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Maternal Employment, Work Schedules, and Children's Body Mass Index

Taryn W. Morrissey,
American University

Rachel E. Dunifon, and
Cornell University

Ariel Kalil
University of Chicago

Abstract

Previous work has shown that mothers' employment is associated with increases in children's body mass index (BMI), a measure of weight-for-height. Nonstandard work (working evenings/nights, weekends, or an irregular shift) may also be associated with children's BMI. In this paper we examine the association between maternal work and children's BMI, and also consider the influence of mothers' nonstandard work schedules. Using data from school-age children in the NICHD's Study of Early Child Care and Youth Development (*N* = 990), we found that an increase in the total time a mother is employed is associated with an increase in her child's BMI; additionally, we find that the association between maternal employment and children's weight is much stronger at 6th grade relative to younger ages. There was no evidence that maternal or home characteristics or children's time use mediated these associations, nor was there any evidence that nonstandard work was associated with children's BMI. Implications for policy and future research are discussed.

Keywords

Maternal employment; nonstandard work schedules; body mass index

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Maternal Employment, Work Schedules and Children's Body Mass Index In the U.S., most mothers work: in 2007, the labor force participation rate for mothers with children under 18 was 71 percent (Bureau of Labor Statistics, 2008). A growing research literature has explored the implications of maternal employment for children's development. Recently, this work has focused on the relationship between maternal employment and children's body mass index (BMI; calculated as weight in kilograms divided by height in meters squared). Body mass index is an important component of well-being, attainment, and health over the lifecourse (Institute of Medicine [IOM], 2004). Moreover, as is widely documented, rates of obesity more than tripled among American children aged 6 to 11 years over the past three decades. In 2004, over 18 percent of children in this age group were considered obese (Centers for Disease Control and Prevention, 2004).

The present paper makes several innovations to the existing research linking maternal employment and children's BMI. First, we relate maternal employment to children's BMI and in doing so, test whether this relationship is cumulative, or whether mothers' initial entries into or exits from employment predict children's BMI. Second, we examine if, conditional on mothers' working, nonstandard work (working evenings, nights, weekends, or an irregular shift) is associated with children's BMI, testing again whether the relationship is cumulative or responsive to an initial change in mothers' work schedules. In all analyses, we employ random effects and within-child fixed effects models to limit the influence of potentially biasing unmeasured characteristics of children or their families. Finally, we examine a broad set of potential mediating factors that might explain any significant linkages we observe.

Maternal Employment and Children's Body Mass Index

A number of recent studies have identified a positive association between maternal employment and children's BMI. The first paper to investigate such linkages (Anderson, Butcher, & Levine, 2003) examined families with 3–11 year olds in the National Longitudinal Survey of Youth (NSLY) and found that 10 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 (Chia, 2008; Phipps et al., 2006; Ruhm, 2008), and there is some evidence that the relationship between maternal employment and child BMI may be stronger among families with more educated mothers (Anderson et al., 2006; Fertig, Glomm, & Tchernis, 2009).

Each of the studies cited above controlled for family income. Given that maternal employment involves a trade-off between time and money, the implication of this previous work is that the impacts of maternal work intensity on children's weight have something to do with time use—either that of the mother, the child, or both. Yet, few studies examined what such explanatory mechanisms related to time use or family processes could be. We do so in the present paper, thereby extending this line of research in an important way.

Several mechanisms may explain the observed linkages between maternal employment and children's BMI. First, working mothers face time constraints; as such, they 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 (Crepinsek & Burstein, 2004). Ziol-Guest, DeLeire, and Kalil (2006), for example, found that among families in which all parents worked, a greater share of the food budget was spent on food away from home, with a lesser share spent on vegetables, fruit, and protein. Cawley and Liu (2007) examined time use data and found that employed women spend less time cooking or eating meals with their children than those who do not work; this is not offset by increased time contributions by their husbands or partners. There is also some direct evidence that the intensity of maternal employment (e.g., hours worked) is associated with poorer nutritional intake (Fertig et al., 2009).

A second perspective suggests that children with working mothers spend less time getting physical exercise, 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, which diminishes children's physical activity (Anderson & Butcher, 2006). Cawley and Liu (2007) found that employed mothers spent less time playing with their children than those who do not work. All else equal, children who engage in less physical activity are at greater risk of having a higher body mass index.

A third perspective suggests that children with working mothers spend more time watching TV (Crepinsek & Burstein, 2004), possibly because they are more often in self-care or in the care of someone who supervises their TV consumption to a lesser extent than would their mother (Fertig et al, 2009). There are several possible ways that television viewing time may affect weight (Dietz & Gortmaker, 1985). First, television time may crowd out time spent in physical activity. Second, increased television watching has been linked with increased

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caloric intake among youth through 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, thus contributing to higher levels of children's energy consumption.

Maternal Nonstandard Employment and Children's Development

Above and beyond the influence of employment itself, mothers' nonstandard work schedules may also have implications for children's BMI. Recent Census data revealed that substantial proportions of workers' schedules do not fit the "traditional" work schedule of Monday through Friday, 9:00 am to 5:00 pm. Among all workers, 18 percent usually worked nonstandard shifts that fell at least partially outside the daytime shift range (McMenamin, 2007); among employed women with children, 12 percent did so (Connelly & Kimmel, 2007). As defined in our sample (described below) these nonstandard shifts include evenings and nights (before 7:00am or after 7:00pm on weekdays), weekends, or schedules that change frequently.

It is not clear a priori whether non-standard work would have positive, negative, or neutral associations with children's BMI. Working nonstandard hours may be preferable for some parents to the extent that they can rely on "split-shift" parenting with another caregiver (Presser, 2003). Others may choose to work alternate shifts because the employer offers higher wages for doing so. If working nonstandard hours is voluntary, for example, there may be little reason to expect any adverse impacts on children's health and development. However, 2004 Census data indicate that nearly half (48%) of all those working nonstandard shifts report "the nature of the job" as their main reason for working nonstandard shifts, whereas only 10 percent indicated it was a "personal preference" and 8 percent said it allowed for "better arrangements for family or child care" (McMenanim, 2007).

Among existing studies, the preponderance of evidence shows adverse associations between maternal nonstandard work and outcomes for children and their families. Studies have linked maternal work at nonstandard times with lower child test scores, school engagement, and participation in extracurricular activities (Han, 2006; Hsueh & Yoshikawa, 2007), higher levels of child behavior problems (Hsueh & Yoshikawa, 2007; Joshi & Bogen, 2007; Strazdins et al., 2004; Strazdins et al., 2006), and adolescents' poorer mental health (Dockery et al., 2009), as well as reduced mother-child engagement in social activities (Rapoport & Le Bourdais, 2007) and school-aged children's educational activities (Wight, Raley, & Bianchi, 2008). Nonstandard work is also associated with mothers' providing less enriching and supportive home environments (Heymann & Earle, 2001), poorer family functioning (Stradzins et al., 2006), increased parental depression and stress (Stradzins et al., 2006; Joshi & Bogen, 2007), and less regular family mealtime routines (Hsueh & Yoshikawa, 2007). Much of this previous research, however, has not controlled for the variety of ways in which mothers working nonstandard schedules may differ from those who do not.

