (34.34%), followed by the South (32.39%), and the North central states (21.13%). Slightly more one tenth of the 10-13 year olds in the sample hailed from the Northeast (12.15%).

The remaining children 598 fell into the 14-19 age range. The average percentile BMI of this group was lower compared to the younger group, with pBMIs of 67.03 on average. Of the 14-19 year olds, 36.58% met the criteria for overweight status, while 21.94% were obese.

The mothers of children in this age group worked slightly more hours each week (21.11) compared to mothers with children in the younger age group. Fathers of older children, conversely, reported slightly fewer hours of paid labor per week (33.42) than fathers of the 10-13 year old children in the sample.

In terms of demographics these children averaged 16.23 years of age and 42.93% of this age group was female. Black children made up 17.04% of the 14-19 year old group, with an additional 21.01% who were Hispanic. The average birth weight of this group was 7.19 pounds, which was lower than that observed among the younger children in the sample, and 60.26% were breastfed during infancy. Children in this age range residing in households which had an average of 2.15 children present.

Hourly wages for mothers of 14-19 year old children was comparable to that of mothers of 10-13 year old children with mothers of older children earning a mean hourly wage of \$10.27. Fathers of children in the 14-19 year old sample earned over a dollar more than fathers of children age 10-13, with children of older fathers making an average of \$20.95 per hour. The annual combined income for parents in this group was approximately 20% higher than that of the former group, with an average yearly income of \$87,420. Receipt of an allowance among this group was more prevalent, with 31.20% percent of 14-19 year olds children being paid an average weekly allowance of \$8.90.

In terms of region of residence the sample of 14-19 year old children was more evenly distributed than the younger group with 30.24% living in the South, 26.82% in the West, 22.08% in the North Central states and 20.86% living in the Northeast.

Descriptive Statistics by Gender

Regarding gender distribution, slightly more than half of the target study populations was male (52.14%). The body mass percentile of the boys was lower than of the girls, measured at 66.60 and 69.42, respectively. Rates of overweight and obesity were comparable among the two groups with girls being slightly higher on both overweight and obesity measures. Among females, 39.66% met or exceeded a BMI percentile of 85 and 22.99% had BMI percentiles of 95 or higher. Among boys in the sample, 38.85% had BMIs at or above the 85th percentile and 22.17% had BMI percentiles that met the criteria for obesity.

Work hours for mothers residing with boys and girls were nearly identical with each group reporting weekly paid labor hours of 20.50 and 20.49 hours, respectively, which exceeded the overall sample mean of 19.00 weekly maternal work hours. Fathers

residing with daughters in the sample clocked slightly more hours than those with sons, with fathers of girls averaging 35.04 weekly work hours and fathers of the boys working 32.94 hours per week. These averages exceeded the sample mean of 31.17 weekly paternal work hours

The mean age of the sample of boys (14.63 years) was slightly higher than that of girls (14.43 years). A greater proportion of the female sample came from racial and ethnic minority backgrounds with 18.29% being Black and 23.70% being Hispanic. Among the male in the sample, 16.63% were Black and 22.63% were Hispanic.

The average birth weight of boys in the sampled (7.30 pounds) was slightly higher than that of the girls (7.25 pounds). The likelihood of being breastfed during infancy was higher for girls (62.17%) than for boys (61.24%). The total number of children residing in the households of girls in the sample was 2.37. The boys in the sample came from households averaging 2.24 children.

No uniform pattern of wages was observed among parents based on child gender. Mother of daughters earned \$10.52 per hour compared to \$9.86 earned by the mothers of sons. The fathers of the boys made slightly more money (\$20.56), however, than the fathers of the girls (\$20.33). Average family incomes were higher among the families with girls, at \$83,170 per year. The families of the boys reported annual incomes of \$79,080 on average. More girls received allowance than boys, 29.29% versus 24.65%. When boys received allowance, however, they received \$6.54 per week compared to \$6.28 received by girls per week.

The body mass indices for mothers of daughters were lower than that of mothers with sons. Mother of the girls sampled reported average BMIs of 26.98 kg/m², whereas

mothers of boys had average BMIs of 27.34 kg/m². The body mass index for fathers of daughter (27.52 kg/m²) was higher than that of fathers with sons (27.26 kg/m²).

The geographic distribution of the boys and girls in the sample was roughly equivalent with approximately 30-31% of each gender in either the Southern or Western portion of the United States. Approximately one-fifth of the boys sampled and one-fourth of the girls resided in the North Central states and 17.65% and 14.87% of boys and girls respectively lived in the Northeast.

To better understand parental role in child's health, and to sharpen the view of the issues and factors involved, we must control for important factors that influence the BMI percentile for children. The next section uses the multiple regression methodology to achieve this task and shed further light on the impact of parents' hours of work on the children weight (BMI percentile) issue.

Summary of Dietary Factors related to Parental Employment

Table 5 presents descriptive statistics for several key dietary factors related to childhood body mass outcomes that have been identified in the current literature. With the exception of high daily fast food consumption rates, the younger children in this sample report the healthiest dietary pattern overall. In terms of breakfast consumption by demographic group, children age 10-13 are most likely to consume breakfast daily (89.60%) followed by boys in the sample (75.08%), children age 14-19 (58.75%), and girls in the sample (21.91%). Among this sample, young children were more likely to consume fast food daily (26.31%) than older children (15.72%) and boys (23.80%) were more likely to regularly consume fast food than girls (14.88%).

Table 5. Dietary factors related to child body mass outcomes by age and sex for full sample (n=1425)

	10-13 (n=513)	14-19 (n=912)	Boys (n=706)	Girls (n=719)
Breakfast consumed daily	89.60%	58.75%	75.08%	21.93%
Fast food consumed daily	26.31%	15.72%	23.80%	14.88%
Family shares main meal daily	29.37%	20.83%	27.84%	19.63%
Child breastfed as infant	62.40%	53.65%	57.14%	56.29%
Allowance received	21.34%	23.21%	22.30%	22.80%

Rates of participation in family meal time were higher among younger children than among adolescents. Overall, 29.37% of young children and 20.83% of adolescents consumed their main meal with family each day. There is also a marked difference in family meal rates by child gender, with male children eating with their families 27.84% of the time and female children eating with their families 19.63% of the time.

Among the current sample girls (56.29%) and boys (57.14%) reported similar breastfeeding rates, whereas younger children (62.40%) reported much higher breastfeeding rates than older children (53.65%). The rate of allowance receipt among children in the sample was 21.34% among children age 10-13 and 23.21% among children age 14-19. Approximately 22% of both sexes received allowances.

