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Article

Does mothers' employment affect adolescents' weight and activity levels? Improving our empirical estimates

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ABSTRACT

Women's lives are marked by complex work and family routines — routines that have implications for their children's health. Prior research suggests a link between mothers' work hours and their children's weight, but few studies investigate the child health implications of increasingly common work arrangements, such as telecommuting and flexible work schedules. We examine whether changes in mothers' work arrangements are associated with changes in adolescents' weight, physical activity, and sedentary behavior using longitudinal data and fixed effects models to better account for mothers' social selection in to different work arrangements and children's underlying preferences. With data from the National Longitudinal Study of Adolescent to Adult Health (N = 10,518), we find that changes in mothers' work arrangements are not significantly associated with adolescents' weight gain or physical activity but are significantly associated with adolescents' sedentary behavior. Adolescents' sedentary behavior declines when mothers become more available after school and increases when mothers work more hours or become unemployed. In sum, after accounting for unobserved, stable traits, including mothers' selection into jobs with more or less flexibility, mothers' work arrangements are most strongly associated with adolescents' sedentary behavior.

Introduction

The issue of adolescent obesity has garnered considerable attention in recent years, due in part to the fact that the prevalence of adolescent obesity nearly quadrupled since the late 1970s (Ogden & Carroll, 2010). This trend is foreboding because adolescent overweight and obesity are often precursors to debilitating chronic conditions such as hypertension, diabetes, and orthopedic disorders (Must & Strauss, 1999). Given these additional risks, physicians and epidemiologists fear that, for the first time, younger generations of Americans will not be healthier than – or even live as long – as their parents (Olshansky et al., 2005).

Adolescents' engagement in physical activity and sedentary behaviors are viewed as important mechanisms in the development of adolescent overweight and obesity (Must & Tybor, 2005), as well as significant behaviors for adolescent aerobic fitness, skeletal health, and psychological well-being (Hallal, Victora, Azevedo, & Wells, 2006). Although some question whether obesity is primarily a risk factor for increased social stigma instead of medical issues (Saguy, 2012), few scholars debate the importance of adolescents' physical activity. Further, behavioral patterns established in adolescence form the foundation for life-long health habits (Harris, Gordon-Larsen, Chantala, & Udry, 2006; Nelson, Gordon-Larsen, Adair, & Popkin, 2005). Thus, adolescent weight and adolescents' engagement in physical activity and sedentary behaviors (e.g., television viewing) are important indicators of adolescent health. For brevity, we refer to physical activity and sedentary behaviors jointly as adolescents' "activity levels" below.

The dramatic rise in adolescent overweight and obesity was preceded by an important shift in American families: the rise in maternal employment. Maternal employment increased from 47% in 1975 to 70% in 2016 (Galinsky, Aumann, & Bond, 2011; U.S. Bureau of Labor Statistics, 2013) and led to noteworthy transformations in families' time use and daily routines (Bianchi, 2011). The temporal sequencing of rising maternal employment followed by rising adolescent obesity have led some to posit a causal relationship. Undergirding this hypothesis are traditional gender norms that place greater responsibility on mothers for children's care (Christopher, 2012). Even today, mothers serve as children's primary caregivers despite increases in fathers' involvement since the 1960s (Bianchi, 2000; Bianchi, Sayer, Milkie, & Robinson,

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2012). A common concern is that any time mothers give to paid work results in an equivalent loss of time and attention for their children (Gottfried, Gottfried, & Bathurst, 2002). Further, the historic rise in maternal employment coincided with rising societal expectations for mothers' intensive involvement with their children (Hays, 1996). Mothers' time is viewed as irreplaceable and critical for children's health and development (Hays, 1996). Along this vein, mothers are expected to be home to monitor and instruct their children to make "healthy choices" in order to curtail the risks of our obesogenic environment (Wright, Maher, & Tanner, 2015). Indeed, the rise of childhood obesity has intensified the cultural discourse about maternal responsibilities for children's health and instilled new fears that mothers' paid employment undermines their ability to protect their children's health (Wright et al., 2015).

Given the medical and social alarms about this obesity "epidemic," as well as the social norms emphasizing mothers' caregiving roles, numerous studies have sought to establish a link between maternal employment and children's risk of obesity (e.g., Anderson, Butcher, & Levine, 2003; Miller, 2011; Ziol-Guest, Dunifon, & Kalil, 2013). Unfortunately, much of the prior work on maternal employment has several methodological limitations that obscure causal associations between maternal employment and adolescent weight, physical activity, and sedentary behaviors. First, prior research typically measures mothers' employment status and usual hours of paid work, but these indicators are inadequate given that an hour of paid work does not translate into an hour less of childcare (Bianchi, 2000). Flexible work arrangements have become increasingly popular and more available in the past few decades (McMenamin, 2007), but research examining the implications for parenting and children's health are lagging. A key consideration is the match between mothers' paid work and their child's schedules and, thus, the opportunity for mothers to influence children's weight and weight-related behaviors (Zaslow, Jekielek, & Gallagher, 2005). Second, most prior work on adolescents does not address the risks of social selection, meaning the non-random assignment of mothers to different work arrangements (Golden, 2001). As such, the observed estimates are likely biased.

We seek to address these limitations. First, we utilize more detailed measures of maternal employment to consider both the location and timing of mothers' work in relation to their child's schedule. Second, to address the risks of social selection, we control for an extensive list of social confounders and leverage change over time to estimate child fixed effects models. Given we restrict our sample to youth who consistently live with their mother, the fixed effect models control for both adolescents' unobserved, stable weight-related preferences and mothers' unobserved, stable traits that lead them to select into different employment options and parenting practices. These improvements not only advance the academic scholarship on this topic but can also inform public debates regarding the risks and benefits of maternal employment.

Background

Mothers' labor force participation is theorized to influence the family's health environment (e.g., parenting practices and leisure activities) which, in turn, influences children's physical activity, nutrition, and obesity (Davison & Birch, 2001). Because dietary intakes are absent or poorly measured in large social surveys (Livingstone & Robson, 2000), we focus on adolescents' body mass index, engagement in physical activity, and hours of sedentary behavior.