We know of only one study linking maternal nonstandard work with children's body mass index: Miller and Han (2008) used the NLSY to examine the association between the number of years mothers worked at nonstandard schedules and adolescent overweight at age 13 or 14 years. Their findings suggested that a child's body mass index increased significantly if mothers worked either a few years or many years at nonstandard schedules, although the mechanisms accounting for these associations were not explored. Compared to both younger children and teenagers, school-age children may be particularly influenced by the times their mothers are at work, as they may attend lower-quality afterschool care settings that are open during nonstandard times or be "latch-key children" who are on their own in the evenings or on weekends.

Mothers who work nonstandard hours may not be available during key times in children's days when they are not in school, including the weekends, late afternoons, dinnertime, the post-dinner hours, bedtime, and wake-time. These are times during which important family routines are typically performed (family meals, organized activities, bedtime routines, and physical activity). Given mothers' traditional role as primary caregivers and managers of children's time (Bianchi, 2000), it is possible that nonstandard schedules hinder mothers' abilities to plan and supervise their children's activities during these key times. This, in turn, could have implications for children's BMI through children's physical activity and TV time, suggesting particular impacts on children when mothers work nonstandard schedules as compared to mothers working standard schedules. However, it may also be the case that mothers have chosen to work nonstandard hours to facilitate the balance of work and parenting. If this were the case, then important family routines may not be affected in ways that impact upon children's BMI.

It is possible that mothers who work during nonstandard hours or whose schedules change frequently may find it difficult to commit to children's afterschool or weekend extracurricular activities (Han, 2006). Mothers' nonstandard work schedules may also interfere with the time they would spend engaging in physical activity with their children, either because they are at work during the times when such activities usually occur, or because their schedules leave them too tired to participate in such activities. On the other hand it may be the case that, unlike parents working standard schedules, those working nonstandard schedules are available on weekday afternoons to shuttle children to activities (although depending on their shift they may be sleeping).

It is also possible that children whose mothers work nonstandard hours spend more time watching television than children of mothers who work standard hours, particularly during mealtime, bedtime, early morning, and on weekends. These are times when mothers working nonstandard schedules often must be out of the home, and when alternate care or activities for children are often not available. Conversely, parents who work nonstandard schedules, especially night shifts, may be home during the day to monitor their children's television time (although again they are likely sleeping during some of this time).

Mothers' mental health and parenting behaviors may represent other important channels through which nonstandard work may influence children's BMI. Evidence suggests that nonstandard work can be stressful for parents, which can affect their sleep and increase depression (Fenwick & Tausig, 2001). Maternal fatigue, stress and depression may play a role in mothers' adopting health-depleting behaviors (e.g., lack of physical exercise or unhealthy eating habits) that children model. Mothers who are tired or stressed from work at nonstandard times may also be less likely to plan mealtimes and prepare healthy foods, and may be more likely to rely on fast or prepared food (Devine, Jastran, Jabs, Wethington, Farell, & Bisogni, 2006; Jabs, Devine, Bisogni, Farrell, Jastran, & Wethington, 2007), which could adversely affect children's body mass index (Anderson et al., 2003).

Finally, nonstandard work, through its influence on depression or stress, may influence mothers' involvement with and responsiveness to children (La Valle, Arthur, Millward, Scott, & Clayden, 2002; Rapoport & Le Bourdais, 2007; Wight et al., 2008), possibly by diminishing their ability to construct an organized and supportive home environment (Heymann & Earle, 2001), which includes regular eating and sleeping routines (Hsueh & Yoshikawa, 2007; La Valle et al., 2002). Children also may have more unsupervised time when mothers work nonstandard schedules, particularly when child care on weekends or at night is difficult to obtain (Henly & Lambert, 2005). When parents are less involved with and responsive to their children, or when children are left unsupervised, there are fewer opportunities to monitor children's caloric intake and physical activity, or to enforce regular mealtimes and bedtimes, all with adverse potential consequences for children's BMI. For instance, skipping meals may disrupt metabolic processes involved in the regulation of BMI (Carlson, Martin, et al., 2007). Other recent research suggests that insufficient sleep can increase a child's body mass index and risk of being overweight (Snell, Adam, & Duncan, 2007).

In summary, several recent studies have linked maternal employment to children's weight, but the mechanisms that may mediate these associations remain largely unknown. Few studies in this area have examined maternal nonstandard work, though there is reason to believe that mothers' nonstandard work may be uniquely associated with children's increased body mass index. Additionally, few studies have examined whether the potential influence of maternal employment patterns on children is cumulative vs. operating at a point-in-time. Considering that higher body mass index has been associated with more behavior problems and lower academic achievement during middle and late childhood (Bradley et al., 2008; Crosnoe & Muller, 2004) and greater stigmatization across the lifecourse (Puhl & Brownell, 2001), results have important policy and practical implications. The goal of this study is to assess the relations between maternal employment, maternal nonstandard employment, and children's body mass index.

Method

Data

To address these questions, we use data from the National Institute of Child Health and Human Development's Study of Early Child Care and Youth Development (NICHD SECCYD). Beginning in 1991, the study collected data in ten cities across the country (Boston, MA; Lawrence, KS; Seattle, WA; Orange County, CA; Little Rock, AR; Pittsburgh, PA; Philadelphia, PA; Morganton, NC; Madison, WI; and Charlottesville, VA). Recruitment and selection procedures are described in greater detail elsewhere (see NICHD ECCRN, 1997). At 1 month of age, 1,364 infants and their families were enrolled in the study in accordance with a conditional random sampling plan. Although the sample was not intended to be nationally representative, the demographic characteristics of the sample were comparable to those of people living in the same geographic areas at the beginning of the study (NICHD ECCRN, 1997). Attrition reduced the sample to 979 children and families by sixth grade. Families who were not lost to attrition represented a range of socioeconomic and ethnic backgrounds, but had, on average, higher maternal education (14.41 vs. 13.85 years) than families who had left the study.

Because much of the previous research on the intensity of maternal employment and child obesity has focused on school-age children (e.g., Ruhm, 2008), we use data from the 3rd, 5th, and 6th grade interviews. Our study included children in the sample at 3rd, 5th, and 6th grades and with complete information on body mass index and family demographic information for at least two of the three grades. A total of 990 children were included in analyses.

Procedure

Family background information was gathered at the child's birth and during a home visit 1 month later. At 3rd, 5th, and 6th grades, data were collected through a series of telephone and in-person interviews conducted with children and their parents at their site's university lab and in their homes. Maternal employment status and schedule measured prior to 3rd grade, collected through phone interviews between 3 months and 2nd grade (19 periods total, at: 3, 6, 9, 12, 15, 18, 24, 27, 30, 33, 36, 42, 46, 50, 54, and 60 months, 1st grade, and 2nd grade), and also at 4th grade, were also included to calculate the cumulative time mothers were employed and working nonstandard schedules, as explained below.

Measures

Predictor: Maternal employment—Mothers reported their employment status at each data collection period (1 = *employed and working*). To test whether persistent employment had a cumulative influence on children's BMI, we also used the data from each interview between 3 months of age to 6th grade and summed the total number of periods employed (*M* = 9.52, *SD* = 5.67, range: 0–19, through 6th grade).