Regression Models

A major objective of this study was to explore the impact of parental contributions to child body mass outcomes. Using the health production function as a model, the key input of interest is parental hours of paid workforce participation. The primarily outcome of interest is child health, measured inversely as child BMI percentile. It was hypothesized the longer hours worked outside the home would leave fewer hours for supervision and child-centered health promoting activities within the home. In addition to investigating the quantity of hours available for health inputs, the quality of parent-child interactions was also investigated in this study using a number of joint activities by which parents may influence the body mass outcomes of children. A total of fourteen parent-child activities were investigated, six of which involved sedentary behaviors, and eight of which involved active physical participation.

In order to investigate the impact of parental work hours on child health, BMI percentile scores were regressed on both maternal and paternal work hours, as well as a number of demographic and control variables. Given that the focus of this study is the role of parents in child health outcomes, only children who resided with their biological parents were included from our regression analyses.

Table 6 presents the results of a model that is used as the baseline for subsequent analyses. This table depicts the basic multiple regression of child BMI percentile on the log of maternal and paternal weekly work hours and other related variables. Because child BMI percentile may not have a purely monotonically increasing or decreasing relationship with parental hours of work, the square of the log of hours of work was also included in the regression model. A multiple regression with quadratic (squared) terms provides further richness and captures the underlying dynamics between child BMI percentile and parental hours. In particular, one would expect child BMI percentile to increase or decrease with parental hours of work before reaching an optimum point, at which it may reverse course. In other words, there is an optimum number of hours after which child BMI may increase or decrease as a mother or father decides to work more or fewer hours outside home.

The model also includes demographic and socioeconomic variables relevant to child BMI percentile outcomes. Thus, the model includes child age, child's gender, race, region of residence, parental BMI, parental wage, and family income. These variables control for a range of potential variations in the child's BMI. child BMI, which are not accounted for by either other transformations of the child's BMI to BMI percentile (using age and sex), or the parental related factors (e.g., hours of work).

Table 6 Regression Analysis Examining Predictors of Children's Percentile BMI

Predictor Variables	B [‡]	SE ¹	t -value
log maternal work hours [†]	9.93**	4.44	2.24
log maternal work hours ^{2†}	-1.18**	0.55	-2.14
log paternal work hours [†]	-8.28**	4.21	-1.97
log paternal work hours ^{2†}	0.92**	0.44	2.12
South	-3.82	3.69	-1.04
Black	5.66	4.32	1.31
Hispanic	5.13	3.61	1.42
Female	2.92	2.88	1.01
Child age	-0.43	0.65	-0.66
Birth weight	0.69	1.34	0.61
Hourly wage of mothers	-0.27**	1.36	-2.00
Hourly wage of fathers	-0.05	0.05	-1.10
Annual household income	0.00**	0.00	2.44
BMI of mothers	0.46**	0.19	2.39
BMI of fathers	0.89**	0.39	2.30
<i>n</i> = 542			
<i>R</i> ² = .10			

[†] : Replaced with their instrumental variables (IV).

[‡] : Coefficient estimates.

¹Standard Error; **Significant at 5%

Several of features of the reported estimated models in Table 6 and thereafter are worth mentioning. First, the inclusion of the demographic and socioeconomic variables reduces the potential for the misspecification of the underlying model. That is, the problem with the omitted variable issue, which could lead to the biased and inconsistent parameter estimates, are reduced. Second, the use of logarithmic values of hours of work for each parent allows for the hours of work to have varying degree of influence as each parent work more or fewer hours. Accordingly, using the coefficient estimates (e.g., β) on the hours of work (e.g., X), the change in the child BMI percentile because of a change in a parent's hour of work (also known as slope) is estimated by dividing β over X (i.e., β / X). Finally, because the hours of work (labor supply) of each parent are usually influenced by the same variables (socioeconomic, demographic, and institutional variables) that also influence the child BMI percentile, then one must be cautious of the potential endogeneity of the hours of work in the model. Leaving the endogeneity of hours of work untreated would cause for the parameter estimates to be statistically inconsistent. Hence, the log of the hours of work for each parent was replaced with their own instrument (predicted values from an auxiliary regression), which was obtained through the application of the Instrumental Variable Estimation Technique.¹

Table 6 shows that, consistent with main study hypotheses, both mothers and fathers weekly work hours had a significant impact on child percentile BMI outcomes

¹ Instruments used for obtaining the predicted log of hours of work for mothers included: the log of wife's hourly wage, the square of the log of wife's hourly wage, log of husband's work hours in 2006, log of total family income, number of children, wife's age, wife's schooling, wife's years of schooling, whether she is married, a single mother, Black, or Hispanic. Instruments used for obtaining the predicted log of hours of work for fathers included: the log of husband's hourly wage, the square of the log of husband's hourly wage, log of wife's work hours in 2006, log of total family income, number of children, whether he graduated from college, whether he is married, Black, or Hispanic.

among in the sample. This implies that previously reported statistical results by other authors could have suffered from misspecification (omitted variable) problem; thus, their estimates could have been biased and inconsistent. The finding that both parents (and not only mothers) decisions about the hours of work can significantly influence child BMI percentile fills the significant void in the current literature that mainly focus on mothers' role in children health.

Reported coefficient estimates in Table 6, however, reveal important complexities in the way parental decision about the hours of work influence children BMI percentile. In particular, it is interesting to note, that mothers' and fathers' decision about their hours of work lead to different outcome for the child's BMI percentile. In line with previous research it was observed that increasing weekly hours of maternal paid labor was positively correlated with child percentile BMI scores. That is, additional hours of maternal labor force participation were predictive of higher child body mass outcomes relative to the child's same age and same sex peers. The opposite relationship was observed for paternal weekly work hours. Increasing workforce participation among fathers was predictive of lower body mass percentiles among their biological children living at home. Thus, additional hours worked by fathers were associated with reduced BMI percentile scores.

Another significant predictor of child percentile BMI scores related to parental employment was mothers' hourly wage. A higher hourly wage among women was predictive of lower percentile BMI outcomes for their children. Annual family income was also found to have a small, but statistically significant positive effect on children's BMI percentile scores.

Table 7 presents the full regression model for this study. The R^2 value of this model is 0.15.² Thus, the specified parental employment variables and related parent-child activities, account for 15% of the variance observed in child health outcome, measured inversely as child percentile BMIs. R-square (R^2) is used to measure goodness-of-fit in the underlying model, and is obtained by comparing explained variation in the model to a naïve model that only includes an intercept. Two main sources of influence on the size of R^2 include the use of trended variables (e.g., time-series data), which manifest their impact in the intercept, producing an artificially inflated R^2 . Second, since R^2 compares the theoretical (explained or causal) model to a naïve model, unexplained variation in the naïve model could lead to low R^2 , though, this will not alter the usefulness of estimated coefficients for proper statistical inference.

Although general linear model assumptions do not specify requirements that R^2 exceed any particular value, given that this study did not involve the use of a time series data which may artificially inflate R^2 , the observed R^2 value of 0.15 for this model is assumed to be appropriately attributed to the parental employment variables and parent-child activities specified in the model (Woodbridge, 1999).