In general, prior research finds that mothers' employment and paid work hours are positively associated with a greater body mass index (BMI) and the risk of being overweight or obese among children (Anderson et al., 2003; Cawley & Liu, 2012; Champion et al., 2011; Fertig, Glomm, & Tchernis, 2009; Morrissey, 2013; Morrissey, Dunifon, & Kalil, 2011) and adolescents (Bauer, Hearst, Escoto, Berge, & Neumark-Sztainer, 2012; Miller, 2011; Ziol-Guest et al., 2013). Fewer studies have examined the role of maternal employment for children's activity levels. For youth sedentary behavior, prior research finds mothers' employment and paid work hours are positively correlated with children's television viewing (Benson & Mokhtari, 2011; Datar, Nicosia, & Shier, 2014; Fertig et al., 2009). Contrary to expectations, the sole American study finds a positive association between mothers' usual work hours and youth physical activity (Datar et al., 2014). The incongruent patterns for physical activity, sedentary behaviors and weight suggest potentially nuanced processes or social selection issues.

Although most research on the risks of maternal employment for youth obesity has focused on young children, we focus on adolescents for several reasons. First, adolescence involves numerous, biological, cognitive, and social transitions (Steinberg, 2005) and the development of life-long identities, preferences, and habits (Harris, 2010). Second, adolescence is a developmentally sensitive period for weight gain (Lee, Lee, Guo, & Harris, 2011). Whereas young children often engage in high levels of physical activity (Kimm et al., 2002), physical activity declines steeply and time spent in sedentary activities increases during adolescence (Mitchell, Pate, Beets, & Nader, 2013; Nelson, Neumark-Stzainer, Hannan, Sirard, & Story, 2006), especially for girls (Nelson et al., 2006). Finally, the interaction of the labor market and family contexts for child development might pose particular risks for adolescents. Although mothers of young children spend more time engaged in direct, physical care activities (Shonkoff & Phillips, 2000), mothers of adolescents expend tremendous effort to coordinate their paid work and adolescents' after-school time to foster greater communication and ensure their adolescent's safety (Kurz, 2000). Further, mothers' time with adolescents is essential for monitoring and structuring adolescents' time (Duncan, Duncan, & Strycker, 2002; Milkie, Nomaguchi, & Denny, 2015; Stattin & Kerr, 2000). Indeed, Milkie et al. (2015) found that, unlike younger children, mothers' time mattered for adolescents, evinced by less engagement in risky behaviors. Zaslow et al. (2005) argue that a work-developmental mismatch can occur when the demands of the workplace exceed the needs of workers and their adolescent children, especially when parents' work arrangements result in too much autonomy and unsupervised time for adolescents. This mismatch could, thus, exacerbate the developmental risks for adolescent weight gain.

Although prior research has offered important insights regarding the associations between maternal employment and adolescent obesity risks and activity levels, there remain important limitations. First, there are challenges with the measurement of maternal employment, especially given the notable diversity in mothers' employment patterns and experiences (Damaske, 2011). Prior work typically measures whether mothers engage in paid employment and their usual work hours. Although recent studies have also explored mothers' engagement in non-standard shift work for adolescent obesity (Miller & Han, 2008) and physical activity (Han, 2006), we argue that additional measures are warranted to better capture mothers' work arrangements. In particular, it is important to measure the timing and location of her paid work, meaning her use of "flextime" (i.e., working at times that differ from the standard, 8 a.m. to 5 p.m. schedule) and "flexspace" (i.e., telecommuting) arrangements. These work options are increasingly available, quite popular, and may help ease frictions between work and family commitments (Rau, 2003), though the accommodations and accessibility of these flexible work options varies across the labor force (Correll, Kelly, O'Connor, & Williams, 2014; McMenamin, 2007).

We draw upon the Work-Home Resources (WHR) Model (ten Brummelhuis & Bakker, 2012) to guide suppositions on the timing and location of mothers' work and their children's activity levels. The WHR model describes the processes whereby parents' work experiences can positively or negatively influence their parenting abilities and home life by either depleting or enriching parents' personal resources (e.g., time, energy, and mood). The key factor is not parents' employment *per se* but their work demands and resources. Supporting this argument, prior research finds that parents who experience excessive work demands

spend less time with their children (Roeters, Lippe, van der Kluwer, & Raub, 2012), have worse moods and energy levels at home (Gassman-Pines, 2013), are more withdrawn from their children (Repetti & Wood, 1997), and have lowered capacity to monitor to their children's activities (Bumpus, Crouter, & McHale, 1999). In contrast, positive work experiences improves parents' moods at home, and in turn, improves their adolescents' mood and physical health (e.g., Lawson, Davis, McHale, Hammer, & Buxton, 2014). Finally, availability of flextime and flexspace is associated significantly lower experiences of work-family conflict despite concerns that flexible work arrangements could inadvertently blur work-family boundaries and increase spillover from work to family life (Allen, Johnson, Kiburz, & Shockley, 2013).

We argue that mothers' access to and utilization of flextime and flexspace benefits can lead to three maternal resources that affect adolescents' activity levels and obesity risks. First, mothers with these workplace benefits can rearrange their schedule and be present when their children are home. Prior research finds that improving employee's control over work increases parents' daily time with children, especially for mothers (Davis et al., 2015). Second, mothers with flextime benefits can reduce work-to-home spillover (Moen, Fan, & Kelly, 2013) and mothers' work-to-home spillover is positively correlated with adolescents' body mass index (BMI; You & Davis, 2010). Third, flexible schedules can improve mothers' parenting capacity because they help reduce mothers' daily stress levels (Almeida & Davis, 2011) and increase their exercise participation (Moen, Kelly, Tranby, & Huang, 2011). As such, we expect parents with more flexible schedules are better able to model, monitor and instruct their adolescents about their weight-related behaviors. In sum, indicators of mothers' availability and telecommuting are important dimensions of modern work arrangements and these work resources could prove beneficial for adolescents' weight and activity levels.

To capture the benefits that flextime and flexspace can provide mothers for coordinating work and parenting responsibilities, it is important to consider the adolescent's schedule as well. Although this may seem obvious, prior research has not considered the alignment of mothers' and adolescents' schedules. For adolescents, this is particularly relevant given their greater involvement in after-school, extra-curricular activities shifts the window within which mothers and adolescents interact. Research relying on time use data documents a slight negative association between maternal work hours and mother-child time together (Bianchi, 2000; Sayer, Bianchi, & Robinson, 2004). Most prior studies predicting children's weight and activity levels do not measure mother-child time together and most studies with time use data have limited to no information on children's weight and weight-related behaviors (Cawley & Liu, 2012; Fertig et al., 2009). Our study fills this gap by measuring a mother's availability in relation to her adolescent's schedule and then evaluates the significance of their aligned schedules for adolescents' weight and activity levels.