Predictor: Mothers' work schedule—Mothers reported their employment schedules at each interview, choosing from one of the following mutually-exclusive categories to indicate the hours typically worked on their primary job: 1) between 7:00am and 7:00pm weekdays (Standard); 2) before 7:00am or after 7:00pm weekdays (Night); 3) on weekends (Weekend); or 4) on a schedule that changes frequently (Variable). For our main analyses, the measures of night, weekend and variable schedules were collapsed into one indicator of nonstandard work (0 = *standard schedule*, 1 = *nonstandard schedule*). As with maternal employment status, we also summed the total number of periods a mother worked a nonstandard schedule across all interviews from 3 months of age to 6th grade (*M* =2.94, *SD* = 3.62, range: 0–19, through 6th grade). The average length of a period of maternal employment or nonstandard work across the 19 data collection points was nearly 6 months (5.26 months).

Outcome: Children's body mass index—Children's height and weight were measured during laboratory visits at 3rd, 5th, and 6th grades. The child was brought into a room with a scale and a yardstick. Shoes and heavy clothing that were easily taken off were removed. At each age, body mass index (BMI) was computed as weight in kilograms divided by height in meters squared (U.S. Department of Health and Human Services, 2001; National Institutes of Health, 1998). BMI is a limited measure of fatness because it does not distinguish fat from muscle (Burkhauser & Cawley, 2008), but is commonly used because the information needed to calculate it is readily available. Our main dependent variable is a standardized measure of BMI that was calculated using age-and gender-specific conversions established by the Centers for Disease Control and Prevention (CDC). Other analyses use dichotomous indicator variables for overweight and for at risk of becoming overweight, which were coded using the CDC's age-and-gender-specific thresholds for BMI (1 = *overweight* or *risk of becoming overweight*). Specifically, a BMI at or above the 95th percentile is considered overweight, and at or above the 85th percentile is considered at risk for becoming overweight (Kuczmarski et al. 2002).

Mediator: TV time—Weekly television time was gathered using the Home Literacy Environment Scale (adapted from Griffin & Morrison, 1997). At 3rd and 5th grades, mothers were asked to report daily hours of children's TV watching for weekdays, for Saturday, and for Sunday; children were asked to self-report at 6th grade. Total weekly hours of TV time was calculated by multiplying the daily hours for Monday through Friday by 5, and adding the hours for Saturday and Sunday. Internal reliability was moderate (α = .71).

Mediator: Physical activity—Information about children's physical activity was collected using a waist-mounted physical activity monitor (PAM) worn by each child for seven consecutive days during a typical school week at each of the three grades (Janz, Witt, & Mahoney, 1995). Specifically, the children wore an Activity Monitor from the Ambulatory Monitoring Applications Division of Computer Science and Applications, Inc., a single-channel accelerator designed to collect movement data. Accelerations, measured in mets, are changes in the rate of body movement; thus, acceleration data serve as measures of a participant's total body movement. Accelerometor stability, a measure of reliability, was high (intraclass correlations indicated that 6 days of monitoring resulted in R = .81 to .84). A complete day of physical activity data was defined as beginning with the first nonzero accelerator count after 5:00am until one or more of the following conditions were met: 1) 60 consecutive minutes of zero counts after 9:00pm; 2) 30 consecutive minutes of zero counts after 10:00pm; or 3) the last nonzero count before midnight. The number of nonzero minutes for any given day was calculated, and the total number of accelerator counts was computed; invalid days that did not meet these criteria (activity began prior to 5:00am or 60 consecutive minutes of zero activity well before 9:00pm) were flagged and removed. The number of minutes spent in Moderate (3–5.9 mets), Vigorous (6–8.9 mets), and Very Vigorous (9+ mets) were determined for each child for each day the monitor was worn. The number of minutes spent per day in Moderate, Vigorous, or Very Vigorous activity was summed and then divided by the total number of minutes wearing the monitor to generate a percent of time spent engaged in the various activity levels. This study uses the percent of time spent in Moderate, Vigorous, or Very Vigorous activity averaged across the days measured (see NICHD SECCYD Phase III Instrument Documentation).

Mediator: Home environment—The Middle Childhood Home Observation for Measurement of the Environment (HOME) was conducted at 3rd grade (59 items), and the Early Adolescent HOME measure was conducted at 5th grade (44 items) to assess the quality and quantity of support and stimulation provided to the child in her or her home environment (Bradley, 1994; Caldwell & Bradley, 1984). At 3rd grade, 7 subscales were administered; Acceptance, Responsivity, Family Companionship, Encouragement of Maturity, Learning Materials, Enrichment, and Physical Environment. At 5th grade, 5 of the 7 subscales were administered: Physical Elements, Learning Materials, Variety of Experiences, Modeling, and Acceptance of Responsibility. The HOME was not administered at 6th grade. This study examines Total Standardized HOME scores at 3rd and 5th grade (M = 0, SD = 1).

Mediator: Parental Supervision and Engagement—During interviews at 3rd and 5th grades, mothers were asked to report their children's usual afterschool arrangements on each day of the week (Vandell & Pierce, 1998). Up to three arrangements could be reported per day: home or elsewhere with mother; home or elsewhere with father/mother's partner; home with siblings; home with adult relative or sitter; home with sitter younger than 18 years; home alone; in another's home with an adult present; in another's home without an adult present; in an afterschool care program; in structured activities or lessons; in any other location with adult supervision; in any other location without adult supervision; or home with peers, no adults or siblings present. Inter-rater reliability for the coding of parental reports was high (99%). This study examined the potential mediating effects of three broad categories: Average Minutes per Week without Adult Supervision, including time at home with siblings, home with a sitter younger than 18 years, home alone, in another's home without an adult present, in any other location without adult supervision, and home with peers; Average Minutes per Week in Structured Activities, including time in afterschool care program or structured activities or lessons; and Average Minutes per Week with Parents, including time at home or elsewhere with mother or father/mother's partner.

Mediator: Maternal Depression—A measure of maternal depression as assessed by the "My Feelings" scale, adapted from the Center for Epidemiological Studies – Depression Scale (CES-D: Radloff, 1997), was gathered at 3rd, 5th, and 6th grades. The scale is based on a 4-point Likert scale on which mothers rated the frequency of their events and thoughts from 1 (Less than once a week) to 4 (5–7 days a week), with greater scores representing greater depressive symptomatology. Internal reliability was high, ranging from .87 to .89.

Time-varying covariates—At each telephone interview, mothers reported the numbers of adults and children living in the home, their marital status (0 = *mother-headed household*, 1 = *married or cohabiting household*), and the number of hours per week mothers worked outside the home, including all jobs. Because the majority of mothers' partners were employed at 3rd, 5th, and 6th grades (96%, 94%, and 93% respectively) and only 3.4 percent and 3.2 percent of families experienced changes in the father/cohabiting partner's employment status between these three time points, his employment status was not included; however, the number of hours the father/cohabiting partner worked per week (0 = *work fewer than 35 hours per week*, 1 = *work 35 hours or more per week*) was included as a covariate. Information on the time of day fathers worked (i.e., schedules) was not collected. Grade was controlled as a dummy variable, with 3rd grade used as the reference category. We also controlled for household income, using the family income-to-needs ratio, computed at each time point using data from the U.S. Census Bureau as the ratio of family income reported to the poverty threshold for each household size. Higher scores indicate greater financial resources. At each grade, families were coded as being low-income (1 = *income-to-needs ratio less than or equal to 2.00*, *M* = 1.22, range: .09 to 1.98) or higher-income (0 = *income-to-needs ratio greater than 2.00*, *M* = 5.48, range: 2.00 to 28.67).