Of the hypothesized joint activities, only three parent-child activities had a significant impact on the pBMI outcomes of children in the sample. Joint participation in yard work was predictive of lower BMI percentiles among children ($p=.039$). Children who worked on building and repair projects with their parents also had significantly lower BMI percentiles. Finally, reading regularly with their parents was also predictive of lower BMI percentiles among children in the sample.

² Given the cross sectional nature of the dataset, an R^2 of 15% reflects good predictive power of the model relative to previously reported studies utilizing cross section data. One should note that, many similar studies do not report any goodness of fit (R^2) measure, thus rendering their analysis potentially suspect.

Table 7 Regression Analysis Including Activities Predicting Children's Percentile BMI

Predictor Variables	B _‡	SE ¹	t Value
log maternal work hours [†]	10.39**	4.64	2.24
log maternal work hours ^{2†}	-1.27**	0.58	-2.19
log paternal work hours [†]	-10.98**	4.42	-2.48
log paternal work hours ^{2†}	1.19***	0.46	2.57
South	-4.44	3.65	-1.22
Black	6.67	4.58	1.46
Hispanic	4.81	3.49	1.38
Female	1.86	2.99	0.62
Child age	-0.97	0.71	-1.37
Birth weight	0.62	1.10	0.57
Hourly wage of mothers	-0.30**	0.15	-2.02
Hourly wage of fathers	-0.08	0.06	-1.37
Annual household income	0.00***	0.00	2.60
BMI of mothers	0.50***	0.19	2.60
BMI of fathers	0.87**	0.40	2.16
Yard work	-10.01**	4.84	-2.07
Laundry	-0.73	3.62	-0.78
Dishes	0.72	3.19	0.23
Shopping	0.87	3.29	0.27
Building /Repairs	-6.27**	3.39	-1.85
Preparing food	4.17	3.47	1.20
Playing sports	2.41	3.36	0.71
Cleaning house	0.84	4.49	0.19
Video games	-1.91	3.93	-0.49
Talking	-4.70**	3.45	-1.36
Crafts	3.05	5.34	0.57
Reading	-7.66**	4.36	-1.76
Homework	-2.78	3.29	-0.84
Board games	2.99	4.49	0.67

¹Standard Error; **Significant at 5%; ***Significant at 1%;

$n = 542$

$R^2 = .15$

[†] : Replaced with their instrumental variables (IV).

[‡] : Coefficient estimates.

Table 8 presents the disaggregated effect parental employment on children's percentile BMI outcomes. Separate regressions were run for each of the fourteen parent-child behaviors to estimate the effect of parental employment on child percentile BMI by joint behavior. The estimations includes child age, gender, race, region of residence, parental BMI, parental wage, and annual family income as control variables, however, only the predicted log and the squared predicted log of parental work hours are presented.

Tables 9 and 10 present separate regression analyses based on child age. Previous research indicates that the mean age of entry into puberty is 12.70 years (Diaz, Laufer, & Breed, 2006), thus children in this sample were broken into two age categories representing an early or pre-pubertal group (children age 10-13) and also a post-pubertal group (children age 14-19). The regression analyses conducted for children age 10-13 and ages 14-19 had R² values of 0.15 and 0.10, respectively. Thus, each model had good predictive power given the cross sectional nature of the data.

Comparison of the regression analyses given in Table 9 and Table 10, indicates that the effect of maternal hours of weekly employment has a more significant impact on children age 10-13 than it does for children age 14-19. Conversely, hours of weekly paternal employment had a greater impact on children age 14-19 than for children age 10-13. For both age groups, paternal BMI was predictive of higher pBMI outcomes in children, however, maternal BMI was only a significant predictor of higher pBMI scores for children age 10-13.

It is interesting to note that the significant shared behaviors by which parents may influence child pBMI outcomes are different for children age 10-13 and children age 14-19 in the sample. Table 9 shows that for younger children, involvement in food

Table 8 The change in the effect of parental employment on child's pBMI by parent-child behavior

	log MHW [†] Estimate [‡] (t-value)	log PWH ^{2†} Estimate [‡] (t-value)	log PWH [†] Estimate [‡] (t-value)	log PWH ^{2†} Estimate [‡] (t-value)
Yard work	9.12** (2.08)	-1.10** (-2.03)	-9.23** (-2.27)	1.03** (2.39)
Laundry	9.77** (2.19)	-1.15** (-2.08)	-7.86** (-1.87)	0.87** (1.98)
Dishes	10.01** (2.24)	-1.20** (-2.15)	-8.52** (-2.00)	0.95** (2.14)
Shopping	10.03** (2.26)	-1.19** (-2.16)	-8.26* (-1.95)	0.92** (2.11)
Cooking	9.92** (2.23)	-1.18** (-2.13)	-8.26* (-1.95)	0.93** (2.10)
Playing sports	10.01** (2.25)	-1.19** (-2.15)	-8.49** (-2.01)	0.94** (2.15)
Building/Repairs	10.07** (2.27)	-1.20** (-2.19)	-8.80** (-2.08)	0.97** (2.22)
Cleaning house	10.07** (2.24)	-1.20** (-2.14)	-8.53** (-2.01)	0.95** (2.16)
Video games	9.87** (2.22)	-1.17** (-2.12)	-8.51** (-2.00)	0.96** (2.16)
Talking	10.49** (2.31)	-1.25** (-2.24)	-9.59** (-2.22)	1.06** (2.37)
Crafts	9.81** (2.20)	-1.17** (-2.12)	-8.32** (-1.98)	0.93** (2.13)
Reading	10.56** (2.32)	-1.27** (-2.25)	-9.23** (-2.19)	1.02** (2.32)
Homework	10.24** (2.30)	-1.22** (-2.22)	-8.93** (-2.13)	1.00** (2.29)
Board games	9.93** (2.24)	-1.19** (-2.15)	-8.36** (-1.98)	0.93** (2.13)

[†] : Replaced with their Instrumental variables (IV).