A second important challenge in prior research is social selection. Women are not randomly assigned to, nor have equal access to, particular work arrangements (Correll et al., 2014; Golden, 2001). Several demographic traits predict mother's labor force participation, such as family income, the number of children, presence of a child under age six, having a child with disability, and the co-residence of a partner or other related adults (Becker, 1981; Bianchi, Robinson, & Milke, 2006; Porterfield, 2002; Stern, 1989). Maternal education is also important and generally leads to higher-status occupations that simultaneously provide greater access to flexible work arrangements (Presser, 2005) but require longer work hours (Jacobs & Gerson, 2005). Further, family income, parents' marital status, and the number of children predict higher levels of parent-child warmth (Riina, Lippert, & Brooks-Gunn, 2016). Many of these traits are associated with adolescent weight and screen time. Specifically, maternal education (Martin, Frisco, Nau, & Burnett, 2012) and number of siblings (Datar, 2017) are negatively correlated with weight. Family income (Wethington, Pan, & Sherry, 2013) and number of siblings (Sisson, Sheffield-Morris, Spicer, Lora, & Latorre, 2014) are negatively correlated with screen time, while living in a stepparent family is associated with greater screen time (Sisson et al., 2014). The relationship between family socioeconomic status and adolescent physical activity is generally positive, but not always statistically significant (Sallis, Prochaska & Taylor, 2000). We control for these demographic traits and mothers' socioeconomic status.

Yet, not all traits that select mothers into different work arrangements are observable in survey data. Several unobserved, but stable traits of mothers not only select them into different work arrangements, but also into different parenting practices. Among these, two important unobserved traits are (1) the salience of their mother role-identity and (2) conscientiousness. Regarding the former, the salience of a woman's motherhood role-identity is the extent to which a woman privileges the mother role-identity above all other roles (Callero, 1985; Stryker, 1968). Regarding the second, conscientiousness is a personality trait defined as a person's prudence, dependability, organizational skills, and persistence (Friedman & Kern, 2014) that is relatively stable in adulthood (Cobb-Clark & Schurer, 2012).

We argue that both conscientiousness and the salience of the mother role-identity would influence mothers' parenting and labor force participation. First, we speculate that women with these personality and identity traits are more likely to deliberately reduce their children's obesity risks. Given conscientious persons are more likely to engage in healthy behaviors and seek out healthy environments (Friedman & Kern, 2014), we speculate that conscientious mothers will develop a home environment that reduces children's obesity risks. Further, we hypothesize that conscientious women and women who privilege their mother role-identity are more responsive to medical professionals' advice regarding children's health and physical activity. Second, these identity and personality traits are also important for women's labor force participation. On the one hand, women who prioritize motherhood above all other role-identities are more likely to stay out of the labor force or work fewer hours (Hays, 1996). On the other hand, among those that seek employment, women with these traits are likely to pursue jobs that offer flexible hours and/or scheduling. In other words, their work arrangements result from both their own and their employers' decisions, although prior work on maternal labor force participation implicitly assumes that work arrangements are external to maternal preferences. Together, mothers' role-identity salience and conscientiousness would affect mothers' norms, parenting behaviors, and labor force participation and, thus, simultaneously affect both her work arrangements and her adolescent's health behaviors and obesity risks. Unfortunately, these traits are difficult to control for in studies leveraging large social surveys and multivariate models. Without their inclusion, however, prior estimates of the significant, positive associations between maternal employment and adolescent weight, physical activity and sedentary behavior are likely upwardly biased (MacKinnon, Krull, & Lockwood, 2000). As such, as a field, we have likely overestimated the importance of maternal employment and work hours for adolescent weight and activity.

These social selection issues plague all research estimating the effects of maternal employment. Yet only two prior studies examining the effects of maternal work hours for adolescent weight seek to address these selection effects and the results are contradictory. Miller (2011) finds that mothers' work hours remain statistically significant in the prediction of adolescent overweight (especially for youth in single-mother families) after controlling for social selection using child fixed effect models; by contrast, Ziol-Guest et al. (2013) find maternal work hours are no longer statistically significant once they control for social selection using sibling models. It is worth noting that the few studies that account for mothers' social selection into labor force participation to study the effects of maternal work hours for younger children's risk of obesity also arrive at mixed conclusions (Anderson et al., 2003; Jung & Chang, 2016; Morrissey et al., 2011). To our knowledge, no studies of adolescent physical activity or sedentary behaviors address this social selection issue.

We address the issue of mothers' selection into different work arrangements by estimating child fixed effects models among a sample of adolescents who consistently live with their mother. We leverage time-varying information on adolescents' weight, activity levels, and mothers' work arrangements across Waves 1 and 2 of the National Longitudinal Study of Adolescent to Adult Health (Add Health) to better approximate the causal effect of these work arrangements. Fixed effects models address problems of non-random assignment of observations to the key independent variables of interest (Allison 1990; Johnson 2005) – here the non-random assignment of mothers to particular work arrangements based on their difficult-to-measure, underlying traits. In addition, these child fixed effects models remove the effects of individual differences in the adolescents' time-invariant preferences for physical activity and other weight-related behaviors (Allison 1990; Johnson 2005). Fixed effects models are preferred to lagged dependent variable models because the fixed effects results are robust to measurement error and omitted variables, whereas lagged dependent variables are not (Johnson, 2005).

There are, however, important trade-offs by estimating fixed effects models. First, by improving our ability to draw causal inferences, the results become less generalizable because they rely on the subset of adolescents who experience a change in the dependent variables (Allison, 2005; Johnson, 2005). Fortunately, we retain 95% of the sample in the models predicting sedentary behavior and 75% of the sample for predicting adolescents' sports and exercise participation. Because only 9% of the sample changes overweight/obesity status, we also estimate supplemental models predicting BMI percentile for the 93% of the sample that changes BMI percentile between waves. Second, the models cannot account for unobserved, time-varying changes in the family. To minimize this risk, we measure and control for numerous observable changes, such as whether the youngest child becomes age-eligible for elementary school and if people move in or out of the household. In sum, our expanded measures of mothers' work arrangements and the estimation of fixed effects models better approximate the causal effects of maternal employment on adolescent weight and activity levels.