Fixed Covariates—Child gender (1 = *male*), race (1 = *black*, 0 = *white or other race*), ethnicity (1 = *Hispanic*), birth order, and birth weight, maternal years of and maternal age in years were collected during the first interview after the child's birth. Family income was gathered at 15 time points from 6 to 54 months, and average family income-to-needs ratio before entering elementary school (described above) was calculated using the mean of these data points.

Analytic Strategy

When estimating the associations between maternal employment and children's BMI, it is possible that children whose mothers are employed or who work nonstandard schedules differ in unobservable ways from those whose are not. For example, 2004 CPS data reveal that less-educated workers are somewhat more likely to work nonstandard schedules than their higher-educated peers, largely because they are over-represented in the fields in which such work is more common, including food preparation and serving, cashiers, orderlies, retail salespersons, and home health aides (Connelly & Kimmel, 2007; McMenamin, 2007; Presser, 1999; 2003; 2004; Presser & Cox, 1997).

Without being able to fully control for all of the potential ways in which mothers (and their children) with different employment experiences differ from each other, Ordinary Least Squares (OLS) regressions of child BMI on maternal employment may be biased. To address this, we used both random effects (RE) and within-child fixed effect (FE) regressions, pooling data from all three periods (3rd, 5th, and 6th grade) and relying on repeated observations of maternal employment and BMI for each child. In both our FE and RE analyses, we utilized two different measures of maternal employment. In some models, maternal employment was allowed to have a cumulative influence on children's BMI as we examined how the total number of periods a women was employed/working a nonstandard job influences her child's BMI. Other analyses examined how a mother's employment status/nonstandard employment in a given period is associated with her child's BMI in the same period.

RE models include a child-specific intercept in order to capture any unobserved characteristics of the mother or child. This model assumes that all omitted variables are randomly distributed, and are independent of predictors and outcomes (Allison, 2005). FE models use within-child comparisons to predict changes in the outcome (BMI) from changes in the predictor. As a result of examining within-child change, all measured and unmeasured fixed (time-invariant) effects of a given child or his or her family drop out of the FE model (e.g., birth weight, child gender). Such fixed characteristics are included in the RE models. As such, FE models examine how a child's BMI at a specific time point deviates from that same child's average level of BMI measured across all three time points. This is predicted by a measure of mothers' employment characteristics at a single time point, from which is subtracted the mothers' average level of employment characteristics across the three time points. The FE model also includes changes over time in any time-varying characteristics, such as family size and composition or work hours. It is important to note that while RE models compare relationships between predictor and outcome variables across different children, within-child FE models examine an individual child over time and relate changes in the predictor to changes in the outcome.

The strength of FE and RE analyses is the ability to control for a host of factors that may differentiate children whose mothers have different employment experiences. Such analyses are not without their problems, however. First, these models do not remove the biasing effects of unmeasured variables that change with time. For example, components of maternal mental health, family socioeconomic status, or maternal stress that co-occur with, or even cause or are caused by, changes in mothers' employment experiences will still bias our estimates. Secondly, the FE model assumes that constant factors such as gender have a time-invariant effect on the dependent variable, and does not account for the fact that the influence of such measures may change over time. Another well-known drawback with any difference method is that it may exacerbate measurement error; if our key dependent or independent variables are measured imprecisely, this will be exacerbated with such a model (Greene, 1997). Additionally, changed-based models are susceptible to regression to the mean, in which individual's initial levels of a variable is associated with their later rate of change in that measure. Finally, none of our models can address issues of reverse-causality, which would occur if, for example, mothers choose to work at all or adjust their work schedules in response to their children's weight. As noted by Edin and Lein (1997), mothers can make choices about employment based, at least in part, on the needs of their children.

As noted above, RE models assume that any unobserved characteristics of mothers or children are not correlated with the predictor or outcome variables, while the FE model makes no such assumption. The Hausman test is one strategy for comparing regression coefficients from RE and FE models; a significant chi-square test indicates that there are systematic differences between the coefficients, suggesting that the FE approach is more appropriate (Hausman, 1978). Results of Hausman tests were significant for all four outcomes, indicating that there were systematic differences between the coefficients in the RE and FE models; thus, we prefer the FE estimates, although we present results from both types of models. Of course, the Hausman test is only one way of selecting RE or FE models; theory and specific research questions should drive the choice of statistical method (Allison, 2005).

FE models rely on children experiencing changes over time in maternal employment or maternal nonstandard work. An examination of our data indicated that such variation does exist. About one-quarter (26.74%) of mothers included in our sample changed employment status at least once between 3rd and 6th grades. Likewise, among employed mothers, a total of 265 (31.81%), changed their work schedules between the 3rd and 5th grades, between the

5th and 6th grades, or both. There was also substantial variation (i.e., change over time) in the outcome (BMI) and all mediators, except for the HOME score.

Additionally, because our FE models are estimated from children whose mothers changed employment status or work schedules over time, it is important to understand the extent to which such children differ from those whose mothers did not change either employment status or work schedules. In analyses (not shown) we found that children whose mothers changed employment status (from working to not working or vice versa) had higher BMIs, had less educated and more depressed mothers, and were more likely to live in low-income families than those whose mothers remained employed over the entire period. Children whose mothers changed work schedules were more likely to be black, had less educated mothers, and were more likely to come from low-income families than those whose mothers did not change work schedules during the period examined.

In addition to the main effects of maternal employment and maternal work schedules, we also tested the potential mediators noted above, as well as the moderating effects of gender, age (i.e., grade), and maternal education using procedures recommended by Baron and Kenny (1986). All continuous variables were centered at the grand mean to reduce the potential for problems resulting from collinearity. In the RE models, effect size (*d*) represents the coefficient divided by the standard deviation of BMI at 3rd, 5th, and 6th grades, which was .998. In the FE models, effect size (*d*) represents the coefficient divided by the average standard deviation of the change in BMI, which was .204 from 3rd to 6th grade.

Results

Descriptive Results

Table 1 provides descriptive information for the sample as a whole, as well as three groups of mothers, measured at 3rd grade: those not employed, those working standard schedules, and those working nonstandard schedules. The majority of the sample was White (78%), with 11 percent African-American and 6 percent Hispanic. At 3rd grade, mothers worked an average of 27 hours per week, and nearly one-quarter of families were considered low-income. Children watched an average of 15.2 hours of television per week and spent about one-fifth of their time in moderate or vigorous physical activity. Children spent about 30 and 50 minutes per week unsupervised and in structured activities, respectively, and about 10 hours per week interacting with parents. About one-fifth of the sample was considered overweight.

In general, children whose mothers worked outside the home were less likely to live in low-income families, more likely to be African-American, live in bigger families, and had more educated mothers, but were less likely to live in two-parent families, and spent less time in structured activities or with their parents, and spent more time unsupervised, than those whose mothers were not employed. Compared to the children of mothers working a standard schedule, children with mothers working nonstandard schedules lived in homes with lower HOME scores and were less likely to have fathers who worked full-time; however, such children were more likely to live in a two-parent household and spent more time with their parents. These differences highlight the importance of controlling for family background variables. However, children’s BMI, television-watching, and physical activity did not significantly vary with either maternal work status or schedules.

Regression Results: Main Effects

Results from the RE and within-child FE regression main effects models are reported in Table 2. Model 1 related the number of periods a mother was employed to child BMI;

Model 2 related mothers employment status at a given time point to BMI; Model 3 related the number of periods a mother worked a nonstandard schedule to BMI; and Model 4 considered mothers' nonstandard schedules at a given time point.