[‡] : Coefficient estimates

*Significant at 10%; **Significant at 5%

Table 9 Regression Analysis Including Activities Predicting Children's Percentile BMI for Child Age 10-13

Predictor Variables	B _‡	SE ¹	t Value
log maternal work hours [†]	10.99*	5.71	1.93
log maternal work hours ^{2†}	-1.26*	0.71	-1.77
log paternal work hours [†]	-3.35	4.26	-0.79
log paternal work hours ^{2†}	0.15	0.49	0.32
South	-1.38	3.90	-0.35
Black	5.28	5.00	0.15
Hispanic	2.69	4.42	1.19
Female	0.40	3.40	0.79
Birth weight	-0.24	1.21	0.33
Hourly wage of mothers	-0.30	0.17	-1.47
Hourly wage of fathers	-0.03	0.07	-0.48
Annual household income	0.00***	0.00	2.98
BMI of mothers	0.77***	0.26	3.01
BMI of fathers	0.87**	0.43	2.04
Yard work	-1.89	5.63	-0.34
Laundry	3.92	3.82	1.02
Dishes	1.03	3.89	0.27
Shopping	-0.21	4.07	-0.05
Building /Repairs	-2.56	4.18	-0.61
Preparing food	10.13***	3.55	2.85
Playing sports	-2.23	4.24	-0.53
Cleaning house	-4.89	4.31	-1.13
Video games	3.10	4.22	0.73
Talking	-9.99**	4.01	-2.49
Crafts	-4.96	4.65	-1.07
Reading	-2.38	4.34	-0.55
Homework	-0.19	3.56	-0.05
Board games	-1.59	4.54	-0.35

¹Standard Error; **Significant at 5%; ***Significant at 1%;

n = 512

*R*² = .15

† : Replaced with their instrumental variables (IV).

‡ : Coefficient estimates.

Table 10 Regression Analysis Including Activities Predicting Children's Percentile BMI for Children Aged 14-19

Predictor Variables	B _‡	SE ¹	t Value
log maternal work hours [†]	2.69	3.87	0.70
log maternal work hours ^{2†}	-0.34	0.48	-0.70
log paternal work hours [†]	-4.99*	2.61	-1.91
log paternal work hours ^{2†}	0.59**	0.29	2.01
South	-3.33	2.91	-1.15
Black	-1.08	3.23	-0.34
Hispanic	2.17	3.71	0.58
Female	0.69	2.51	0.28
Birth weight	1.91*	0.98	1.94
Hourly wage of mothers	-0.30**	0.13	-2.24
Hourly wage of fathers	-0.01	0.06	0.14
Annual household income	0.00	0.00	-0.04
BMI of mothers	0.17	0.18	0.96
BMI of fathers	0.80**	0.36	2.26
Yard work	-2.94	4.88	-0.60
Laundry	-7.06**	3.49	-2.02
Dishes	-4.25	3.66	-1.16
Shopping	9.61***	3.28	2.93
Building /Repairs	-4.60	3.52	-1.31
Preparing food	3.51	3.87	0.91
Playing sports	2.20	3.55	0.62
Cleaning house	5.86	4.03	1.45
Video games	-1.85	3.79	-0.49
Talking	2.69	3.15	0.85
Crafts	7.87	6.12	1.29
Reading	-0.41	4.65	-0.09
Homework	-4.95	3.80	-1.30
Board games	-3.83	4.77	-0.80

¹Standard Error; *Significant at 10%; **Significant at 5%; ***Significant at 1%;

n = 912

*R*² = .10

† : Replaced with their instrumental variables (IV).

‡ : Coefficient estimates.

preparation is predictive of higher pBMI outcomes, whereas talking with parents serves as a protective factor against elevated pBMI scores.

Table 10 indicates that for children age 14-19 the shared activities of washing and folding laundry with parents and shopping with parents significantly impacted child body mass outcomes. Joint participation in laundry related activities served as a protective factor against high pBMIs for adolescents in the sample, whereas participation in shopping activities with one's parents was predictive of higher body mass outcomes among children age 14-19 in the sample.

Thus, the overall results of regression analyses indicated that parental employment is significantly related to childhood obesity, with younger children being more susceptible to impact so of maternal labor, and older children more vulnerable to paternal employment influence on child weight. Relative to that of fathers' work hours, mothers' work was more likely to be associated with elevated percentile BMI scores in children. Maternal wage, but not paternal wage, showed a protective effect in terms of children's weight outcomes. Elevated BMIs among mothers of young children, and among fathers of children across the full age range of the sample were more likely to have children who were also overweight or obese.

According to general and age-specific regression analyses, numerous shared-parent child behaviors were found to impact child weight. Active behaviors such as yard work, or building and repair projects reduced obesity risk, as did regular reading and talking with children. Time spent joint on shopping and food preparation were found to increase the likelihood that children would develop BMI percentiles qualifying as obese.

CHAPTER V: DISCUSSION

Parental Work Hours

Consistent with previous studies investigating the relationship between maternal employment and childhood obesity (Anderson, Butcher, & Levine et al., 2003; Cawley & Liu, 2007; Fertig et al., 2009) this study finds that maternal paid labor hours are predictive of higher body mass percentiles in children. Considering that women continue to perform a disproportionate share of child-rearing duties within families (Bianchi et al., 2000; Coltrane, 2000), the household production model employed here indicates that increased maternal labor force participation, reduces overall parental input hours available for child health production, thus leading to increases in childhood obesity rates.

A unique contribution of this study is the finding of a significant association between paternal paid labor hours and child body mass. An interesting aspect of the observed relationship between paternal employment and child health is the fact that an increase in hours of paternal workforce participation reduced the likelihood of childhood overweight and obesity. Explanations for the differing impacts of maternal and paternal labor hours on child health may be related to the fact that mothers typically contribute a greater proportion of direct child health investments than fathers (Bianchi et al., 2000), perhaps due to lower opportunity costs related to household commodity production. Due to pervasive inequalities in wage rates, fathers may have a comparative advantage related to market earnings and will therefore be expected to supply a larger share of indirect child health inputs in terms of income and access to health care services.

Even when fathers are present in the home, gendered division of labor within families may marginalize fathers' participation in domestic activities directly related to

children's health (Gavanas, 2004). Overall, the relative impact of fathers' labor hours on children's health was not found to have the same detrimental effect on childhood obesity as did maternal paid labor outside the home, suggesting mothers may be more efficient than fathers in terms of direct child health production.

Parental Hourly Wage

A negative relationship was observed between the mean hourly wage of mothers and children's body mass outcomes, but no such significant association was observed between paternal hourly wage and child percentile BMI. The existence of a significant relationship for mothers', but not for fathers' wages is likely related to the fact that mothers provide a greater proportion of childcare and domestic labor than fathers (Bianchi et al., 2000; Coltrane, 2000). Given extant research indicating that maternal education is conducive to child health production (Becker, 1965; Grossman, 1972; Shehzad, 2006), the results of this study suggest that hourly wage in this case may serve as a proxy for maternal education. It may be that mothers with higher hourly wages have greater educational attainment, and may ostensibly make healthier decisions on behalf of their children related to food purchases and the encouragement of physical activity and other positive health behaviors.

Analysis of Parent-Child Activities

Of the fourteen joint parent-child activities investigated in this study, only three were found to have a significant impact on child weight among the full sample. The activities demonstrating a beneficial influence on children's pBMI included yard work,

building/repairing work, and reading together. Not surprisingly, regular participation in physically demanding tasks such as shared yard work tasks and building or repairing projects, was shown to be protective against increases in child body mass percentiles. According to basic physiological principles, both of these active behaviors were anticipated to increase energy expenditures and therefore reduce children's overall BMI percentile scores.