Materials and methods

Data

Add Health is a United States school-based sample of 1994-1995 7th–12th graders from over 140 high schools and middle schools (Udry, 2003). The original sample was collected in schools in 1994, and followed up in homes in 1994–1995 (Wave 1), 1995–1996 (Wave 2), 2001–2002 (Wave 3) and 2007–2008 (Wave 4). Add Health includes oversamples of Cubans, Puerto Ricans, Chinese, and high socioeconomic status African Americans (Harris et al., 2003). Although the Add Health Wave 1 and Wave 2 surveys are now quite old, this is the only data set that measures the alignment of mothers' and adolescents' schedules and longitudinally measures adolescent weight, activity levels and mothers' work arrangements. As such, it is the only data set that allows us to estimate the child fixed effects models and reduce social selection bias.

We make several restrictions to arrive at our final sample. Of the 14,736 adolescents interviewed in Wave 2, we drop those who do not live with a "residential mother" in both Waves 1 and 2 (n = 1355). To ensure we accurately identify and track the same mothers across waves, we drop youth who live in one of the following family types in either wave (n = 956): foster family, lesbian family, family with three or more parent-like figures (e.g., mother, father, and father's partner), or two-parent family within which the identified guardians have different relationships to the child across waves. To eliminate the confounding of pregnancy, weight and weight-related behaviors, we drop female adolescents who were pregnant in either Wave 1 or 2 (n = 476). Next, we drop respondents who are age 19 and older in Wave 2 (n = 669). Lastly, we drop those without a Wave 2 survey weight (n = 762). Our final sample is 10,518 adolescents.

Most of our variables have low levels of item non-response (i.e., less than 5%), but the following three items deriving from the Wave 1 parent interview (which was not completed for 11% of our sample) have the highest proportions of missing data: family income (21%), youth birth weight (12%), and mother's obesity status (11%). To address item non-response, we use multiple imputation assuming multivariate normal distributions for missing variables in Stata 14. We generate eight person-level imputations and include several auxiliary variables in the imputation model, measured in Waves 1 and 2 unless otherwise noted: parent report of difficulty paying bills (Wave 1), whether the youth plays sports with a parent, frequency of eating family dinners, frequency of eating fast food, whether the youth usually skips breakfast, youth smoking, maternal smoking (Wave 1), and the number of school-based sports teams the youth participated in (In-school survey). For our analyses, we appropriately pool imputation estimates (Rubin, 1987) using the "mi estimate" Stata command.

Measures

For the standard, cross-sectional models, we use Wave 2 data on the independent and dependent variables with some additional measures from the Wave 1 parent survey. For the longitudinal and fixed effects models, we rely on time-varying information consistently measured in the in-home Wave 1 and Wave 2 adolescent surveys.

Adolescent weight

We calculate adolescents' body mass index (BMI = weight in kilograms/[height in meters]^2) based on their Wave 1 and Wave 2 self-reported weight and height. Although interviewer-measured BMI is more accurate (Strauss, 1999), self-reported BMI correctly classifies 96% of adolescents' obesity status and has been validated for research use (Goodman, Hinden, & Khandewal, 2000). Further, Add Health did not objectively measure adolescents' height and weight in Wave 1. We then translate these raw BMI scores into BMI percentiles to account for standard age- and sex-based growth curves in accordance with Centers for Disease Control procedures (Ogden, Kuczmarski, et al., 2002). Adolescents whose BMI is greater than or equal to the 85th percentile are considered overweight, while those in the 95th percentile or greater are considered obese (Ogden, Kuczmarski, et al. 2002).

Adolescent activity levels

We predict scaled measures of adolescents' physical activity and sedentary behavior based on adolescents' Wave 1 and Wave 2 self-reports. Add Health asked adolescents to report the number of times they engaged in various leisure activities during the past week (0 = "not at all," 1 = "1 or 2 times," 2 = "3 or 4 times" and 3 = "5 or more times"). Adolescents were asked to recall how often they "play an active sport, such as baseball, softball, basketball, soccer, swimming or football," and "do exercise, such as jogging, walking, karate, jumping rope, gymnastics or dancing." We sum the values for these two items into a scale ranging from 0 to 6. To calculate the adolescent's sedentary behavior, we sum their self-reported weekly hours of watching television, watching videos, and playing video or computer games.

Mothers' work arrangements

For each residential parent in both Waves 1 and 2, adolescents respond to the question "Approximately, how many hours a week does s/he work for pay?" We create variables indicating mothers' paid work hours and its quadratic (i.e., hours^2), and a flag to indicate she does not work for pay (= 1). To measure mothers' availability in relation to the child's schedule, we utilize adolescents' responses to the following question asked in both Waves 1 and 2: "How often is she at home when you leave for school?" (0 = "never," 1 = "almost never," 2 = "some of the time," 3 = "most of the time," 4 = "always," or 5 = "she takes me

to school"). Add Health asked identical questions about mothers' after-school availability with the final option instead phrased as "she brings me home from school." We collapse responses indicating that the mother was always available or transported the adolescent to/from school. Adolescents also report in Waves 1 and 2 whether currently employed residential mothers work outside the home, at home, or both. To measure mothers' telecommuting, we combine mothers who always and sometimes work from home into one category (= 1). Mothers who never work from home are the reference group. For the supplemental models restricted to youth living with a residential father, we measure fathers' work arrangements in the same manner.

Time-invariant control variables

We control for several adolescent characteristics associated with adolescent weight and activity levels (Cook, Li, & Heinrich, 2015; Sallis et al., 2000) and maternal employment (Bianchi et al., 2006): adolescent sex (female = 1), whether the youth has a physical or learning disability (= 1, Wave 1 parent report), whether the youth is the first-born child (= 1), and race/ethnicity and nativity with the following seven categories: non-Latino White with two U.S.-born parents (omitted category); non-Latino Black with two U.S.-born parents; Latino with two U.S.-born parents; "other" race with two U.S.-born parents; Latino with an immigrant parent; Non-Latino Asian with an immigrant parent; and "other" race with an immigrant parent. We also control for family traits that predict adolescent weight and activity levels (Molnar, Gortmaker, Bull, & Buka, 2004; Sallis et al., 2000) measured only in Wave 1: mother's educational attainment (a 5-category variable based on adolescent and parent reports), mother's obesity status (= 1, parent report), family income (parent report for the prior year), and Census region.