Results from the RE models, which compare outcomes across different children, did not reveal any significant associations between mothers' employment, or nonstandard employment, and their children's BMI. Looking at the within-child FE regression models (our preferred models), which related within-child changes in mothers' employment experiences to changes in that child's BMI over time, we see in Model 1 that an additional period of maternal employment over the child's lifetime was associated with a 10 percent of a standard deviation increase in children's body mass index (d = .10; .02/.204). The fact that such an association was found in the FE models, but not the RE models may be due to the different nature of such models; specifically, RE models compared across different children whose mothers had different employment experiences, while the FE models related an individual child's accumulation of maternal employment to changes in that same child's BMI. There were no significant associations between maternal employment status at a given time point (Model 2) and BMI, and also no associations (at conventional levels of significance) between maternal nonstandard work and child BMI (Models 3 and 4).

Results from mediation analyses (not shown) indicated that although cumulative maternal employment was predictive of several of the potential mediators (TV time, maternal depression, and unsupervised time), none of our theorized mediators account for the significant association between mothers' cumulative employment and children's increased BMI shown in Table 2.

Post-hoc Analyses

The influence of nonstandard work on children's BMI may differ depending on whether the mother is working a night vs. a weekend shift. We examined whether night and weekend shifts are differentially related to child BMI by entering them as separate predictors in Models 3 and 4. Although the both the night and weekend schedules were positively associated with an increase in BMI, the individual coefficients for these measures were not significant. Further, post-hoc tests indicated there were no significant differences between the night and weekend coefficients, leading us to prefer the estimates in which these measures are combined.

To test whether the predictors had a threshold effect, as opposed to a linear effect, on child BMI, we repeated the analyses in Table 2, using as dependent variables the likelihood of a child being overweight (BMI greater than or equal to 95th percentile for age) or at risk for becoming overweight (BMI greater than or equal to 85th percentile for age). None of the predictors were associated with these outcomes.

To examine differential effects by grade, grade was interacted with the maternal employment measures. We found evidence that grade moderated the effect of employment status on BMI for 6th grade (B = .08, SE = .03, p = .025) and the effect of employment status on the likelihood of being overweight at 5th and 6th grade (B = 2.09, SE = .96, p = .029 for 5th grade, B = 2.44, SE = 1.01, p = .016 for 6th grade). That is, among 6th graders, a mother's entry into employment was associated with an increase in BMI of about two-fifths (40%) of a standard deviation, and those children were about 6 times more likely to be overweight. Additionally, among 5th and 6th graders, entry into employment was associated with an increase in the likelihood of being overweight of 8 and 11 times, respectively. However, there was no evidence that TV time or physical activity mediated this relationship at either 5th or 6th grade, or that total HOME score, time spent unsupervised, in structured settings, or with parents mediated this relationship at 5th grade (the HOME scale and time-use data were gathered at 3rd and 5th grades only).

Secondly, we tested whether our pattern of results differed by gender or maternal education, finding that they did not. Finally, additional analyses examined whether other factors of mothers' jobs, which may be correlated with their employment experiences, may confound the association between maternal work and children's BMI. To test this, we performed analyses (not shown) adding controls for maternal wages and found that our overall pattern of results did not change.

Discussion

The goal of this paper was to examine the influences of maternal employment generally, and nonstandard work specifically, on children's BMI. We examined whether children's BMI was influenced by maternal employment in a cumulative manner, or whether it responded to an initial change in mothers' employment status, using two robust regression techniques, and testing a wide range of potential mediators to account for these associations.

Our fixed effects results provide evidence for a cumulative influence of maternal employment; every period of time (averaging 5.3 months) a mother was employed was associated with an increase in her child's BMI of 10 percent of a standard deviation. For a child of average height, this is equivalent to a gain in weight of nearly 1 pound every 5 months above and beyond what would typically be gained as a child ages. This link between maternal employment (versus non-employment) and children's BMI is consistent with a growing body of evidence on this question (e.g., Anderson et al., 2003), including studies that have adopted comparable analytic approaches. Whereas many previous studies have examined intensity of maternal employment in terms of her work hours, we extend this line of work by showing an association between intensity of maternal employment over the child's lifetime (i.e., cumulative exposure to maternal employment as the child grows older) and her child's BMI.

Our results also showed that this association was strongest when children were in 5th and 6th grades (relative to 3rd grade). For example, when children were in 6th grade, maternal employment was associated with a substantially (40% of one standard deviation) higher level of BMI and a six times greater likelihood of being overweight. It is possible that because 5th and 6th graders generally have more independence and less adult supervision over their time use and food choices than 3rd graders, maternal employment precipitates poorer food choices and more sedentary activity. Children's lesser supervision at older ages may be related to the diminished likelihood of being in an after-school program and a greater likelihood of being in self-care (Johnson, 2005). The ways in which the link between maternal employment and child health may be moderated by child age warrants more research attention.

In contrast, we found no evidence that maternal nonstandard work was associated with child BMI at conventional significance levels (though the association between maternal non-standard work and children's BMI at a point in time approached conventional levels of statistical significance). The only study that we know of in this area (Miller & Han, 2008) found that nonstandard work was associated with higher BMI among 13 and 14 year olds. Given the paucity of studies on this particular topic, it is too soon to reach a consensus on this point. The role of child age may be particularly important in the association between maternal non-standard work and children's BMI, just as we showed it to be relevant in the influence of maternal employment itself.

We tested several theoretically plausible factors that may account for the association between maternal employment and child BMI. None of the factors we examined served as mechanisms linking maternal employment to children's body weight. Given the high quality of these data, our analyses may permit us to rule out these measures as plausible mediators, and point to the need for researchers to look elsewhere for explanatory factors. Two key contenders as yet unexamined include children's eating and sleep behaviors—including the quality, quantity and regularity of these aspects of children's lives. Unfortunately, data were not available at all of the necessary time points to test these potentially important factors.

Limitations and Future Research

Our FE models examined how changes in maternal employment influence children. Such changes may also co-occur with other potentially disruptive changes in children's lives, such as residential moves or changes in household structure. Our models control for some of these potential changes, such as family structure, number of children in the household, family income, maternal work hours, and maternal depression. However, to the extent that other work conditions or other aspects of children's lives change but are not included in our model, results from these models will be biased.

Another limitation of the FE model is that it is not able to address issues of reverse causality; specifically, the possibility that mothers may change their work status or schedules in response to the needs of their children (in this case, in response to their children's BMI). Such concerns are eased by the fact that the vast majority of mothers work. Nevertheless, to the extent that mothers' decisions to work occur in response to their children's BMI, our results are biased.

Thirdly, while the NICHD SECCYD data are extremely rich in terms of repeated measures of children's BMI, family processes, and maternal work, such data are inherently limited in that they provide snapshot views of children's experiences at given points in time. It is possible that mothers may be changing employment status or schedules more than once in-between waves of data collection and that we are missing potentially important transitions experienced by children. Likewise, we do not know how long mothers have been working at specific jobs at a given interview point. One child may have experienced a change in nonstandard work from 3rd to 5th grade only a few weeks before the measurement of BMI occurred; another child may have experienced that change up to five months prior. Our analyses are not able to distinguish between these two experiences. Further, this study examined children's BMI in relation to their mothers' work status and schedules, but the role that fathers' work plays in children's physical health remains unexplored.