It is worth noting that among the full sample, reading with children also reduced children's BMI percentiles. Although reading together may not directly effect on metabolic expenditures, it nevertheless reduced children's risk of becoming obese. One plausible explanation for this finding is the importance of literacy skills in health outcomes. Maternal literacy, particularly in health related matters, have been shown to have a positive effect on child health outcomes (Shieh & Halstead, 2009). Parents who frequently read with their children are more likely to possess the health literacy skills needed to internalize and apply information conducive to child health production than are parents who engage in less frequent reading with their children.

The age-specific joint activities that emerged as significant predictors of child pBMI outcomes among children ages 10-13 included food preparation and talking with parents. Although food preparation may require some physical activity, food preparation was found to be predictive of higher child pBMIs. Given that this effect was observed among younger children but not older children in the sample, it is possible that the skill level required for food preparation by younger children may necessitate the input of more pre-cooked or frozen meals and convenience foods. These types of pre-prepared food

items are typically higher in fat and calories (Haines et al., 2007) and may contribute to increases in child weight.

A second joint activity that was significantly related to child weight outcomes for younger children in the sample was talking with one's parents. Although talking does not directly impact energy intake or expenditure, it was observed that frequently parent-child conversations had a protective effect against elevated pBMI scores among children ages 10-13. Possible reasons for this result include the fact that a secondary physical activity, such as walking, may have occurred concurrently with conversations between parents and children. It is also possible that information about positive health practices was communicated during the parent-child discussions. Indeed, previous research has indicated that parental involvement has a positive impact on numerous mental and physical health outcomes in children, and reduces behavioral problems as well (Garfield & Isacco, 2006; Goncy & van Dulmena, 2010). Thus, talking with parents may promote health knowledge and positive health behaviors related to children's diet and physical activity.

Among the adolescent children ages 14-19 in this sample, the shared behaviors of laundry and shopping were found to be related to child pBMI outcomes. Assistance with the washing and folding of laundry does require a low level of physical activity, and was found to be protective against increases in children's body mass percentile. Extant research also suggests that adolescents who are more concerned about weight and body image may also be more concerned with the style, brand, and appearance of their clothes, perhaps prompting them take a more active role in the laundering of clothing (Nichter, & Nichter, 1991; Nichter, & Vuckovic, 1994; Parker et al., 1996). Hence, adolescents who

are more conscientious about their physical appearance may be more inclined to diet, exercise, and take a greater interest in the upkeep of their clothes.

Shopping activities, which tend to be considerably more active than participation in laundry, were nevertheless found to be predictive of higher child BMI percentiles among adolescents. It is possible, depending on the duration of shopping activities, that the co-location and availability of fast food outlets may result in greater intake of convenience foods in conjunction with shopping activities. Given that shopping trips remove individuals from their homes, mall food courts, restaurants and fast food outlets are more likely to be utilized for meals. Research has indicated that caloric intake is higher when restaurant meals or fast food is consumed (Bowman, Gortmaker, Ebbeling et al., 2004; French, Story, Neumark-Sztainer, et al 2001). Concurrent purchasing of fast food during shopping activities was not addressed in the data, thus further research is need to specify whether additional activities affecting child weight are occurring during shopping.

Another shortcoming of the current data is that the type of shopping engaged in with parents is not specified. Clothes shopping may have a different impact on weight outcomes than grocery shopping, particularly if children or adolescents influence decisions about family food purchases in unhealthy ways. Additional research that allows for distinctions between shopping types, and that determines whether the shopping activity was accompanied by other activities such as fast food consumption would be useful in clarifying the observed relationship between shopping and increased childhood obesity risk.

Parental BMI

A positive association was observed for both maternal and paternal body mass indices and child weight. Though a genetic component may exist in the observed relationship between parent and child body mass outcomes, shared health behaviors in terms of dietary consumption and physical activity levels may contribute to observed familial patterns in overweight and obesity. Numerous studies have reported that children's dietary practices and physical activity levels are correlated to those of their parents (Gillman, 2003; McGuire et al., 2002; Moore et al., 1991). This finding is consistent with sociological and developmental research that indicates proximal processes, such as behaviors modeled by parents, exert considerable influence on child behavior (Bandura, 2004, Bronfenbrenner, 1994). For this reason, several parent and child activities were investigated in this study in an order to determine the shared health behaviors that may serve as risk and protective factors for childhood obesity.

Summary

This paper utilizes the Child Development Supplement of the PSID to investigate the role of mothers and fathers in producing health outcomes among children, measured inversely as child percentile BMI. In accordance with previous research, this study finds a positive relationship between maternal employment and childhood obesity, with younger children more susceptible to weight gains associated with maternal employment. Maternal wage was also found to have an effect on childhood obesity risk. Maternal hourly wage may serve as a proxy for educational attainment as it was observed that children of more highly paid mothers were less likely to be obese.

An important contribution of this study to existing research on maternal employment and childhood obesity is the consideration of the contributions of fathers in determining children's body mass outcomes. The analyses demonstrated that paternal employment is negatively associated with child body mass, particularly among adolescents, indicating that different patterns of contributions exist for mothers and fathers in terms of children's health outcomes.

In addition to investigating the impact of parental paid labor force participation, which presumably reduces the quantity of discretionary time available for parents to invest in child health production, the present study also investigated the quality of parent-child interactions in order to determine the behavioral processes by which parents may influence childhood obesity. This research identified a number of shared parent-child behaviors that either increased or decreased the likelihood that children would become obese. Among the full sample, three parent-child shared activities had a statistically significant impact on childhood obesity. Joint participation in yard work, working on building/repair projects, and regularly reading together were predictive of lower BMI percentiles among children. Frequent parent-child participation in yard work and building/repair projects increased physical activity and led to lower observed body mass outcomes among children. Reading together, which may serve as a proxy for parental health literacy skills, also translated into more favorable weight outcomes for children (Shieh & Halstead, 2009).

Age-specific patterns for parent-child behaviors influencing child weight were also explored. It was determined that for children age 10-13, involvement in food preparation was predictive of higher pBMI outcomes. This may be related to lower

levels of food preparation skill possessed by younger children resulting in greater reliance on convenience foods (Haines et al., 2007). Talking with parents served as a protective factor against elevated pBMI scores among children ages 10-13. This finding is consistent with previous research indicating that parental involvement is associated with a host of positive mental and physical health outcomes among children (Garfield & Isacco, 2006; Goncya & van Dulmena, 2010).