Time-varying control variables

We also control for several adolescent-reported, time-varying characteristics: adolescent age, pubertal development, mother's age, mother's disability status (= 1), mother's occupational status (Duncan SEI score), the number of co-residential children, whether there is a child under age six in the home (= 1), the number of parents in the home, the number of co-residential non-guardian adults, and whether the adolescent or interviewer reports the neighborhood is unsafe (= 1).

Statistical analysis

All models are weighted using the Wave 2 person weight and account for the clustering of adolescents within schools. We begin with standard, cross-sectional models of adolescents' Wave 2 weight and activity levels. Model 1 includes mothers' employment status, her work hours and the demographic control variables, meaning all control variables minus the mothers' socioeconomic traits (i.e., educational attainment, occupational status). Then we add our new indicators of mother's before- and after-school availability and working from home (Model 2) and, finally, mother's socioeconomic traits (Model 3). To leverage the longitudinal nature of Add Health, we estimate models that stack Wave 1 and Wave 2 data and includes both time-invariant and time-varying information plus a control for which wave the data derive from (Model 4). Finally, we estimate fixed effects models that leverage change in the independent variables between waves to predict change in the dependent variables and net out the effects of time-invariant unobserved traits of the adolescent and their mother (Model 5). To estimate these fixed effects models, we use the "xtreg" Stata command, including for the prediction of adolescents' overweight status to be able to include the survey weights for these multiply imputed data.

Table 1
Weighted descriptive statistics for multiply-imputed analytic sample (N = 10,518).

		Means/proportions	
	Range	Wave 1	Wave 2
Dependent variables			
Overweight or obese (= 1)	0,1	0.25	0.25
Body Mass Index Percentile	0–100	0.60	0.59
Sports-exercise engagement	0–6	3.19	3.11
Hours of sedentary behavior	0–200	23.13	21.07
Mother's work arrangements			
Does not work for pay (= 1)	0, 1	0.22	0.21
Availability before school	0–4	2.93	2.95
Availability after school	0–4	2.22	2.15
Among employed mothers			
Total work hours	0–100	36.55	37.48
Total work hours^2	0–10,000	1485.51	1541.15
Works for pay from home (= 1)	0, 1	0.11	0.11
Demographic control variables			
Adolescent Traits			
Female (= 1)	0, 1	0.49	–
Age	12–18	14.75	15.65
First-born (= 1)	0, 1	0.51	–
Physical or learning disability (= 1)	0, 1	0.16	–
Physical maturity	1–5	3.24	3.24
Birth weight	3–12	7.36	–
Family Traits			
Family income (1994, in $1,000s)	0–999	47.05	–
Number of children in household	1–11	2.25	2.17
Child under age six present (= 1)	0, 1	0.14	0.13
Number of parents in the home	1, 2	1.73	1.76
Family structure change, Waves 1-2 (= 1)	0, 1	–	0.07
Number of other adults in the home	1–12	0.51	0.51
Race/ethnicity/generation (omitted: White, 2 US-born parents)			
Black, 2 US-born parents	0, 1	0.13	–
Latino, 2 US-born parents	0, 1	0.04	–
Other, 2 US-born parents	0, 1	0.02	–
Latino, 1+ immigrant parent(s)	0, 1	0.07	–
Asian, 1+ immigrant parent(s)	0, 1	0.04	–
Other, 1+ immigrant parent(s)	0, 1	0.04	–
Mother's demographic traits			
Mother's age	23–68	40.32	41.22
Mother is obese (= 1)	0, 1	0.19	–
Mother is disabled (= 1)	0, 1	0.04	0.05
Residential Traits			
Neighborhood does not feel safe (= 1)	0, 1	0.09	0.09
Region (omitted: South)			
Northeast	0, 1	0.17	–
Midwest	0, 1	0.32	–
West	0, 1	0.14	–
Mother's socioeconomic traits			
Mother's education	1–8	5.02	–
Mother's occupation SEI	19.4–60.9	39.08	39.13

Note: Dashes indicate where Add Health did not collect new information on these characteristics in Wave 2.

Results

Sample characteristics

Descriptive statistics are presented in Table 1. Overall, a quarter of the adolescents are overweight or obese in either Wave 1 or 2, such that the average adolescent is at the 60th and 59th BMI percentile in Wave 1 and 2, respectively. On average, adolescents exercised or played a sport between 2 or 3 times per week. The average hours of sedentary behavior per week is roughly 23 h in Wave 1 and 21 h in Wave 2.

In this sample, about a fifth of mothers are not currently employed. Among mothers that are currently employed, mothers averaged 37 h of paid work in both waves. Eleven percent of employed mothers work at

Table 2
Selected coefficients from models predicting adolescents' weight and activity levels (N = 10,518).

	Cross-Sectional (only Wave 2)						Longitudinal			Fixed Effects		
	Model 1			Model 2			Model 3			Model 4			Model 5		
Panel A. Logistic Regression Models Predicting Adolescent Overweight/Obesity[a]															
Does not work for pay (= 1)	0.51	(0.23)	*	0.42	(0.23)		0.39	(0.23)		0.23	(0.16)		0.01	(0.02)	
Paid work hours	0.02	(0.01)		0.01	(0.01)		0.02	(0.01)		0.01	(0.01)		0.00	(0.00)	
Paid work hours^2	− 0.00	(0.00)		− 0.00	(0.00)		− 0.00	(0.00)		− 0.00	(0.00)		− 0.00	(0.00)	
Before school availability	–	–		− 0.00	(0.03)		− 0.00	(0.02)		− 0.00	(0.02)		− 0.00	(0.00)	
After school availability	–	–		− 0.01	(0.03)		− 0.02	(0.03)		− 0.01	(0.02)		0.00	(0.00)	
Works for pay from home (= 1)	–	–		− 0.26	(0.14)		− 0.25	(0.14)		− 0.22	(0.11)	*	− 0.01	(0.00)	
Panel B. Linear Regression Models Predicting Adolescent Sports and Exercise Engagement															
Does not work for pay (= 1)	− 0.21	(0.12)		− 0.16	(0.13)		− 0.16	(0.13)		− 0.16	(0.11)		− 0.20	(0.14)	
Paid work hours	− 0.01	(0.01)		− 0.01	(0.01)		− 0.01	(0.01)		− 0.01	(0.01)		− 0.01	(0.01)	
Paid work hours^2	0.00	(0.00)	*	0.00	(0.00)		0.00	(0.00)		0.00	(0.00)	*	0.00	(0.00)	
Before school availability	–	–		− 0.01	(0.01)		− 0.01	(0.01)		0.01	(0.01)		0.01	(0.02)	
After school availability	–	–		0.04	(0.02)	*	0.04	(0.02)	*	0.04	(0.01)	**	0.02	(0.02)	
Works for pay from home (= 1)	–	–		0.08	(0.09)		0.08	(0.09)		− 0.00	(0.07)		0.11	(0.09)	
Panel C. Linear Regression Models Predicting Adolescent Sedentary Behavior															
Does not work for pay (= 1)	4.65	(1.41)	**	4.22	(1.39)	**	3.69	(1.39)	**	3.98	(1.10)	***	6.84	(1.88)	***
Paid work hours	0.12	(0.09)		0.12	(0.09)		0.13	(0.09)		0.14	(0.06)	*	0.28	(0.09)	**
Paid work hours^2	− 0.00	(0.00)		0.00	(0.00)		− 0.00	(0.00)		− 0.00	(0.00)		− 0.00	(0.00)	
Before school availability	–	–		0.15	(0.17)		0.13	(0.17)		0.13	(0.14)		− 0.05	(0.20)	
After school availability	–	–		0.16	(0.18)		0.07	(0.18)		− 0.13	(0.15)		− 0.71	(0.23)	**
Works for pay from home (= 1)	–	–		− 1.30	(0.95)		− 1.30	(0.95)		− 1.90	(0.67)	**	− 0.01	(0.85)	
Demographic controls[b]		Yes			Yes			Yes			Yes			Yes	
Mothers' socioeconomic traits[c]		No			No			Yes			Yes			Yes	

