Published in final edited form as:

Soc Sci Med. 2013 October ; 95: 52–59. doi:10.1016/j.socscimed.2012.09.004.

Parental Employment and Children's Body Weight: Mothers, Others, and Mechanisms

Kathleen M. Ziol-Guest,
Cornell University

Rachel E. Dunifon, and
Cornell University

Ariel Kalil
University of Chicago

Abstract

A robust body of literature spanning several countries indicates a positive association between maternal employment and child body mass index (BMI). Fewer studies have examined the role of paternal employment. More importantly, little empirical work examines the mechanisms that might explain the relationships between parental employment and children's BMI. Our paper tests the relationship between the cumulative experience of maternal and spouse employment over a child's lifetime and that child's BMI, overweight, and obesity at age 13 or 14. We further examine several mechanisms that may explain these associations. We use data from the U.S. National Longitudinal Survey of Youth (NLSY79) merged mother-child file on cohorts of children who were born during a period of dramatic increase in both childhood obesity and maternal employment. We find that the number of hours that highly-educated mothers work over her child's lifetime is positively and statistically significantly associated with her child's BMI and risk of overweight at ages 13 or 14. The work hours of mothers' spouses and partners, on the other hand, are not significantly associated with these outcomes. Results suggest that, for children of highly-educated mothers, the association between maternal work hours and child BMI is partially mediated by television viewing time.

Keywords

Body mass index; child overweight/obesity; National Longitudinal Survey of Youth; mediators; parental employment; USA

Childhood obesity is a key public health concern. According to the Centers for Disease Control, 16.9% of U.S. children were obese in 2007–2008. Obesity among children has almost tripled since 1980, with the vast majority of the increase occurring between 1976 and 2000ⁱ (Ogden & Carroll, 2010). Childhood obesity is linked to a range of adverse outcomes

© 2012 Elsevier Ltd. All rights reserved.

Corresponding author: Kathleen M. Ziol-Guest, kmz7@cornell.edu.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ⁱData on trends in childhood obesity come from the National Health and Nutrition Examination Surveys (NHANES), which uses measured height and weight among U.S. children, and in which obesity is defined as having a Body Mass Index (BMI) at or above the 95th percentile of sex-specific BMI growth charts.

in childhood and adulthood. Among children, elevated Body Mass Index (BMI; a measure of weight-for-height) is associated with greater internalizing problems (Bradley et al., 2008), an increase in depression among girls (Needham & Crosnoe, 2005), and lower academic achievement (Crosnoe & Muller, 2004). Excess weight in childhood is a risk factor for excess weight in adulthood (Strauss, 1999), and the effects of obesity on chronic conditions have been found to be even larger than those of current or past smoking and problem drinking (Sturm, 2002). Finally, research suggests stigma against overweight individuals are commonplace, including in the workplace (Cawley, 2004), in the health care system, and in schools (reviewed in Puhl & Brownell, 2001).

At the same time that childhood obesity has increased in the U.S., so too have rates of maternal employment. In 2010, 50.1% of mothers of infants were employed, as were 63.9% of mothers with children under age 6 and 76.5% of those whose youngest child is aged 6–17 years old (Bureau of Labor Statistics, 2011). Interestingly, trends in maternal employment follow a similar pattern to those of childhood obesity, with a dramatic increase in maternal employment between 1976–1990 that subsequently leveled off. For example, in 1968 only 16.8% of new mothers were working 12 months after giving birth. This rate increased to 60.8% by 1990 but has remained level since that time (Johnson, 2008). In contrast, rates of paternal employment have remained above 90%, irrespective of the age of household children (Bureau of Labor Statistics, 2011).

The dramatic increase in childhood obesity in recent decades has spawned a burgeoning line of research seeking to understand the factors that may have caused such a change. Several possible social determinants of childhood obesity have been examined, from the built environment (Sallis et al., 2011), to food assistance programs (Ver Ploeg, 2011), to socioeconomic status (McLaren, 2011), or the availability of healthy food (Beydoun et al., 2008). For children, a key environment that may influence childhood obesity is the family. Parental employment represents an important aspect of family life that may be an important social determinant of childhood obesity.

Much work in this area focuses exclusively on maternal employment, and finds a positive association between maternal employment and children's BMI (summarized in Anderson, 2011). Our study contributes to this literature in several ways. First, we take a longer view of childhood than most studies by measuring employment starting in the year prior to birth and going through the end of his or her 13th or 14th year. Second, we consider the employment of mothers' partners (many of whom are fathers of the children we study). Third, we examine whether associations between parental employment and child BMI differ for by maternal education. Fourth, we estimate models designed to account for omitted variable bias. Finally, we test several theoretically-derived factors that may account for the associations between parental employment and child BMI. We do so using data from a cohort of children born during the periods that saw the most dramatic increases in both childhood obesity and maternal employment.

Parental Employment and Children's Body Mass Index

The association between maternal employment and child BMI has been widely reported in the economics, psychology, and sociology literatures. Anderson and colleagues (Anderson et al., 2003) were the first to examine such linkages, finding that, among families with 3–11 year-olds in the National Longitudinal Survey of Youth (NSLY), ten additional weekly hours of maternal employment over the child's life increases children's obesity by 1.0 to 1.5 percentage points. Since that time, several others have documented a positive relationship between additional maternal work hours and children's BMI or risk of overweight (Chia, 2008; Fertig et al, 2009; ; Morrissey, 2012; Morrissey et al., 2010; Phipps et al, 2006; Ruhm,

2008), and evidence suggests that the relationship between maternal employment and child BMI may be stronger among families with more advantaged mothers (Anderson et al., 2003; Fertig et al., 2009; Hawkins et al., 2008; Ruhm, 2008). Further, several studies have identified high intensity maternal work (e.g., full-time work) as particularly deleterious for children's BMI (Phipps et al., 2006; Ruhm, 2008; Scholder, 2008). Finally, as noted by Anderson (2011), research finding a link between maternal employment and childhood obesity is not limited to the U.S. Studies from Canada, Australia, the UK, Germany and the Netherlands have found similar associations as well.