For children age 14-19 participation in washing and folding laundry with parents was predictive of lower pBMIs, potentially due to greater emphasis placed on image by adolescents concerned with body weight, appearance and self-image (Nichter, & Nichter, 1991; Nichter, & Vuckovic, 1994; Parker et al., 1996). Conversely, shopping with parents was associated with higher body mass among children age 14-19, and may have been related to increased consumption of convenience foods while out on long shopping trips or an influence exerted by teenagers on family food purchases (Bowman, Gortmaker, Ebbeling et al., 2004; French, Story, Neumark-Sztainer, et al 2001).

Finally, aside from work hours and shared parent-child behaviors, parents' own body mass served as a significant predictor of child weight. The diet and physical activities modeled by parents exert a strong influence on children's weight outcomes. The findings of the current study support previous research indicating that dietary practices, physical activity levels, and body mass outcomes of children strongly correlate with those of their parents (Gillman, 2003; McGuire et al., 2002; Moore et al., 1991). Overall, this study finds that both the nature and quantity of time spent with children affects child health outcomes, measured here in terms of children's BMI percentiles.

Limitations

An important limitation encountered in this research was a reduced sample size available for studying the joint role of parents in childhood obesity due to increased single parent families and lack of paternal involvement. A larger sample size would permit more age-specific analyses of childhood obesity. This could be useful given that BMI percentile outcomes are age-dependent. A high percentage of non-resident fathers had to be excluded from considerations of shared parent-child behaviors investigated in this study. Only 51.65% of children in the sample lived with both parents. For these children, joint parent-child behaviors for both parents were investigated to determine their relative role in developmental outcomes related to child body weight status. For the remainder of children in the sample, however, the influence of fathers' health-related behaviors on child weight outcomes is less clear. Additional research is needed to determine the effect of non-resident fathers on child body weight outcomes.

Furthermore, certain of the parent child behaviors could be more clearly specified in the data. Activities such as talking or playing video games may be accompanied by secondary activities that involve either physical activity or dietary consumption of snack food or meals. Also, the shared parent-child behavior of "shopping" is not clearly specified in terms of the type of shopping being performed. More explicit details on what each joint parent-child activity entailed would foster a clearer understanding of the nature and types of parental interactions with children which are most relevant in addressing growing rates of childhood obesity.

Conclusion and Recommendations

This study contributes to the body of extant research that addresses the role of maternal work hours on child body mass outcomes. Consistent with previous research (Anderson, Butcher, & Levine, 2003; Cawley and Liu, 2007; Fertig et al., 2009), maternal employment was found to be a risk factor for childhood obesity. The household production model asserts that decreases in overall parental contributions to child health associated with increased maternal labor force participation will impact child health, observed here as increases in childhood obesity. Household production models predict that this result would be more pronounced for young children who are more dependent on parents for basic dietary and health-related needs. In accordance with the study hypotheses it was observed that the effect of maternal employment on child weight was more pronounced for mothers with young children than for mothers of adolescents.

According to the household production model, the observation that employed mothers continue to fulfill a disproportionate amount of domestic and child-rearing duties within families (Bianchi et al., 2000; Coltrane, 2000) is perhaps not evidence of a “stalled revolution” (Hochschild & Machung, 1989), but rather represents an efficient allocation of household resources that maximize the production of child health. Given that maternal hours available for child health inputs yield more positive child health outcomes, mothers may have a comparative advantage over fathers in terms of child health production. Hence, greater health benefits for children in terms of maintaining a healthy weight may be realized at a lower total cost in hours when mothers produce a greater share of children’s health.

In addition to substantiating the observed significant positive relationship between maternal work hours and children's percentile BMI rankings (Anderson, Butcher, & Levine, 2003; Cawley and Liu, 2007; Fertig et al., 2009), this research adds new detail on the contributions of fathers' work hours to children's health outcomes. It was determined that hours spent in the labor force by fathers was not associated with increases in childhood obesity. On the contrary, additional labor force participation by fathers reduced the likelihood that children would develop elevated BMI percentiles and thus qualify as being overweight or obese. The present findings suggest child health production is not hindered by fathers' labor force participation to the same extent as that of mothers. Rather, fathers may have a comparative advantage in terms of producing indirect inputs that may be allocated to child health production, such as overall household income or access to health care benefits.

Numerous parent-child activities have also been presented here that serve as either risk or protective factors in cases of elevated rates of childhood overweight and obesity (Andersen & Butcher, 2006; Lin, Huang, & French, 2004; Wang & Beydoun, 2007; Sassi, Devaux, Cecchini, & Rusticelli, 2009). Several behaviors were identified in this study that may affect energy balance and help children maintain a healthy weight. Additional behaviors that fostered parental involvement and the potential transmission of health messages to children were also identified as protective factors against overweight and obesity. The observation that talking and reading with children reduced the likelihood of children becoming overweight or obese suggests that parents should be provided with educational tools designed to foster literacy and communication skills.

Overall, given the divergent impacts of maternal and paternal inputs on child health production, measured here inversely as child percentile BMI, national family policies should support the crucial roles that mothers and fathers play in child health production. Although the responsibility for child health is widely regarded as a feminine activity, socioeconomic changes in recent decades have led to an increase in father participation in domestic activities (Garfield & Isacco, 2006). The findings of this research indicate that fathers' household production input hours may not be as efficient as maternal time spent on child health production, perhaps due to family processes such as maternal gatekeeping, which actively exclude fathers from making consistent, effective contributions to child wellbeing (Allen & Hawkins, 1999). Fathers may also face a degree of external social stigma related to assuming more active roles in child health production (Gavanas, 2004).

Overall, fathers may benefit from social supports, training, and education resources focused on children's health issues, including nutrition, meal preparation, and the promoting of healthy physical activity among children. It is important that fathers' contributions within the home be validated and supported in order to more effectively utilize the increasing amounts of time they are expected to contribute to childrearing activities as mothers continue to steadily transition into full-time paid labor. Considering that unemployment associated with the current U.S. recession has disproportionately affected adult males, and that further expansion of the female labor force is anticipated, the role of fathers is expected to play an increasingly substantial role in household production related to child health.

Mothers, particularly those with young children, should be supported in ways that will allow for adequate investments in child health, while meeting the demands associated with increased labor force participation. Although fathers are contributing more time to domestic tasks than was observed in past decades, child health outcomes, as measured by increasing childhood obesity rates, have continued to worsen. The impact of the reduction of maternal hours dedicated to child health production has not been adequately compensated for at this point.

One possible remedy that has recently gained prominence in the national debate about family policy is the expansion of flex time work schedules. Flexible work schedules would support both mothers and fathers in balancing time constraints associated with labor market participation and child rearing, and have been shown to improve the overall well-being of household members (Hill, Hawkins, Ferris, & Weitzman, 2001). Given that both parents are increasingly engaged in full-time breadwinning roles, adjustments to current patterns of employment are advisable in order to provide both mothers and fathers with sufficient flexibility to meet occupational demands and provide adequate investments into the health of their children. Further research is needed to determine if, in addition to improving parents' perceived work-life balance, childhood obesity rates may be reduced by allowing for additional parental monitoring and encouragement of healthy dietary and physical activity choices during the after schools periods when most parents are currently occupied outside the home in paid labor activities.