Data: Multiply imputed data from Waves 1 and 2 of Add Health. See text for sample restrictions.

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$

[a] Fixed effects models of adolescent overweight/obesity use a linear probability model to include adolescent survey weights.

[b] Where appropriate, models control for time-invariant adolescent gender, first-born status, disability status, race/ethnicity/ immigrant generation, birth weight, family income, mother's obesity status, and region. Models also include the following time-varying characteristics: adolescent age, pubertal development, number of children in the household, presence of a child under age six, number of parents in the home, number of other adults in the home, mother's age, mother's disability status, and neighborhood deemed unsafe.

[c] Models add controls for mother's time-invariant educational attainment and time-varying occupational status

least partially from home. The mean for mothers' before-school availability is 2.9 in both Waves, which approximates being home "most of the time." Yet the distribution is quite skewed (results not shown); for example, 58% of youth have mothers who are "always" home before school in Wave 2. On average, mothers are less available after school ($\bar{x}$=2.2), and the distribution of mothers' after-school availability is more uniform: 25% have mothers who are "always" home and 23% have mothers who are "never" home in Wave 2.

Multivariate models predicting adolescents' weight and activity levels

Table 2 presents multivariate results for the full sample and a panel for each modeled outcome, beginning with adolescent overweight status in Panel A. Model 1 is a cross-sectional model and includes the traditional indicators of maternal employment (i.e., whether she does not work and linear and quadratic measures of paid her work hours) and the demographic control variables. In contrast to prior research, mothers' work hours are not significantly associated with adolescents' overweight status. Further, the odds that an adolescent is overweight increases by a factor of 0.05 (b = 0.51; e^b = 1.05; $p < 0.05$) if their mothers are not employed. The coefficient for mother's employment status declines in magnitude and becomes statistically nonsignificant with the inclusion of our new measures of mothers' work arrangements (Model 2). Yet mothers' before- and after-school availability and mothers' telecommuting are not significantly associated with adolescents' overweight status. Model 4 is the longitudinal model relying on Wave 1 and 2 data. The results do not change with an additional year of data. Finally, we estimate the fixed effects model in Model 5. Again, we find no significant effect of mothers' employment or availability on adolescents' overweight status.

Panel B provides the multivariate results for the linear models predicting adolescents' sports and exercise engagement. Only the quadratic of mothers' paid work hours is statistically significant in Model 1, but the magnitude of the coefficient is miniscule (b < 0.001, $p < 0.05$). Interestingly, it is not statistically significant in Models 2 and 3 when additional variables are controlled, but it is again statistically significant in the longitudinal models, though still small in magnitude. In the cross-sectional models, mothers' after-school availability is positively associated with adolescents' sports and exercise engagement (Model 2; b = 0.04; $p < 0.01$). A unit increase in mothers' after-school availability is associated with a 0.04 increase in adolescents' sports and exercise participation ($p < 0.05$). This positive association remains statistically significant even with the inclusion of mothers' socioeconomic traits (Model 3) and longitudinal information (Model 4). Yet once we control for stable, unobserved traits of adolescents and their mothers in the child fixed effects model (Model 5), the effect of mothers' after-school availability declines in magnitude and becomes statistically nonsignificant. In fact, none of the indicators of mothers' work arrangements are significant predictors of adolescents' physical activity in the fixed effects models (Model 5).

Finally, Panel C provides the multivariate model results for adolescents' sedentary behavior. In Model 1, we see that adolescents whose mothers are unemployed engage in an additional 4.65 h of sedentary behavior per week ($p < 0.01$). Mothers' paid work hours, however, are not statistically significant. The magnitude of the coefficient for mothers' employment status declines across models, but remains statistically significant as we add additional indicators of mothers' work arrangements (Model 2) and socioeconomic status (Model 3). In the

longitudinal models (Model 4), mothers' unemployment is associated with 3.98 additional hours of sedentary behavior ($p < 0.001$). The results shift in important ways, however, in the child fixed effects models (Model 5). First, the coefficient for mothers' unemployment increases in magnitude to 6.84 hours ($p < 0.001$). Second, mothers' work hours become statistically significant, such that a one-hour increase in mothers' work hours is associated with a 0.28 h increase in adolescents' sedentary behavior ($p < 0.01$). Finally, mothers' after-school availability is statistically significant; a one-unit increase in mothers' availability is associated with a 0.71 h decline in sedentary behavior ($p < 0.01$).