In contrast, among the smaller number of studies that have also included spouse's or fathers' employment in predicting body weight during early adolescence (i.e., Hawkins et al., 2008; Morrissey, 2012; Phipps et al., 2006; Ruhm, 2008;), not only does the inclusion of spouse's work hours do little to change the association between maternal employment and children's body weight but fathers' work hours are not associated with children's body weight in such regressions. This may be due to the limited variation in fathers' work hours (Brown et al., 2010) or to gender-specific time allocation patterns within households in which mothers spend more time than fathers in the role of primary caregiver (Bianchi, 2000), thus making the relationship between employment and child development more salient for mothers.

Theoretical Perspectives and Linking Mechanisms

Several theoretical perspectives underlie potential linkages between parental employment and child BMI. Many studies linking parental employment and children's BMI control for family income (see, e.g., Anderson et al., 2003; Morrissey et al., 2010). Because employment involves a trade-off between time and money, such findings imply that the impact of parental employment on children's BMI relates to time use—either that of the parent, the child, or both. Parents' employment patterns may be associated with both the quality and quantity of children's time with parents, key ingredients in healthy development (Shonkoff & Phillips, 2000). Increased work involvement may impose a burden on parents' time, resulting in poorer supervision or care of children and less time available to provide emotional support or foster the child's involvement in activities. Time-diary data confirm that working reduces the time mothers spend with children, although research suggests that mothers protect quality time with children by cutting back least on activities directly engaging children (Bianchi, 2000; Sandberg & Hofferth, 2001).

Working mothers also spend less time in meal preparation and rely more heavily on fast foods or prepared foods, which generally are high in fat and calories, than do non-working mothers (Cawley & Liu, 2007; Crepinsek & Burstein, 2004; Ziol-Guest et al., 2006). Additionally, school-aged children of working mothers may be more likely to rely on school-provided meals, rather than bringing their lunch from home (Datar & Nicosia, 2010). This could be associated with obesity, as evidence shows that children who eat school meals are more likely to be obese than those who bring a lunch from home (Schanzenbach, 2009).

Parental employment may be associated with children spending less time getting physical exercise than do other children, perhaps because they have less active recreational time, given their greater participation in child care, lack of parental time available to drive children to sports or other physical activities, or because it is more common for working parents to drive their children to school en route to work (Anderson & Butcher, 2006). Cawley and Liu (2007) found that employed mothers spent less time playing with their children than those who do not work.

Children with working parents may spend more time watching TV (Crepinsek & Burstein, 2004), possibly because they are more often in self-care or in the care of someone who does not adequately supervise their TV consumption (Fertig et al., 2009). Brown and colleagues

(Brown et al., 2010) show that children of part-time working mothers watch less TV than those of full-time or non-working mothers, and Fertig and colleagues (Fertig et al., 2009) show that time spent watching TV partially accounts for the associations between maternal work hours and child BMI. There are several possible ways that television viewing time may affect weight (Dietz & Gortmaker, 1985). Television time may crowd out time spent in physical activity. Additionally, increased television watching has been linked to increased preference for and consumption of calorically-dense foods commonly advertised on television (e.g., snack foods or fast food; Weicha et al., 2006). Third, time in front of the television may be accompanied by snacking.

There is also reason to think that the associations between maternal employment and child BMI may differ by families' socio-economic status (SES). On one hand, more advantaged parents may be better able to purchase healthy inputs for their children to compensate for the time they lose by being at work—such as purchasing healthy prepared foods, hiring high quality child care, or enrolling their children in health-promoting activities. If this is the case, the linkages between parents' employment and child BMI would be concentrated among the disadvantaged. On the other hand, children may benefit more directly from the time they spend with more advantaged parents, and may suffer more when that time is reduced, compared to the children of less-advantaged mothers. This would be the case if higher SES parents were better able to promote child health through their knowledge and behaviors and if the reduction in their time available to do so leads to detriments in child health. The empirical findings in the existing literature are somewhat mixed on this point. Fertig et al. (2009) find that among higher educated mothers, employment increases child's BMI, while the opposite was true for children of less-educated mothers. Several related studies that rely on the data we use here (the National Longitudinal Survey of Youth) also find associations concentrated among higher-SES families (e.g., Anderson et al. 2003, Ruhm, 2008; but see Miller, 2011 for contradictory results).

Method

Sample

Data for this paper are drawn from the U.S. National Longitudinal Survey of Youth 1979 (NLSY79) and Children of the National Longitudinal Survey of Youth (CNLSY). The NLSY79 is a nationally representative sample of 12,686 youth (6,283 females and 6,403 males) aged fourteen to twenty-two years old in 1979 (Hispanic, Black, and low-income youth were oversampled). The primary research focus of the NLSY79 is labor force behavior, but a range of other important demographic and behavioral information is also collected. These youth were re-interviewed every year until 1994 and biennially since 1994. In 1986 a separate survey of the children of the original NLSY79 female respondents were interviewed (CNLSY). Child cognitive, socioemotional, and physiological assessments as well as a variety of attitude, aspiration, and psychological well-being questions have been administered for age appropriate children biennially. Ethics approval was not required for this study since we drew on a publically available dataset.