Finally, as parental employment hours and labor force continue to increase, the role of third-party caregivers in childhood obesity outcomes should be examined further.

Given the large percentage of children who are raised in homes with a single working parent or dual earner families, the role of outsourced care on child health outcomes will be come increasingly meaningful. The role of childcare has not been adequately addressed by policy makers, despite the fact that increasing numbers of children are expected to participate in out-of-home care associated with high rates of parental employment (Story, Kaphingst, & French, 2006). Outside of school, many children may spend more waking hours in daycare than in any other setting, hence the prevailing dietary and physical activity practices of child care settings may play an increasingly important role in child health outcomes, Additional research is need to determine what effect day care may be having on children's dietary quality and physical activity levels. Effective support and training for care providers should also be developed in order to ensure that outsourced childcare serves as an effective support, rather than a hindrance, to parents in their efforts to raise healthy children while managing household resources wisely.

RECORD # _____



2 to 20 years: Girls
Body mass index-for-age percentiles

RECORD # _____

[illegible]

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Appendix C: Healthy People 2010 Nutrition and Overweight Objectives

Healthy People 2010—Summary of Objectives

Goal: Promote health and reduce chronic disease associated with diet and weight.

Number Objective Short Title

Weight Status and Growth

- | | |
|------|---|
| 19-1 | Increase the proportion of adults who are at a healthy weight |
| 19-2 | Reduce the proportion of adults who are obese |
| 19-3 | Reduce the proportion of children and adolescents who are overweight or obese |
| 19-4 | Reduce growth retardation among low-income children under age 5 years |

Food and Nutrient Consumption

- | | |
|-------|--|
| 19-5 | Increase the proportion of persons aged 2 years and older who consume at least two daily servings of fruit |
| 19-6 | Increase the proportion of persons aged 2 years and older who consume at least three daily servings of vegetables, with at least one-third being dark green or orange vegetables |
| 19-7 | Increase the proportion of persons aged 2 years and older who consume at least six daily servings of grain products, with at least three being whole grains |
| 19-8 | Increase the proportion of persons aged 2 years and older who consume less than 10 percent of calories from saturated fat. |
| 19-9 | Increase the proportion of persons aged 2 years and older who consume no more than 30 percent of calories from total fat. |
| 19-10 | Increase the proportion of persons aged 2 years and older who consume 2,400 mg or less of sodium daily |
| 19-11 | Increase the proportion of persons aged 2 years and older who meet dietary recommendations for calcium |

Iron Deficiency and Anemia

- | | |
|-------|---|
| 19-12 | Iron deficiency in young children and in females of childbearing age |
| 19-13 | Reduce anemia among low-income pregnant females in their third trimester. |
| 19-14 | (Developmental) Reduce iron deficiency among pregnant females |

Appendix C (continued): Healthy People 2010 Nutrition and Overweight Objectives

Schools, Worksites, and Nutrition Counseling

- 19-15 (Developmental) Increase the proportion of children and adolescents aged 6 to 19 years whose intake of meals and snacks at school contributes to good overall dietary quality
- 19-16 Increase the proportion of worksites that offer nutrition or weight management classes or counseling
- 19-17 Increase the proportion of physician office visits made by patients with a diagnosis of cardiovascular disease, diabetes, or hyperlipidemia that include counseling or education related to diet and nutrition

Food Security

- 19-18 Increase food security among U.S. households and in so doing reduce hunger

Appendix D: Healthy People 2020 Nutrition and Weight Status Draft Objectives

Proposed Healthy People 2020 Objectives

Objectives Retained As Is From Healthy People 2010

- NWS HP2020–1: Increase the proportion of adults who are at a healthy weight.
- NWS HP2020–2: Reduce the proportion of adults who are obese.
- NWS HP2020–3: Reduce iron deficiency among young children and females of childbearing age.
- NWS HP2020–4: Reduce iron deficiency among pregnant females.

Objectives Retained But Modified From Healthy People 2010

- NWS HP2020–5: Reduce the proportion of children and adolescents who are overweight or obese.
- NWS HP2020–6: Increase the contribution of fruits to the diets of the population aged 2 years and older.
- NWS HP2020–7: Increase the variety and contribution of vegetables to the diets of the population aged 2 years and older.
- NWS HP2020–8: Increase the contribution of whole grains to the diets of the population aged 2 years and older.
- NWS HP2020–9: Reduce consumption of saturated fat in the population aged 2 years and older.
- NWS HP2020–10: Reduce consumption of sodium in the population aged 2 years and older.
- NWS HP2020–11: Increase consumption of calcium in the population aged 2 years and older.
- NWS HP2020–12: (Developmental) Increase the proportion of worksites that offer nutrition or weight management classes or counseling.
- NWS HP2020–13: Increase the proportion of physician offices visits that include counseling or education related to nutrition or weight.
- NWS HP2020–14: Eliminate very low food security among children in U.S. households.

Appendix D (continued): Healthy People 2020 Nutrition and Weight Status Draft Objectives

Objectives New to Healthy People 2020

- NWS HP2020–15: (Developmental): Prevent inappropriate weight gain in youth and adults.
- NWS HP2020–16: Increase the proportion of primary care physicians who regularly measure the body mass index of their patients.
- NWS HP2020–17: Reduce consumption of calories from solid fats and added sugars in the population aged 2 years and older.
- NWS HP2020–18: Increase the number of States that have State-level policies that incentivize food retail outlets to provide foods that are encouraged by the Dietary Guidelines.
- NWS HP2020–19: Increase the number of States with nutrition standards for foods and beverages provided to preschool-aged children in childcare.
- NWS HP2020–20: Increase the percentage of schools that offer nutritious foods and beverages outside of school meals.

Objectives Archived From Healthy People 2010

Archived objectives are Healthy People 2010 objectives that are not included in the proposed set of Healthy People 2020 objectives for data, target or policy reasons.

- HP2010 19-4: Reduce growth retardation among low-income children under age 5 years.
- HP2010 19-9: Increase the proportion of persons aged 2 years and older who consume no more than 30 percent of calories from total fat.
- HP2010 19-13: Reduce anemia among low-income pregnant females in their third trimester.

Appendix E: Healthy People 2010 Physical Activity and Fitness Objectives

Healthy People 2010—Summary of Objectives

Goal: Improve health, fitness, and quality of life through daily physical activity.