Robustness checks

We estimated a series of supplemental models to test the robustness of our findings. First, in Appendix Table A, we predicted adolescent BMI percentile as a complement to Table 2 Panel A. Because more youth change BMI percentiles versus change overweight status, the sample for the fixed effects models (Model 5) for BMI percentile is more representative of the adolescent population. The results for BMI percentile largely mimic the findings for adolescent overweight. Adolescents whose mothers are not employed have a higher BMI percentile (Model 1; $b = 0.05$; $p < 0.05$) but this difference becomes statistically nonsignificant when we control for mothers' socioeconomic status (Model 3). In contrast to the models predicting overweight status, mothers' unemployment is significant in the longitudinal models predicting adolescent BMI percentile (Model 4; $b = 0.04$; $p < 0.05$). An additional difference is that mothers' work hours are positively associated with adolescent BMI in Model 1 ($b = 0.001$; $p < 0.05$), but the coefficient attenuates and becomes nonsignificant once additional variables are included in Models 2 and 3. In the fixed effects models of adolescent BMI percentile (Model 5), all indicators of mothers' work arrangements are statistically nonsignificant, similar to the fixed effects results for adolescent overweight status.

Second, in Appendix Table B, we estimated stratified models by family structure to be able to include father's traits and work arrangements for youth consistently living with two parents across waves ($n = 7746$). We measure residential fathers' disability status, employment status, paid work hours (and hours^2), before- and after-school availability, working from home, educational attainment, and occupational status identically to the parallel items for mothers. The substantive conclusions for youth consistently living with two residential parents are the same as those found with the full sample; controlling for fathers' traits does not alter the results. Likewise, we arrive at the same substantive conclusions for youth consistently living with a single mother ($n = 2039$). Interestingly there are two unique findings for youth that change family structures between Waves 1 and 2 ($n = 733$). In these fixed effects models, a mother's shift to working from home (i.e., telecommuting; $b = 0.68$; $p < 0.05$) and her increased after-school availability ($b = 0.12$; $p < 0.05$) are associated with significant increases in adolescents' sports and exercise engagement.

Finally, because many American mothers of adolescents are employed and because maternal employment status frequently dominated the results in Table 2, we also estimated models restricted to adolescents with working mothers in Appendix Table C. Our aim is to better reveal the operation of these maternal work arrangements for adolescent weight and activity levels. The fixed effects models continue to arrive at null findings for mothers' work arrangements in the prediction of adolescent overweight and sports and exercise participation. For adolescents' sedentary behavior, the fixed effects results differ for this subsample: only mothers' work hours squared is statistically significant, but the magnitude of the coefficient is small ($b < 0.001$; $p < 0.01$). The linear measure of mothers' paid work hours and mothers' after-school availability are not statistically significant in the fixed effects models for this subsample.

Conclusions

We explored whether mothers' work arrangements, more broadly construed than in prior research, influences adolescents' weight and activity levels. We sought to better approximate the causal, independent effects of these work arrangements by controlling for observable common correlates, such as mothers' occupational ranking, and unobservable, stable traits that select mothers into different work arrangements and adolescents into different behavioral tendencies. Based on our fixed effects analyses that exploit one-year changes in mothers' work arrangements and adolescent weight and activity levels, we arrive at the following conclusions.

First, the fixed effect models imply that mothers' labor force participation is not a significant predictor of adolescent overweight or BMI percentile after accounting for mothers' socioeconomic status. This suggests a stronger role of maternal education and occupational ranking than mothers' labor force participation for determining adolescents' risks of becoming overweight. Second, adolescents with more available mothers after school engage in more sports and exercise, but these significant differences appear to be due to the unobserved but stable traits of these available mothers and their adolescent children. Finally, the evidence suggests that mothers' labor force participation may have a causal effect on adolescent sedentary behaviors; both the traditional indicators of maternal labor force participation and our new indicator of mother's after-school availability are statistically significant in the fixed effects models.

Yet the fixed effects results for adolescents' sedentary behavior do not tell a simple story; adolescent screen time decreases when mothers become more available after school, but it also increases with mothers' work hours *and* mothers' unemployment. These results point to the importance of considering mothers' work arrangements, not just employment status, given the heterogeneity in mother's work experiences. Specifically, adolescents are predicted to engage in 43 fewer minutes of sedentary behavior if mothers increase their availability, but they engage in an additional 17 minutes of sedentary behavior with each increasing hour of paid work. Likewise, adolescents are predicted to engage in 6.84 more hours of screen time per week if their mothers become unemployed versus begin working for pay. Based on prior research (Damaske, Smyth, & Zawadzki, 2014), we suspect that these newly unemployed mothers are not otherwise finding time for themselves except for when their children are occupied by television or video games. We also suspect that there is a delicate balance to strike with regard to mothers' time: for paid work, personal time, their children, and household tasks.

There are several limitations in the current study. First, adolescent weight and activity levels are self-reported and, thus, at risk of bias due to errors in memory or social desirability (Dhurandhar et al., 2014). Second, we rely on adolescents' reports of parents' work arrangements because parents were not surveyed in both Waves 1 and 2, but this could increase measurement error. Further, it would be preferable to have more detailed and specific measures about parents' work schedules, including how routinized and predictable they are. Third, we measure parents' availability, but it could be the quality of parents' time matters more. Even when present, parents are not always involved with their children, such that mothers frequently multi-task childcare and housework activities (Offer & Schneider, 2011). Indeed, recent research emphasizes the importance of the quality of parents' time for other adolescent outcomes (Milkie et al., 2015). Fourth, these results are not causal estimates. Although the fixed effects results help account for unobserved heterogeneity due to stable parental, adolescent, and family traits, they do not control for unobserved time-varying factors that could cause parents' work arrangements and adolescents' weight-related behaviors to change over time. Therefore, we remain cautious in our interpretations. Finally, the data are relatively old and there have been important shifts in the labor market since these data were collected. Since the mid-1990s, work shifts have become longer and have

expanded outside the standard 9 to 5 day shift (Mishel, 2013; Presser, 2005). For white collar workers in particular, work has become more flexible (Correll et al., 2014; Golden, 2001). Further, new technologies provide parents more options today for staying in contact with their children while working (Rakow & Navarro, 1993; Williams & Williams, 2005). Although electronic messaging technologies help parents monitor their adolescents, they are not as effective as in-person monitoring (Weisskirch, 2009) and, thus, likely do not substantially alter adolescent physical activity or sedentary behavior. Therefore, the greater variability in work shifts since 1995 likely alters the *distributions* of maternal availability, but we believe that the *associations* between parents' work arrangements and adolescents' health have not shifted significantly during this time.