We merged the female respondents from the NLSY79 with their children, drawing a sample of 13 or 14 year-old children from the 1994–2008 survey waves, thus representing birth cohorts born between 1979 and 1995. These children represent a children born to women born between 1957 and 1964 and living in the US in 1979. Children born in the earliest years consist of children born to very young mothers. In our sample, the average child was born when his or her mother was 25. Because the children's surveys are conducted once every two years, we selected children who were either 13 or 14 at the time of the survey. After removing children for whom we had no outcome information (body mass index) or maternal and spouse employment information (independent variables of interest), 4,192

children remained. Using listwise deletion would reduce our sample to 3,473 children. Instead, we employed multiple imputation procedures for the missing data, using the MICE system of chained equations in STATA 11 SE. We created five imputed datasets each with 10 cycles of regression switching carried out between imputations. The sample requiring imputation was more likely to be non-white and have lower education and lower income than those not missing any data. Further, those in the imputed sample had higher body mass index, were more likely to be overweight or obese, and their mothers had lower average weekly work hours. Of the sample of 4,192 children, 83% had no missing data; and the majority of those who were missing any data were only missing information on one variable. Three percent of children (121) were missing two or more control variables. The most common missing variables requiring imputation were the child's birthweight (7% were missing) and household income (5% were missing).

Dependent Variables

We use three anthropometric outcomes to assess child health. The measure of adolescent

body mass index was calculated as: $\frac{(Weight)}{(Height)^2} \times 703$, where weight is measured in pounds and height is measured in inches. The first outcome measure is the **standardized z-score of BMI** which is a measure of the distance from the mean of children of the same age and gender set to standards established by the Centers for Disease Control (CDC) in 2000. Second, an indicator of **overweight** is defined as having a BMI greater than the 85th percentile for the child's age and gender. Finally, an indicator of **obese** is defined as a BMI greater than the 95th percentile for the child's age and gender, based on CDC protocols (Kuczmarski et al., 2002).

Independent Variables

Employment—Maternal employment information was taken from the weekly work history files, a week-by-week array spanning from January 1, 1978 through the current interview. Each week contains reports of the respondents' work status and the number of hours worked. Our analyses focus on the average hours per week worked over the child's lifetime, specifically, the average number of hours until the child is 12 (for those ages 13 at the measured outcome) or 13 (for those ages 14 at the measured outcome). Mothers who did not work at all in the child's life are provided a value of zero for the number of hours worked. Regression analyses used the linear measure of work hours over the child's lifetime, divided by 10 for ease of interpretability.

Unlike maternal employment, there is no weekly work history for her spouse; additionally, the mother, rather than the spouse himself reports his employment. As a result, spouse employment is measured differently than is maternal employment. We use two survey questions to create a lifetime measure of spouse weekly work hours for each child. In the survey years 1979–1994 and the even years 1996–2008 mothers report on the average number of hours worked by her spouse in the previous calendar year (so 1978–1993 and the odd years between 1995–2007). To determine the spouse average weekly work hours in the even years between 1994–2008 we use the mother's report of how many hours the spouse worked in the previous week. While some of the spouses are not the biological fathers of the children in the sample, 69% are (authors' calculations; among those mothers who report a spouse over the child's entire lifetime, 97% are the child's father).

Table 1 presents the distribution of maternal and spouse average weekly work hours among the sample. These figures highlight differences in the work patterns of mothers and spouses in the data, indicating that spouses are more likely to work full-time, whereas mothers are

more likely to work part-time. For example, most women work either 1–19 or 20–34 hours per week, while most spouses work 35 or more hours per week.

Control variables—A rich set of control variables representing child, maternal, and household characteristics are included in our analysis. We include only measures that are exogenous to parental employment patterns—that is, those that are likely not influenced by employment itself, but that may capture important aspects of the mother, spouse, child or family that might be associated with child health. Child characteristics include gender; age in months when body mass index was measured; birth order; and whether the child was normal birth weight, low birth weight (weighed less than 2,500 grams at birth), and very low birth weight (weighed less than 1,500 grams at birth). Maternal characteristics include race, the Armed Forces Qualifying Test (AFQT; a measure of aptitude) taken in 1980, education (less than high school, high school graduate, some college, college graduate or more) at the time the child's body mass index was measured, marital status in the year of the child's birth (the prenatal or postnatal year was used if the birth year was unavailable), and the mother's own body mass index measured in 1981 (prior to the birth of the child in almost all cases). We further include a control that represents the proportion of the child's life that the mother reported a spouse in the household (and therefore the proportion of years for which we have spouse employment information). Finally, a log of the three-year average (prenatal, birth year, postnatal year) of household income is included to capture economic resources around the time of the child's birth but not reflect resources that are endogenous to employment. All analysis also includes dummy variables for the child's birth year and month in order to control for cohort or seasonal patterns in child BMI.

Mechanisms

Guided by the theoretical perspectives discussed above, we test several potential mechanisms that may explain the relationship between employment and child BMI. Each of our proposed mechanisms are measured when the child was 13 or 14 (when BMI was measured). Several variables gauge maternal supervision and time spent with the child: child and mother report of whether or not the mother knows who the child is with when they are not together the number of activities the mother participates with the child (play/sports, going out to eat, and activities around the house), and the number of household chores the child takes responsibility for in the home.

The NLSY79 does not provide information on the composition of children's diets including fast food consumption, but rather includes a question regarding how often the child eats meals with parents. We created a measure of eating with the parents frequently, defined as four or more times per week. We use two measures to examine the role of television watching, specifically whether or not the child reports that there are rules about TV watching in the home and the average number of daily hours the child reports watching television (averaged between weekday and weekend watching). Finally, though the NLSY79 does not include specific measures of exercise for children, we created a measure for whether the child participates in school or after-school sports.

Regression Analysis

Ordinary least squares (OLS) regressions were estimated for analyses looking at BMI z-scores, and logistic regressions were estimated when predicting overweight and obesity status. The MI ESTIMATE command in STATA 11 SE was used to run the OLS and logistic regressions.