Finally, the NICHD SECCYD sample is not nationally representative, and contained fewer low-income, minority, and single-parent families than in the general population (for example, 80% of our sample lives in two-adult households and more than 75% are higher income). It is possible that our overall lack of findings linking nonstandard work to child BMI, and our lack of identifying mechanisms that link maternal employment experiences to child BMI, results from the fact that the families in our sample do not face the difficulties balancing work and family that less advantaged ones might. At the same time, previous research suggests that children whose mothers have more education are particularly vulnerable to the negative impacts of maternal employment on their body mass index, and our sample is well-suited to test this question (Anderson & Butcher, 2006; Fertig et al., 2009). Although our results did not vary by maternal education, it is possible that this phenomenon was common across our sample, given the higher average maternal education. Because the kinds of jobs low- and higher-income parents work differ in quality, flexibility, and the degree of employee control over schedules, which may in turn affect the ability to plan meals or adequate afterschool care or activities (Henly & Lambert, 2005), future research should examine the relationship between parents' work schedules and children's physical health in lower-income samples, and delve deeper into issues of specific concern for less advantaged parents.

Raising Healthy Children: Implications for Policy and Practice

The results of this study have implications for policy and practice. We find that maternal employment has a cumulative influence on children's BMI which, over time, could lead to an increase in the likelihood that a child is overweight or obese. We also find evidence that, among older children in particular, maternal employment status is linked to an increased likelihood of being overweight. 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). On average, in 2002, an obese adult and an overweight adult spent an additional $395 and $125 in health care costs per year, respectively, than healthy-weight individuals (Sturm, 2002).

In addition to the physical health and economic consequences as adults, being overweight as a child has social-emotional implications. During the early elementary school years, higher BMIs are associated with greater internalizing problems (Bradley et al., 2008). In adolescence, overweight status is associated with an increase in depression among girls (Needham & Crosnoe, 2005). Additionally, overweight teens have lower academic achievement, especially in contexts in which being overweight is stigmatized (e.g., schools with high rates of dating or lower average BMI; Crosnoe & Muller, 2004). For girls, higher BMIs are also associated with a reduction in dating (but not in having sex; Cawley, 2001; Cawley, Joyner, & Sobal, 2006). Overall, research suggests stigma against overweight individuals are commonplace, including in the workplace, in the health care system, and in schools (reviewed in Puhl & Brownell, 2001).

The important health and social consequences of childhood overweight and obesity highlight the need for changes in policy, and several employer-, school-, and community-level initiatives have been proposed. Very little research exists to provide guidance on which types of programs are most effective, however. This, combined with the current study's inability to determine the mechanisms linking maternal employment to children's BMI, makes it difficult to know how to focus potential initiatives. However, our results do suggest that children whose mothers work may be a good target for interventions.

Some of the most promising interventions designed to promote healthy weight among children take place in schools. Two, which have been rigorously evaluated and proven effective, are Planet Health and the Coordinated Approach to Child Health (CATCH; Brown et al., 2007; IOM, 2005). While primarily taking place in classrooms, programs such as these could be enhanced by recognizing and accommodating the needs of children of working mothers. For example, in addition to integrating information on nutrition and physical activity in the classroom, the Planet Health curriculum also includes fact sheets for parents that offer advice on how to increase physical activity (e.g., suggesting parents play tag with their children after school), and reduce TV time (by banning it during dinner, for example; Planet Health, 2007). Encouraging family mealtimes and reserving one day a week without extracurricular activities is another possible avenue (Fiese & Schwartz, 2008). School-based programs such as CATCH and Planet Health may be even more effective if they can be tailored to fit the particular issues of parents with various employment circumstances.

In conclusion, previous research has uncovered links between maternal employment and children's behavioral and social development. This study builds upon the existing literature to demonstrate that mothers' employment is associated with higher levels of children's body mass index, and that this is particularly the case among older school-aged children. Further work is needed to better understand the mechanisms underlying this association. In light of the growing rate of childhood overweight and its deleterious impacts on long-term health, economic, and social-emotional outcomes, research that guides the provision of additional supports to families balancing work and family life is an important goal.

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References

Allison, PD. Fixed effects regression methods for longitudinal data using SAS. Cary, NC: SAS Publishing; 2005.

Anderson P, Butcher K, Levine P. Maternal employment and overweight children. Journal of Health Economics. 2003; 22:477–504. [PubMed: 12683963]

Anderson P, Butcher K. Child obesity: Trends and potential causes. Future of Children. 2006; 16:19–45. [PubMed: 16532657]

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]

Bianchi S. Maternal employment and time with children: Dramatic change or surprising continuity? Demography. 2000; 37:401–414. [PubMed: 11086567]

Bradley, RH. The HOME Inventory: Review and reflections. In: Reese, HW., editor. Advances in child behavior and development. Vol. Vol. 25. San Diego, CA: Academic Press; 1994. p. 241-288.

Bradley R, Houts R, Nader P, O'Brien M, Belsky J, Crosnoe R. the NICHD Early Child Care Research Network. 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 H, Perez A, Li Y, Hoelscher D, Kelder S, Rivera R. The cost-effectiveness of a school-based overweight program. International Journal of Behavioral Nutrition and Physical Activity. 2007; 4:47–59. [PubMed: 17908315]

Bureau of Labor Statistics. Employment characteristics of families in 2007. Washington, D.C: United States Department of Labor; 2008.

Burkhauser RV, Cawley J. Beyond BMI: The value of more accurate measures of fatness and obesity in social science research. Journal of Health Economics. 2008; 27:519–529. [PubMed: 18166236]

Caldwell, B.; Bradley, B. Home Observation for Measurement of the Environment. Little Rock, AR: University of Arkansas at Little Rock; 1984.

Cawley, J. Body weight and the dating and sexual behaviors of young adolescents. In: Michael's, RT., editor. Social Awakening: Adolescent Behavior as Adulthood Approaches. New York: Russell Sage; 2001. p. 174-198.

Cawley J, Joyner K, Sobal J. Size matters: The influence of adolescents' weight and height on dating and sex. Rationality and Society. 2006; 18:67–94.

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.

Connelly, R.; Kimmel, J. The role of nonstandard work hours in maternal caregiving for young children. 2007 October. IZA Discussion Paper No. 3093. Retrieved from http://ssrn.com/abstract=1028205

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]

Devine C, Jastran M, Jabs J, Wethington E, Farell T, Bisogni C. "A lot of sacrifices": Work-family spillover and the food choice coping strategies of low-wage employed parents. Social Science and Medicine. 2006; 63:2591–2603. [PubMed: 16889881]

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]

Dockery A, Li J, Kendall G. Parents' work patterns and adolescent mental health. Social Science and Medicine. 2009; 68:689–698. [PubMed: 19084312]

Edin, K.; Lein, L. Making ends meet: How single mothers survive welfare and low-wage work. New York: Russell Sage Foundation; 1997.

Fenwick R, Tausig M. Scheduling stress: Family and health outcomes of shift work and schedule control. American Behavioral Scientist. 2001; 44:1179–1198.

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.

Fiese, BH.; Schwartz, M. Reclaiming the family table: Mealtimes and child health and well-being. Society for Research in Child Development Social Policy Report, XXII. 2008. Retrieved from http://www.srcd.org/index.php?option=com_content&task=view&id=232&Itemid=550

Greene, W. Econometric analysis. 3rd ed.. Upper Saddle River, New Jersey: Prentice Hall; 1997.