Number Objective Short Title

Physical Activity in Adults

- 22-1 Reduce the proportion of adults who engage in no leisure-time physical activity
- 22-2 Increase the proportion of adults who engage regularly, preferably daily, in moderate physical activity for at least 30 minutes per day
- 22-3 Increase the proportion of adults who engage in vigorous physical activity that promotes the development and maintenance of cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion

Muscular Strength/Endurance and Flexibility

- 22-4 Increase the proportion of adults who perform physical activities that enhance and maintain muscular strength and endurance
- 22-5 Increase the proportion of adults who perform physical activities that enhance and maintain flexibility

Physical Activity in Children and Adolescents

- 22-6 Increase the proportion of adolescents who engage in moderate physical activity for at least 30 minutes on 5 or more of the previous 7 days
- 22-7 Increase the proportion of adolescents who engage in vigorous physical activity that promotes cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion
- 22-8 Increase the proportion of the Nation's public and private schools that require daily physical education for all students
- 22-9 Increase the proportion of adolescents who participate in daily school physical education.
- 22-10 Increase the proportion of adolescents who spend at least 50 percent of school physical education class time being physically active activity
- 22-11 the proportion of adolescents who view television 2 or fewer hours on a school day

Appendix E (continued): Healthy People 2010 Physical Activity and Fitness Objectives

Access

- | | |
|-------|---|
| | Developmental) Increase the proportion of the Nation's public and private schools that provide access to their physical activity spaces and facilities for all persons outside of normal school hours (that is, before and after the school day, on weekends, and during summer and other vacations). |
| 22-12 | |
| 22-13 | Increase the proportion of worksites offering employer-sponsored physical activity and fitness programs |
| 22-14 | Increase the proportion of trips made by walking |
| 22-15 | Increase the proportion of trips made by bicycling |

Appendix F: Healthy People 2020 Physical Activity and Fitness Draft Objectives

Proposed Healthy People 2020 Objectives

Objectives Retained As Is From Healthy People 2010

- PAF HP2020–1: Reduce the proportion of adults who engage in no leisure-time physical activity.
- PAF HP2020–2: Increase the proportion of the Nation’s public and private schools that require daily physical education for all students.
- PAF HP2020–3: Increase the proportion of adolescents who participate in daily school physical education.
- PAF HP2020–4: Increase the proportion of adolescents who spend at least 50 percent of school physical education class time being physically active.
- PAF HP2020–5: Increase the proportion of the Nation’s public and private schools that provide access to their physical activity spaces and facilities for all persons outside of normal school hours (that is, before and after the school day, on weekends, and during summer and other vacations).

Objectives Retained But Modified From Healthy People 2010

- PAF HP2020–6: Increase the proportion of adults that meet current Federal physical activity guidelines for aerobic physical activity and for muscle strength training.
- PAF HP2020–7: Increase the proportion of adolescents that meet current physical activity guidelines for aerobic physical activity and for muscle-strengthening activity.
- PAF HP2020–8: Increase the proportion of children and adolescents that meet guidelines for television viewing and computer use.
- PAF HP2020–9: (Developmental) Increase the proportion of employed adults who have access to and participate in employer-based exercise facilities and exercise programs.
- PAF HP2020–10: (Developmental) Increase the proportion of trips made by walking.
- PAF HP2020–11: (Developmental) Increase the proportion of trips made by bicycling.

Appendix F (continued): Healthy People 2020 Physical Activity and Fitness Draft Objectives

Objectives New to Healthy People 2020

PAF HP2020–12: Increase the proportion of States and school districts that require regularly scheduled elementary school recess.

PAF HP2020–13: Increase the proportion of school districts that require or recommend elementary school recess for an appropriate period of time.

Objectives Moved From Another Healthy People Topic Area

PAF HP2020–14: Increase the proportion of physician office visits for chronic health diseases or conditions that include counseling or education related to exercise.

Objectives Archived From Healthy People 2010

Archived objectives are Healthy People 2010 objectives that are not included in the proposed set of Healthy People 2020 objectives for data, target or policy reasons.

HP2010 22-5: Increase the proportion of adults who perform physical activities that enhance or maintain flexibility.

Appendix G. Weighted Means by Age and Sex for Full Sample (n=1425)

	10-13 (n=513)	14-19 (n=912)	Boys (n=706)	Girls (n=719)
Child BMI percentile ¹	68.91	66.97	66.28	69.10
Weekly hours worked by mother in 2006	19.56	18.69	19.96	17.98
Weekly hours worked by father in 2006	34.53	29.35	31.88	30.43
Age of child	12.37	15.72	14.64	14.44
Black	17.79%	24.07%	21.01%	22.76%
Hispanic	25.22%	16.98%	19.67%	20.10%
Female	50.54%	47.90%	0.00%	100.00%
Birth weight (pounds)	7.40	7.21	7.33	7.22
Breastfed	62.40%	53.65%	57.14%	56.29%
Number of children in household	2.48	1.77	2.06	1.98
Hourly wage of mother	\$10.00	\$8.91	\$9.51	\$9.06
Hourly wage of father	\$19.72	\$17.53	\$19.17	\$17.38
Annual family income in 2006 ('000)	\$72.44	\$78.20	\$77.59	\$74.68
Receives an allowance	21.34%	23.21%	22.30%	22.80%
Amount of allowance per week	\$3.28	\$6.40	\$5.72	\$4.86
BMI of mother	27.60	27.15	27.53	27.08
BMI of father	27.46	27.25	27.20	27.46
Northeast	11.91%	16.46%	16.65%	12.98%
North Central	21.00%	32.87%	19.78%	22.48%
South	33.38%	32.87%	35.08%	30.91%
West	33.71%	24.16%	28.48%	26.52%

¹ Percentiles based on 2000 CDC Growth Charts by gender and child's age in month

Appendix H. IRB Approval Form



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Date: November 10, 2009

To: Lisa Benson
Family Science

From: Joseph M. Smith, MA, CIM
IRB Manager
University of Maryland, College Park

Re: Request for Non-Human Subject IRB Form #09-NHS-0033

Title: Parental Role in Childhood Obesity: Evidences from the Panel Study of Income Dynamics (PSID)

The request for determination of Non-Human Subject Research for the above-cited project has been reviewed by the University of Maryland College Park Institutional Review Board. According to the information provided, it has been determined that this project does not meet one or both of the following definitions and therefore does not require further evaluation by the University of Maryland College Park Institutional Review Board.

§46.102 - (d) Research means a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge.

§46.103 - (f) Human subject means a living individual about whom an investigator (whether professional or student) conducting research obtains:

- (1) Data through intervention or interaction with the individual, or**
- (2) Identifiable private information.**

If the scope of your project changes and meets one of the above definitions, an IRB protocol must be created and submitted to the UMCP IRB for approval. For further clarification, questions or concerns please contact the IRB Office at 301-405-0678.

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