We used average weekly work hours of the mother and her spouse over the child's entire lifetime (up to the 12th year for 13 year-olds and the 13th year for 14 year-olds) to predict child BMI, overweight, and obesity. Specifically, we estimated the following:

$$Y_i = \alpha + \beta H_{iL} + \gamma S H_{iL} + \varphi X_i + \lambda A_i + \sigma M_i + \varepsilon_i$$

where Y_i represents child i 's anthropometric outcome at either age 13 or 14, H_{iL} is the average number of maternal weekly work hours (in 10-hour units) for child i over the lifetime (L), $S H_{iL}$ is the average number of spouse weekly work hours (in 10-hour units) for child i over the lifetime (L), X_i is a vector of control variables for child i , A_i is a vector of dummy variables for the year of the child's birth, M_i is a vector of dummy variables for the month of the child's birth, and ε_i is the error term. We also perform these same analyses separately on two sub-samples of children; those whose mothers have a high school education or less (less-educated mothers) and those with at least some college (highly-educated mothers).

As in Scholder (2008), our analyses explicitly exclude the child's lagged BMI (or overweight or obese) status, because our main interest is in obtaining estimates for the cumulative association of parental employment. We also do not specifically look at when or at what age the child becomes overweight or obese; instead, we are interested in the total effect of employment on the child's anthropomorphic status at age 13 or 14.

An important concern in these types of analyses is omitted variable bias, in which parents with certain employment experiences differ from each other in unobservable ways that are also correlated with child BMI. To address this issue, we conduct sibling difference models, which capitalize on within-family variation in parental employment across siblings in various periods of childhood. Such models use sibling differences in parental employment to predict sibling differences in BMI. By examining differences between siblings, such models control for any parent- or family-specific characteristics (including unobservable factors) that are constant across siblings. Such an analysis requires that the siblings differ in their exposure to parental employment. Such variation is present in our data. Only five percent of the siblings in our sample have identical exposure to the average hours their mothers worked across their lifetimes. Across their lifetimes, on average siblings differed in their exposure to weekly maternal work hours by 4.8 hours per week and exposure to weekly maternal spouse work hours by 4.4 hours per week. Additionally, there is wide variation in the siblings' body mass index such that, on average, siblings differ by one standard deviation (1.20 BMI z-score). Due to sample size concerns when examining more detailed work hours categories and the dichotomous outcomes of obesity and overweight, the sibling fixed effects models only examine child BMI.

Finally, our analysis will test several theorized mechanisms linking parental employment and child BMI, following Baron and Kenny (1986). Specifically, we will test three pathways. Pathway A will examine whether maternal and spouse hours are significantly associated with the mediator. If pathway A is supported, we will test pathway B that will estimate the relationship between the child's BMI and the mediator. Should we find support for pathway B as well, we will test the full model which regresses child BMI on both the mediator and maternal and spouse work hours.

Results

Table 2 presents the descriptive statistics of the study variables including the health outcomes, employment measures, and controls for the total sample ($n=4,192$). Over one-

third (35.9%) of the children are overweight at age 13/14, and nearly one-fifth (18%) are obese, figures that compare to the national average. On average, mothers worked almost 20 hours per week over the child's life; and spouses worked on average 39 hours per week.

On average, the children in the sample are the second born and were of normal birth weight. Mothers were on average age 25 at the time of the child's birth, and the majority had a high school diploma or more and was married around the child's birth. Mothers reported having no spouse for 28% of the child's lifetime (9% of the sample never had a spouse present and an additional 41% had a spouse present over the entire lifetime).

Lifetime maternal and spouse employment

Table 3 presents the findings from three regressions (one for each outcome--the BMI z-score, overweight, and obese). Results show that mothers' weekly work hours measured over the child's lifetime is associated with significantly higher standardized BMI scores, and increased likelihood of overweight and obesity at ages 13 or 14. More specifically, a ten hour increase in weekly work hours on average over the child's life is associated with .04 standard deviation increase in BMI, a 1.09 odds increase (approximately equivalent to 1.9 percentage points) in the likelihood of overweight, and a 1.10 odds increase (approximately equivalent to 1.2 percentage points) in the likelihood of obesity. Spousal employment is not significantly associated with children's BMI, and in all three cases, the coefficient on spouse work hours is statistically different from the coefficient on maternal work hours. Closer examination of the developmental timing of maternal employment suggests that employment when the child is between ages six and 10 is particularly detrimental specifically with respect to obesity (see online Appendix Table 1).

Maternal education sub-groups

Table 4 presents regressions separately for those children whose mothers are less-educated (high school diploma or less) and more-educated (at least some college). Findings echo those presented in Table 3, in which linear maternal work hours over the child's lifetime are associated with higher standardized BMI and a significantly higher likelihood of being overweight at adolescence, but here we see that this is only the case for children with more educated mothers. For neither group is parental work associated with the likelihood of obesity. Analysis of the timing of maternal employment indicates that among high-educated mothers employment when the child is between ages six and 10 are associated with higher BMI, overweight, and obesity (see online Appendix Table 2).

Family fixed effects models

Table 5 presents results from a series of family fixed effects regression models. Due to sample size problems with estimating fixed effects models on dichotomous outcomes (which require both variation in the independent variable and dependent variable, such that one sibling needs to be overweight while the other is not) we focus only on the standardized BMI regressions here.