Griffin EA, Morrison FJ. The unique contribution of home literacy environment to differences in early literacy skills. Early Child Development and Care. 1997; 127–128:233–243.

Han W-J. Nonstandard work schedules and child care decisions: Evidence from the NICHD Study of Early Child Care. Early Childhood Research Quarterly. 2004; 19:231–256.

Han W-J. Maternal nonstandard work schedules and child outcomes. Child Development. 2005; 76:137–156. [PubMed: 15693763]

Han W-J. Maternal work schedules and child outcomes: Evidence from the National Survey of American Families. Children and Youth Services Review. 2006; 28:1039–1059.

Han W-J, Waldfogel J. Parental work schedules, family process, and early adolescents' risky behavior. Children and Youth Services Review. 2007; 29:1249–1266.

Han W-J, Waldfogel J, Ruhm C, Washbrook E. The timing of mothers' employment after childbirth. Monthly Labor Review. 2008:15–27.

Hausman J. Specification tests in econometrics. Econometrica. 1978; 48:1251–1271.

Heymann SJ, Earle A. The impact of parental working conditions on school-age children: The case of evening work. Community, Work and Family. 2001; 4:305–326.

Henly, JR.; Lambert, S. Nonstandard work and child care needs of low-income parents. In: Bianchi, S.; Casper, L.; King, R., editors. Work, family, health and well-being. Mahwah, NJ: Lawrence Erlbaum Associates; 2005.

Hsueh J, Yoshikawa H. Working nonstandard schedules and variable shifts in low-income families: Associations with parental psychological well-being, family functioning, and child well-being. Developmental Psychology. 2007; 43:620–632. [PubMed: 17484575]

Institute of Medicine of the National Academies. Childhood obesity in the United States: Facts and figures. Institute of Medicine of the National Academies; 2004 September. Retrieved from http://www.iom.edu/Object.File/Master/22/606/FINALfactsandfigures2.pdf

Institute of Medicine of the National Academies. Preventing Childhood Obesity: Health in the Balance. Washington, DC: National Academies Press; 2005.

Jabs J, Devine C, Bisogni C, Farrell T, Jastran M, Wethington E. Trying to find the quickest way: Employed mothers' constructions of time for food. Journal of Nutrition Education and Behavior. 2007; 39:18–25. [PubMed: 17276323]

Janz KF, Witt J, Mahoney LT. The stability of children's activity as measured by accelerometry and self report. Medical Science: Sports Exercise. 1995; 9:1326–1332.

Johnson, JO. Who's minding the kids? Child care arrangements: Winter 2002. U.S. Census Bureau, U.S. Department of Commerce; 2005 October.

Johnson, RC.; Kalil, A.; Dunifon, RE. Work after welfare reform and the well-being of children: Evidence from the Michigan Women's Employment Survey. Kalamazoo, MI: W. E. Upjohn Institute for Employment Research; 2009.

Kuczmarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, Wei R, Curtin LR, Roche AF, Johnson CL. 2000 CDC Growth Charts for the United States: Methods and development. Vital Health Statistics. 2002; 11:1–190.

Joshi P, Bogen K. Nonstandard schedules and young children's behavioral outcomes among working low-income families. Journal of Marriage and Family. 2007; 69:139–156.

La Valle, I.; Arthur, S.; Millward, C.; Scott, J.; Clayden, M. Happy families? Atypical work and its influence on family life. Bristol, UK: The Policy Press; 2002.

McMenamin T. A time to work: Recent trends in shift work and flexible schedules. Monthly Labor Review. 2007; 130:3–15.

Miller D, Han W-J. Maternal nonstandard work schedules and adolescent overweight. American Journal of Public Health. 2008; 98:1495–1502. [PubMed: 18556610]

Needham B, Crosnoe R. Overweight status and depressive symptoms during adolescence. Journal of Adolescent Health. 2005; 36:48–55. [PubMed: 15661596]

NICHD Early Child Care Research Network. Familial factors associated with the characteristics of non-maternal care for infants. Journal of Marriage and the Family. 1997; 59:389–408.

National Institutes of Health. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. Washington, DC: NIH; 1998. p. 98-4083.

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]

Planet Health: An Interdisciplinary Curriculum for Teaching Middle School Curriculum and Physical Activity. 2007. Retrieved from http://www.planet-health.org/

Presser H. Toward a 24-hour economy. Science. 1999; 284:1778–1779.

Presser H. Nonstandard work schedules and marital instability. Journal of Marriage and the Family. 2000; 62:93–110.

Presser, H. Working in a 24/7 economy: Challenges for American Families. New York: Russell Sage Foundation; 2003.

Presser, H. Employment in a 24/7 economy. In: Crouter, A.; Booth, A., editors. Work-family challenges for low-income parents and their children. Mahwah, NJ: Erlbaum; 2004. p. 83-106.

Presser H, Cox A. The work schedules of low-educated American women and welfare reform. Monthly Labor Review, April. 1997:25–34.

Puhl R, Brownell K. Bias, discrimination and obesity. Obesity Research. 2001; 9:788–805. [PubMed: 11743063]

Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. Applied Psychological Measurement. 1977; 1:385–401.

Rapoport B, Le Bourdais C. Parental time and working schedules. Journal of Population Economics. 2007 April.21:903–932.

Ross-Phillips, K. Parent work and child well-being in low-income families. Washington, DC: Urban Institute; 2002.

Ruhm, C. Labour Economics. Vol. 15. 2008. Maternal employment and adolescent development; p. 958-983.

Snell E, Adam A, Duncan J. Sleep and the body mass index and overweight status of children and adolescents. Child Development. 2007; 78:309–323. [PubMed: 17328707]

Strauss RS. Childhood obesity. Current Problems in Pediatrics. 1999; 29:1–29. [PubMed: 9919427]

Strazdins L, Korda R, Lim L, D.H. Broom D, D'Souza R. Around-the-clock: parent work schedules and children's well-being in a 24-h economy. Social Science & Medicine. 2004; 59:1517–1527. [PubMed: 15246179]

Strazdins L, Clements M, Korda R, Broom D, D'Souza R. Unsocialised work? Nonstandard work schedules, family relationships, and children's wellbeing. Journal of Marriage and Family. 2006; 68:394–410.

Sturm R. The effects of obesity, smoking, and drinking on medical problems and costs. Health Affairs. 2002; 21:245–253. [PubMed: 11900166]

Vandell DL, Pierce KM. Self-Care Checklist—Child. Study of After-School Care glossary. 2000

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.

Wight V, Raley S, Bianchi S. Time for children, oneself, and one's spouse among parents who work nonstandard hours. Social Forces. 2008; 87:243–271.

Ziol-Guest K, DeLeire T, Kalil A. The allocation of food expenditure in married and single-parent families. Journal of Consumer Affairs. 2006; 40:347–371.

Table 1

Sample Descriptive Statistics at 3rd Grade.