Findings in the full sample suggest that the coefficient linking lifetime average weekly work hours for mothers and standardized BMI is the same size as the coefficient in the original regression presented in Table 3, but the estimate is much less precise. Further, among high-educated mothers, the coefficient is larger in size compared to the OLS estimate (Table 4), but also imprecisely estimated. Examination of the timing of maternal employment, again suggests that these effects are concentrated between the ages of six and 10 among higher-educated mothers (see online Appendix Table 3). Taken together, then, the pattern and magnitude of results from the sibling fixed-effects models help to support our previous findings suggesting that maternal employment, and not spouse employment, particularly

among high-educated mothers, is associated with higher standardized BMI in adolescence. However, the fact that the results in the sibling model are not significant leads to some caution in interpreting these results. We lack precision in the estimates, likely due to the small sample size who have siblings in the analysis (2,914 siblings from 1,247 mothers), particularly when splitting the samples by maternal education. Additionally, sibling fixed effects models do not hold child-specific attributes (uncorrelated with the maternal fixed-effect) constant which could result in bias larger than the OLS estimates if these unobserved differences across children are a key determinant of sibling variations in maternal labor supply (Ruhm, 2008).

Mechanisms

Table 6 presents coefficients from the mediation tests for four of the potential mechanisms. These analyses were conducted for the high-educated mother sample, for whom we observed significant associations between employment and BMI. We further only present results for analyses in which parental employment was shown to be linked to the potential mediator. Maternal and spousal work hours were not associated with the potential mediators of maternal monitoring (child report), activities with parents, chores, and participation in sports. Thus, there is no evidence for a mediational role for any of these measures.

In contrast, findings suggest that greater maternal work hours are associated with lower levels of monitoring as reported by mothers, fewer child rules about watching television, and higher reported hours of television watched by children. Additionally, greater spouse work hours are associated with less frequent family meals. However, monitoring, eating meals together frequently, and rules about watching television are not significantly associated with child BMI, thus precluding them as potential mediators.

Thus, the only remaining candidate as a potential mediator is the child's hours of television viewing, which is positively and significantly associated with the child's BMI. We find that the average number of hours of television the child watches partially mediates the relationship between maternal work hours and child BMI, accounting for 6% of the total relationship.

Sensitivity tests

We estimated several models to examine if our findings were robust to various sample selection criteria. First, we ran the standardized BMI regressions on a sub-sample of children whose mothers were married at each survey wave across the child's life, as well as those children whose mothers were married at all during the child's lifetime. Findings mirror the findings shown in Tables 3 and 4. Second, we tested for non-linearity in maternal and spouse employment using a quadratic specification of hours worked per week which tests whether or not the impact of working intensively is non-linear. These findings replicate those found in the main analysis, namely that maternal employment is associated with increased standardized BMI but spouse employment is not. The results also indicated that the squared term was small, negative, and significant at trend level ($p = .082$). Taking the two coefficients together, the relationship for maternal work hours is concave such that additional maternal work hours increase BMI, with the apex of the curve at about 30 hours per week.

Discussion

The present study was designed to investigate the linkages between maternal and spouse employment over the course of the child's lifetime and the child's BMI and risk of overweight and obesity in adolescence. We did so in a sample uniquely suited to this

purpose by virtue of its being large, nationally-representative, and providing exceptionally high-quality measures of both maternal employment and children's BMI. We also tested for factors that might account for the associations between parental employment and child BMI.

Our results both replicate and add to what is known about this question. We find, first, that the number of hours that mothers work over her child's lifetime are positively and statistically significantly associated with her child's BMI and risk of overweight and obesity at ages 13 or 14. These findings are comparable to Anderson et al. (2003) who used the same data and adopted a similar approach but focused on child overweight as an outcome and only examined maternal employment when children were between the ages of 3 and 11. Nevertheless, our point estimates are similar, with Anderson et al finding that an additional 10 hours per week of work over a child's life causes about a 1 to 1.5 percentage point increase in the probability that her child is overweight and our estimates showing that an additional 10 hours per week of work over a child's life increases the risk of overweight in adolescence by 1.9 percentage points.

Our findings are also comparable to Ruhm (2008), who also used data from the NLSY and examined children's body weight at ages 10–11. Ruhm (2008) found that an extra 20 hours of weekly employment is predicted to raise obesity and overweight risk by 1.6 and 3.0 percentage points, respectively, whereas our respective figures for a 10-hour increase in weekly work hours are 1.2 and 1.9 percentage points. The fact that our estimates for the impact of 10 extra hours of weekly employment are more than half the size of Ruhm's 20-hour impact and are also somewhat larger than Anderson's estimates could suggest that the teenage years are a sensitive period for body weight in relation to maternal employment.

Our findings are also comparable to Anderson et al. (2003) and Ruhm (2008) in showing that these associations are more apparent among children of highly-educated mothers. A plausible interpretation of these findings is that time constraints may be the key mechanism underlying these associations, suggesting that time taken from higher SES mothers may be more likely than that taken from low SES mothers to be time that would have been spent preparing home-cooked meals, engaged in or supervising active play, or other health-promoting activities.

Similar to other studies (eg. Miller, 2011) we also find that spouse employment is not significantly associated with any of our anthropometric measures. This may reinforce the findings from time use studies that mothers, even when they are employed outside the home, assume greater responsibility for child care and home management than do fathers (Bianchi, 2000). Time use studies also show that unemployed fathers in general do not substitute time in home production for time not working (Burda & Hamermesh, 2009). Consequently, the tradeoffs between time in the labor market and in child care or home production may be more relevant for mothers.

One of the unique features of our analysis was its inspection of a wide range of possible mechanisms that could link maternal employment for children of advantaged mothers to their higher body weight. We find some support for the role of television viewing in explaining the relationship between maternal employment and children's BMI for the high-educated mothers. Here, our results are strikingly similar to Fertig et al. (2009), who used data from the Panel Study of Income Dynamics' Child Development Supplement to show that among higher educated mothers, employment increases time children spent watching television, which in turn increases the child's BMI. However, in our study this mediator explains less than 10% of the relationship between maternal employment and children's BMI, suggesting that the vast majority of this association remains unexplained.