	Maternal Work Status and Schedule				
	Nonemployed	**Employed**	**Standard**	**Nonstandard**	**Sample**
Proportion of sample	24.44%	75.65%	65.81%	34.19%	100%
Background characteristics:					
% Child is male	48.29%	51.29%	49.63%	54.32%	50.55%
% Child is White	77.56%	78.23%	78.84%	76.98%	78.07%
% Child is Black[a]	7.64%	12.18%	11.24%	14.03%	11.06%
% Child is Hispanic	6.46%	5.66%	6.37%	4.32%	5.86%
% Child is another race[a]	8.37%	3.94%	3.56%	4.68%	5.02%
Child birth weight (g)	3,481 (528)	3,508 (509)	3,519 (490)	3,485 (544)	3,502 (514)
Maternal education (in years)[a]	14.14 (2.51)	14.53 (2.45)	14.63 (2.54)	14.33 (2.26)	14.43 (2.47)
Time-varying Covariates:					
Hours per week mother works[a]	0	35.46 (13.15)	35.43 (11.32)	35.60 (16.08)	26.79 (19.06)
% Mother is married/cohabitating[ab]	87.60%	79.50%	77.06%	84.13%	81.48%
% Father/partner works 35 or more hours per week (if mother is partnered)[b]	92.92%	92.25%	94.04%	89.47%	92.42%
Number of adults in the home	1.97 (.38)	1.91 (.56)	1.89 (.58)	1.96 (.52)	1.93 (.52)
Number of children in the home[a]	2.78 (1.06)	2.28 (.92)	2.24 (.91)	2.37 (.94)	2.40 (.98)
% Family is low-income[a]	30.38%	21.74%	19.51%	25.79%	23.83%
Maternal depression	8.66 (8.68)	9.15 (8.91)	8.72 (8.94)	9.91 (8.76)	9.03 (8.85)
Number of epochs mother was employed[a]	5.27 (4.10)	11.15 (4.01)	11.23 (3.92)	10.98 (4.17)	9.70 (4.75)
Number of epochs mother worked nonstandard schedule[ab]	2.10 (3.04)	2.99 (3.55)	1.75 (2.56)	5.37 (3.97)	2.81 (3.47)
Mediating Variables:					
Hours per week child watched TV	14.91 (10.73)	15.26 (9.67)	15.07 (9.56)	15.56 (9.88)	15.17 (9.93)
% of time spent in moderate to vigorous physical activity	22.59% (5.67)	22.19% (5.97)	22.36% (5.87)	21.83% (6.12)	22.29 (5.91)
Total HOME Score[b]	.03 (1.08)	−.001 (.97)	.07 (.93)	−.14 (1.04)	.01 (1.00)
Minutes per week child spent unsupervised[a]	6.06 (33.22)	39.17 (127.53)	44.26 (136.17)	29.45 (108.67)	31.32 (113.43)
Minutes per week child spent in structured activities or lessons[a]	68.01 (96.70)	48.31 (71.92)	49.15 (72.77)	46.74 (70.48)	52.98 (78.90)
Minutes per week child spent with parents[ab]	807.79 (218.67)	580.73 (313.93)	534.54 (321.78)	669.04 (277.69)	634.56 (309.52)
Outcome variable:					
Body Mass Index (standardized)	−.05 (.92)	.01 (1.02)	−.01 (1.00)	.04 (1.06)	−.01 (1.00)

	Maternal Work Status and Schedule				
	Nonemployed	**Employed**	**Standard**	**Nonstandard**	**Sample**
% of children overweight or at risk for being overweight (>=85th percentile for age)	35.71%	34.31%	34.18%	34.73%	34.63%
% of children overweight (>=95th percentile for age)	19.05%	18.49%	18.14%	19.25%	18.61%
N	263	813	534	278	1,076

Note Means and standard deviations are presented for continuous variables; percentages are provided for categorical variables. The sample includes children whose mothers provided employment status at 3rd grade.

[a]Children with non-employed mothers and those with employed mothers significantly differ ($p < .05$).

[b]Among families with employed mothers, children with mothers working standard schedules and those with mothers working nonstandard schedules significantly differ ($p < .05$).

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Table 2

Predicting Child Body Mass Index: Random Effects and Within-Child Fixed Effects Regression Results

	Random Effects Results				Within-Child Effects Results			
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 1**	**Model 2**	**Model 3**	**Model 4**
	B (SE)	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***	***B (SE)***
Number of periods mother was employed	.002 (.006)				.02* (.01)			
Mother was employed		−.01 (.04)				.01 (.04)		
Number of periods mother worked nonstandard schedule			−.006 (.007)				.005 (.012)	
Mother worked a nonstandard schedule				04† (.02)				.04† (.02)
Grade 3 (reference)								
Grade 5	.01 (.02)	.01 (.01)	.01 (.01)	.01 (.01)	−.03 (.02)	.01 (.01)	.01 (.01)	.02 (.02)
Grade 6	.01 (.02)	.01 (.01)	.02 (.01)	.01 (.01)	−.04 (.03)	.01 (.01)	.01 (.02)	.03† (.02)
Hours per week mother works	.001 (.001)	.001 (.001)	.001 (.001)	<.001 (.001)	<.001 (<.001)	<.001 (.001)	<.001 (.001)	<.001 (.001)
Maternal depression	<.001 (.001)	<.001 (.001)	<.001 (.001)	<.001 (.001)	<.001 (.001)	<.001 (.001)	−.001 (.001)	−.001 (.001)
Mother is married or cohabiting	−.04 (.04)	−.04 (.04)	−.03 (.05)	−.04 (.04)	−.01 (.05)	−.01 (.05)	−.004 (.047)	−.04 (.06)
Father/partner works 35 or more hours per week	<.001 (.03)	<.001 (.03)	−.01 (03)	.002 (.033)	−.004 (.033)	−.002 (.033)	−.01 (.03)	.004 (.04)
Number of adults in the home	.05* (.02)	.05* (.02)	.05* (.02)	.05* (.02)	.05† (.03)	.04† (.03)	.04† (.03)	.08** (.03)
Number of children in the home	−.04 (.02)*	−.05* (.02)	−.04* (.02)	−.04* (.02)	.02 (.03)	−.03 (.02)	−.03 (.02)	−.04 (.04)
Family is low-income	.03 (.03)	.03 (.03)	.03 (.03)	.03 (.03)	.02 (.03)	.01 (.03)	.01 (.03)	.01(.04)
Child is male	−.02 (.06)	−.01 (.06)	.01 (.06)	−.01 (.06)				
Child is Black	.32** (.10)	.32** (.10)	.30** (.11)	.32** (.10)				
Child is Hispanic	−.01 (.12)	−.01 (.13)	−.01 (.13)	−.01 (.12)				
Mother's age at child's birth	<.001 (.001)	<.001 (.01)	<.001 (.01)	<.001 (.01)				
Mother's years of education	−.03 (.02)	−.02 (.02)	−.02 (.02)	−.02 (.02)				
Child's birth order	−.04 (.04)	−.04 (.04)	−.04 (.04)	−.04 (.04)				
Child's birth weight (kg)	.32*** (.06)	.32*** (.06)	.32*** (.06)	.32*** (.06)				
Average family income-to-needs ratio 6–54 months	−.03† (.01)	−.02 (.02)	−.03* (.01)	−.02† (.01)				
Constant	−.46 (.31)	−.46 (.31)	−.46 (.32)	−.46 (.31)	−.25* (.13)	−.02 (.04)	−.03 (.05)	−.002 (.06)
R^2 (within for FE)	.083	.085	.086	.084	.007	.004	.005	.015
N	985	985	950	829	990	990	954	829

† $p < .10$.

*$p < .05$.

**$p < .01$.

***$p < .001$

Note: Time-invariant covariates were included in the random effects models only. Data collection site was also controlled in the random effects models (not shown).

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