It should be noted that our potential mechanisms are measured at the same point as the child's BMI, rather than over the child's lifetime, and therefore may underestimate the role that these factors truly play in linking parental employment and child BMI. Other factors, such as actual nutritional intake, may also be more relevant but such data are not widely available. Indeed, one recent study notes that family food environments are less healthy when mothers (but not fathers) are employed (Bauer et al., in press). It is also possible that the linking mechanisms revolve around other measures of physiological and health functioning, such as sleep. For instance, maternal employment has been shown to curtail children's sleep (Kalil et al., 2012) and sleep is emerging as a key factor in regulating body weight. Unfortunately, such data are lacking in the NLSY. Additionally, we have solely focused on mediators present in the home environment, but other important factors that could be explored include the school environment and the availability of healthy food choices in the neighborhood. In sum, despite our best efforts to examine a wider range of mechanisms than has been done in prior studies, we were not able to identify any single factor that plays a major mediating role. A continued focus on identifying the mechanisms thus remains an important goal for future research.

This study contains important limitations. We are not able to determine a causal relationship between maternal employment patterns and BMI. It is possible that unobservable characteristics of mothers and/or children differentiate mothers with certain employment patterns. Our sibling fixed effects analyses help to address this problem, but the lack of precision that plagues these types of models in general was a problem here as well. Additionally, reverse-causality is a concern—mothers may adjust their employment behavior in response to child health. Our inclusion of important covariates, such as maternal AFQT scores and child birthweight, can help alleviate, but not eliminate, these concerns.

Despite these limitations, our study informs research in this area by highlighting the importance of maternal employment for children's health (especially for children of advantaged mothers), underscoring adolescence as a potentially sensitive period for this association, and identifying at least one factor that may account for a portion of these associations.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Support for this work was provided by grant R01 HD057952 from the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD) to the second and third authors.

References

- Anderson, P. Maternal employment. In: Cawley, J., editor. *The Oxford Handbook of the Social Science of Obesity*. Oxford, UK: Oxford University Press; 2011.
- Anderson P, Butcher K. Child obesity: Trends and potential causes. *Future of Children*. 2006; 16:19–45. [PubMed: 16532657]
- Anderson P, Butcher K, Levine P. Maternal employment and overweight children. *Journal of Health Economics*. 2003; 22:477–504. [PubMed: 12683963]
- Baron RM, Kenny DA. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic and statistical considerations. *Journal of Personality and Social Psychology*. 1986; 51:1173–1182. [PubMed: 3806354]
- Bauer KW, Hearst MO, Escoto K, Berge JM, Neumark-Sztainer D. Parental employment and work-family stress: Associations with family food environments. *Social Science & Medicine*. In press.

- Beydoun MA, Powell L, Wang Y. The association of fast food, fruit and vegetable prices with dietary intakes among US adults: Is there modification by family income? *Social Science & Medicine*. 2008; 66(11):2218–2229. [PubMed: 18313824]
- Bianchi S. Maternal employment and time with children: Dramatic change or surprising continuity? *Demography*. 2000; 37:401–414. [PubMed: 11086567]
- Bianchi SM, Milkie MA, Sayer LC, Robinson JP. Is anyone doing the house- work? Trends in the gender division of household labor. *Social Forces*. 2000; 79:191–228.
- Bradley R, Houts R, Nader P, O'Brien M, Belsky J, Crosnoe R. Body mass index and its relation to internalizing and externalizing problems from infancy through middle childhood. *Journal of Pediatrics*. 2008; 5:629–634. [PubMed: 18639889]
- Brown JE, Broom DH, Nicholson JM, Bittman M. Do working mothers raise couch potato kids? Maternal employment and children's lifestyle behaviours and weight in early childhood. *Social Science & Medicine*. 2010; 11:1816–1824. [PubMed: 20299142]
- Bureau of Labor Statistics. Employment characteristics of families in 2010. Washington DC: United States Department of Labor; 2011.
- Burda, MC.; Hamermesh, DS. Unemployment, market work and household production. 2009. Institute for the Study of Labor (IZA) Discussion Paper No. 3955
- Cawley J. The impact of obesity on wages. *Journal of Human Resources*. 2004; 39(2):451–474.
- Cawley J, Liu F. Maternal employment and childhood obesity: A search for mechanisms in time use data. NBER working paper 13600. 2007
- Chia Y. Maternal labour supply and childhood obesity in Canada: Evidence from the NLSCY. *Canadian Journal of Economics*. 2008; 41:217–244.
- Crepinsek, MK.; Burstein, NR. Maternal employment and children's nutrition: Vol II Other nutrition-related outcomes (E-FAN-04-006-2). Washington, DC: Economic Research Service, U.S. Department of Agriculture; 2004.
- Crosnoe R, Muller C. Body mass index, academic achievement and school context: Examining the educational experiences of adolescents at risk of obesity. *Journal of Health and Social Behavior*. 2004; 45:393–407. [PubMed: 15869112]
- Datar, A.; Nicosia, N. Outsourcing meals: Effects of maternal employment on children's school meal participation. Paper presented at the annual conference of the Population Association of America; 2010.
- Dietz WH, Gortmaker SL. Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. *Pediatrics*. 1985; 75:807–812. [PubMed: 3873060]
- Fertig A, Glomm G, Tchernis R. The connection between maternal employment and childhood obesity: Inspecting the mechanisms. *Review of Economics of the Household*. 2009; 7:227–255.
- Hawkins S, Cole T, Law C. Maternal employment and early childhood overweight: findings from the UK Millennium Cohort Study. *International Journal of Obesity*. 2008; 32:30–38. [PubMed: 17637703]
- Johnson, JO. Who's minding the kids? Child care arrangements: Winter 2002. Washington, DC: U.S. Department of Commerce, U.S. Census Bureau; 2005.
- Johnson, T. Maternity Leave and Employment Patterns of First-Time Mothers: 1961–2003. 2008. Available online at: <http://www.census.gov/prod/2008pubs/p70-113.pdf>
- Kalil A, Dunifon R, Crosby D, Su J. Maternal work hours, work schedules, and sleep duration among mothers and their young children. Mimeo. 2012
- Kuczmarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, et al. 2000 CDC growth charts for the United States: Methods and development. *Vital Health Statistics*. 2002; 11:1–190. [PubMed: 12043359]
- McLaren, L. Socioeconomic Status and Obesity. In: Cawley, J., editor. *The Oxford Handbook of the Social Science of Obesity*. Oxford, UK: Oxford University Press; 2011.
- Miller DP. Maternal work and child overweight and obesity: The importance of timing. *Journal of Family & Economic Issues*. 2011; 32:204–218.
- Morrissey TW. Trajectories of growth in body mass index across childhood: Associations with maternal and paternal employment. Working paper. 2012

- Morrissey TW, Dunifon RE, Kalil A. Maternal employment, work schedules, and children's body mass index. *Child Development*. 2010; 82:66–81. [PubMed: 21291429]
- Needham B, Crosnoe R. Overweight status and depressive symptoms during adolescence. *Journal of Adolescent Health*. 2005; 36:48–55. [PubMed: 15661596]
- Ogden, C.; Carroll, M. Prevalence of Obesity Among Children and Adolescence: United States, Trends 1963–1965 Through 2007–2008. 2010. Available online at: http://www.cdc.gov/nchs/data/hestat/obesity_child_07_08/obesity_child_07_08.pdf
- Phipps S, Lethbridge L, Burton P. Long-run consequences of parental paid work hours for child overweight status in Canada. *Social Science and Medicine*. 2006; 62:977–986. [PubMed: 16099085]
- Puhl R, Brownell K. Bias, discrimination and obesity. *Obesity Research*. 2001; 9:788–805. [PubMed: 11743063]
- Ruhm C. Maternal employment and adolescent development. *Labour Economics*. 2008; 15:958–983. [PubMed: 19830269]
- Sallis, JF.; Adams, MA.; Ding, D. Physical activity and the built environment. In: Cawley, J., editor. *The Oxford handbook of the social science of obesity*. Oxford, UK: Oxford University Press; 2011.
- Sandberg JF, Hofferth S. Changes in children's time with Parents, United States, 1981–1997. *Demography*. 2001; 38:423–436. [PubMed: 11523269]
- Schanzenbach DW. Do school lunches contribute to childhood obesity? *Journal of Human Resources*. 2009; 44:684–709.
- Scholder, SvHK. Maternal employment and child overweight: Does timing matter? *Health Economics*. 2008; 8:889–906.
- Shonkoff, J.; Phillips, D., editors. *From neurons to neighborhoods: The science of early childhood development*. Washington, DC: National Academy Press; 2000.
- Strauss RS. Childhood obesity. *Current Problems in Pediatrics*. 1999; 29:1–29. [PubMed: 9919427]
- Sturm R. The effects of obesity, smoking, and drinking on medical problems and costs. *Health Affairs*. 2002; 21:245–253. [PubMed: 11900166]
- Ver Ploeg, M. Food Deserts and Obesity. In: Cawley, J., editor. *The Oxford Handbook of the Social Science of Obesity*. Oxford, UK: Oxford University Press; 2011.
- Weicha JL, Peterson KE, Ludwig DS, Kim J, Sobol A, Gortmaker SL. When children eat what they watch: The impact of television viewing on dietary intake in youth. *Archives of Pediatric and Adolescent Medicine*. 2006; 160:436–442.
- Ziol-Guest KM, DeLeire T, Kalil A. The allocation of food expenditure in married and single-parent families. *Journal of Consumer Affairs*. 2006; 40:347–371.

Highlights

- The number of maternal work hours during her child's life are associated with higher BMI and overweight risk at ages 13 or 14
- These positive associations are more apparent among children of highly-educated mothers
- For children of highly-educated mothers, the association between maternal work hours and child BMI is partially mediated by television viewing time

Table 1

Distribution of Maternal and Spouse Average Weekly Work Hours

	No spouse	0 Hours	1–34 Hours	35–44 Hours	45+ Hours
<u>Maternal Work Hours</u>					
0 Hours	0.69%	0.26%	0.64%	1.46%	1.19%
1–19 Hours	5.01%	0.57%	3.91%	20.61%	15.20%
20–34 Hours	2.46%	0.10%	2.39%	18.58%	33.90%
35+ Hours	1.10%	0.05%	0.76%	9.59%	5.06%

Table 2

Descriptive Statistics of Study Variables (n=4,192)

	<u>Mean or %</u>	<u>SD</u>
<u>Outcomes</u>		
Standardized Body Mass Index	0.59	1.11
Overweight	35.85%	---
Obese	18.01%	---
<u>Employment</u>		
Maternal weekly work hours	19.76	12.81
Spouse weekly work hours	39.00	15.46
<u>Mechanisms</u>		
Child report of maternal monitoring	3.69	0.68
Mother report of maternal monitoring	3.64	0.59
Mother activities with child	1.62	0.97
Number of household chores	2.63	1.07
Eats frequently with parents	48.13%	---
Rules about watching television	42.42%	---
Average number of hours watching television	4.94	4.48
Participates in sports	62.12%	---
<u>Controls</u>		
Child age (months)	164.49	5.49
White	48.26%	---
Hispanic	21.30%	---
Black	30.44%	---
Male	50.88%	---
Birth order	1.96	1.08
Mother's AFQT (1980)	36.43	27.94
Mother's BMI (1981)	22.25	3.66
Mother's age at birth	25.08	4.59
Mother less than high school	13.50%	---
Mother high school	43.86%	---
Mother some college	26.56%	---
Mother college graduate	16.08%	---
Mother married around child's birth	66.71%	---
Mother reported no spouse (% of child's life)	28.86%	34.69
Child born normal birth weight	92.52%	---
Child born low birth weight	6.39%	---
Child born very low birth weight	1.09%	---
Log household income (three-year average)	10.51	1.08

Table 3

Regressions of Lifetime Maternal and Spouse Employment

	Standardized BMI			Overweight			Obese		
	B	SE	OR	SE	OR	SE	OR	SE	OR
Maternal average hours	0.04	**	0.01	1.09	**	0.03	1.10	*	0.04
Spouse average hours	-0.02		0.02	0.97		0.03	0.99		0.04
Child age (months)	-0.21		0.22	0.90		0.43	0.64		0.39
Child age (months squared)	0.00		0.00	1.00		0.00	1.00		0.00
Hispanic	0.00		0.05	1.10		0.12	1.04		0.14
Black	0.09		0.05	1.28	*	0.14	1.46	**	0.19
Male	0.01		0.03	1.18	*	0.08	1.30	**	0.11
Birth order	-0.02		0.02	0.94		0.04	0.94		0.05
Mother's AFQT (1980)	0.00	*	0.00	1.00	*	0.00	0.99	*	0.00
Mother's BMI (1981)	0.08	***	0.00	1.15	***	0.01	1.16	***	0.01
Mother's age at birth	0.00		0.01	1.00		0.02	1.02		0.02
Mother high school	-0.10		0.06	0.84		0.11	0.75		0.11
Mother some college	-0.08		0.07	0.79		0.12	0.76		0.14
Mother college graduate	-0.14		0.09	0.74		0.14	0.65		0.15
Mother married around child's birth	-0.02		0.05	0.94		0.10	0.97		0.13
Mother reported no spouse (% of child's life)	0.00		0.00	1.00		0.00	1.00		0.00
Child born low birth weight	0.03		0.07	1.01		0.16	1.31		0.24
Child born very low birth weight	-0.47	*	0.20	0.51		0.20	0.61		0.27
Log household income (three-year average)	0.03		0.02	1.03		0.04	1.03		0.05
p-value		0.009		0.013			0.040		

Note:

 $p < .001$,**
 $p < .01$,*
 $p < .05$,+
 $p < .10$. B are OLS coefficients for continuous body mass index and OR are odds ratios for dummy variables. A one-unit change corresponds to a 10 hour increase. Regressions also include birth month and year fixed effects. P-value represents the p-value for the F-test for the equality of the coefficient on maternal and spouse hours of employment. Standard errors are adjusted for the presence of siblings.

Table 4
Regressions of Lifetime Average Work Hours by Maternal Education Sub-Group

	Standardized BMI			
	Low-Educated Mothers		High-Educated Mothers	
	B	SE	B	SE
Maternal average hours	0.03	0.02	0.05	* 0.02
Spouse average hours	-0.04	* 0.02	0.02	0.02
Overweight				
	Low-Educated Mothers		High-Educated Mothers	
	OR	SE	OR	SE
Maternal average hours	1.05	0.04	1.10	* 0.05
Spouse average hours	0.94	0.04	1.04	0.06
Obese				
	Low-Educated Mothers		High-Educated Mothers	
	OR	SE	OR	SE
Maternal average hours	1.09	0.06	1.06	0.06
Spouse average hours	0.96	0.04	1.01	0.06

Note:

p < .001,
**
p < .01,
*
p < .05,

+ p < .10. B are OLS coefficients for continuous variables and OR are odds ratios for dummy variables. A one-unit change corresponds to a 10 hour increase. Regressions include all control variables as well as birth month and year fixed effects. Standard errors are adjusted for the presence of siblings.

Family Fixed Effects Models of Standardized BMI: For the Full Sample and by Maternal Education

Table 5

	Full Sample		Low-Educated Mothers		High-Educated Mothers	
	B	SE	B	SE	B	SE
Maternal average hours	0.04	0.06	0.03	0.08	0.07	0.11
Spouse average hours	-0.03	0.04	-0.04	0.05	0.00	0.09

Note:

*** p < .001,

** p < .01,

* p < .05,

+ p < .10. B are OLS coefficients. A one-unit change corresponds to a 10 hour increase. Regressions include all control variables as well as birth month and year fixed effects.

Table 6

Test of Mediators for High-Educated Mother Sample

	Monitoring (mother report)		Eating meals together frequently		Rules about watching TV		Average daily hours TV watched	
	B	SE	B	SE	B	SE	B	SE
<u>Pathway A (Mediator regressed on work hours)</u>								
Maternal average hours	-0.03	**	-0.09	0.05	-0.11	*	0.25	**
Spouse average hours	0.02	0.01	-0.15	0.06	0.01	0.05	0.02	0.10
	Standardized BMI		Standardized BMI		Standardized BMI		Standardized BMI	
	B	SE	B	SE	B	SE	B	SE
<u>Pathway B (BMI regressed on mediator)</u>								
Mediator	0.07	0.05	0.04	0.05	-0.07	0.05	0.02	0.01
<u>Pathway C (BMI regressed on work hours and mediator)</u>								
Maternal average hours							0.04	0.02
Spouse average hours							0.02	0.02
Mediator							0.02	*
% effect mediated							0.06	

Note:

**
p < .01,

*

p < .05. B are OLS coefficients for continuous measures and logit coefficients for dichotomous variables. A one-unit change in employment corresponds to a 10 hour increase. Regressions include all control variables as well as birth month and year fixed effects.