Despite these limitations, the current study makes several contributions. First, given the diversity in mothers' work arrangements, we move beyond a simple focus on mothers' labor force participation and work hours, which has predominated work and family research (Perry-Jenkins, Repetti, & Crouter, 2000). With direct measures of mothers' availability and working from home, we explore what has heretofore been assumed, but unexplored: mothers' presence in the home facilitates adolescents' healthy, weight-related behaviors and, in this study, by reducing adolescents' sedentary behavior. In addition, we not only study adolescent weight but also their engagement in physical activity and sedentary behaviors to more broadly assess the importance of mothers' work arrangements for adolescent health. Finally, we estimate child fixed effects models to better approximate the causal effects of these work arrangements. By removing the role of mothers' selection into jobs with different time demands and levels of flexibility, we can better assess the influence of these work arrangements on adolescent weight and activity levels.

Interestingly, the results vary across our different outcomes, such that after controlling for observed and unobserved traits that select mothers into different work arrangements and parenting practices, we only find significant associations between mothers' work arrangements and adolescents' sedentary behavior. This could simply reflect measurement differences. Because our measure of sedentary behavior has a long-range, continuous scale, it might be easier to document and, thus, leverage change in sedentary behaviors in the fixed effects models. Yet BMI percentile is detailed and continuous and we do not see significant associations with maternal work arrangements in those fixed effects models. Therefore, the results could also reflect differences in timing effects. It usually takes years to accumulate excess weight (Spiegelman & Flier, 2001), whereas sedentary behavior is likely more responsive to short-term environmental shifts, such as we have measured here. Finally, these results remind us that, among adolescents, the cross-sectional correlations amongst BMI, sedentary behavior and physical activity are weak. In our data, as with prior studies (Eisenmann, Bartee, & Wang, 2002; Peart, Velasco Mondragon, Rohm-Young, Bronner, & Hossain, 2011), the cross-sectional correlation between BMI percentile and sedentary behavior is small (Wave 1: 0.07; $p < 0.05$), though slightly larger than the correlation between BMI percentile and physical activity (Wave 1: 0.05; $p < 0.05$). Further, the cross-sectional correlation between sedentary behavior and physical activity is not statistically significant in our data, as is true in other studies (Sallis et al., 2000; Utter, Neumark-Sztainer, Jeffery, & Story, 2003).

Together, the findings do not meet the standard expectation that mothers' employment negatively affects children (Bianchi, 2000). Paid work is normative for mothers of adolescents and this could account for why maternal employment status is not harmful, but actually helpful for children's sedentary behavior. Further, the findings suggest that the social selection effects may work in the opposite direction for adolescents' physical activity and sedentary behavior. On the one hand, mothers who privilege being more available after school have more physically active youth, but this finding becomes statistically nonsignificant in the fixed effects models. This suggests that it is not her availability *per se* that matters but other unobserved stable traits, possibly her conscientiousness, that boosted her adolescent's physical activity. On the other hand, mothers' after-school availability was not statistically significant in the standard models for adolescents' sedentary behavior but became statistically significant in the fixed effects models. In other words, even if more conscientious mothers are more available, mothers' after-school availability appears to reduce adolescents' sedentary behavior. Concomitantly, the size of the effect for mothers' unemployment and work hours became *stronger* in the fixed effects models. This suggests that unobserved stable traits, such as having an ill family member or high insurance bills, affects women's labor force participation and adolescents' sedentary behavior. Accounting for those unobserved traits, however, allows us to better observe a nuanced association between mothers' work arrangements and adolescents' sedentary behavior: youth engage in the most sedentary behavior when their mothers do not work or work long hours. We can only speculate about these stable traits omitted in standard models, but our findings reaffirm the importance of accounting for the social selection of mothers into a diverse set of maternal work arrangement to understand the direct effects of these work arrangements on children.

Future research should continue to investigate how mothers' work arrangements fit with an array of family routines and family members' needs. In addition, future research should examine the role of fathers' work arrangements given fathers are more involved in childcare than in the past even while working relatively long hours (McGill, 2014). Such advances would improve our understanding of the conditions that promote an optimal fit between parents' paid employment, family responsibilities, personal interests, and children's schedules for promoting family health. Then workplace policies and practices could be tailored to better meet employees' needs in balancing multiple, often conflicting, responsibilities, while benefitting the employers' bottom line and promoting the health of their employees' children – the next generation of workers.

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Ethics approval

We use restricted-use, secondary data from the National Longitudinal Study of Adolescent to Adult Health (Add Health) with permission from Add Health staff and the Pennsylvania State University's Institutional Review Board (ID: PRAMS00035098).

Conflicts of interests

The authors have no conflicts of interests or financial gains to disclose.

Appendix A. Supplementary material

The Appendix Tables associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.ssmph.2018.03.003.

References

Allen, T. D., Johnson, R. C., Kiburz, K. M., & Shockley, K. M. (2013). Work-family conflict and flexible work arrangements: Deconstructing flexibility. *Personnel Psychology, 66*(2), 345–376. http://dx.doi.org/10.1111/peps.12012.

Allison, P. D. (2005). *Fixed Effects Regression Methods for Longitudinal Data Using SAS.* Thousand Oaks, CA: SAS Institute.

Almeida, D. M., & Davis, K. D. (2011). Workplace flexibility and daily stress processes in hotel employees and their children. *The Annals of the American Academy of Political and Social Science, 638*(1), 123–140. http://dx.doi.org/10.1177/0002716211415608.

Anderson, P. M., Butcher, K. F., & Levine, P. B. (2003). Maternal employment and overweight children. *Journal of Health Economics, 22*(3), 477–504.

Bauer, K. W., Hearst, M. O., Escoto, K., Berge, J. M., & Neumark-Sztainer, D. (2012). Parental employment and work-family stress: Associations with family food environments. *Social Science Medicine, 75*(3), 496–504.

Becker, G. S. (1981). *A treatise on the family.* Cambridge, MA: Harvard University Press.

Benson, L., & Mokhtari, M. (2011). Parental employment, shared parent-child activities and childhood obesity. *Journal of Family and Economic Issues, 32*(2), 233–244. http://dx.doi.org/10.1007/s10834-011-9249-0.

Bianchi, S. M. (2000). Maternal employment and time with children: Dramatic change or surprising continuity? *Demography, 37*, 401–414.

Bianchi, S. M. (2011). Family change and time allocation in American families. *The Annals of the American Academy of Political and Social Science, 638*(1), 21–44. http://dx.doi.org/10.1177/0002716211413731.

Bianchi, S. M., Robinson, J. P., & Milke, M. A. (2006). *The changing rhythms of American family life.* New York: Russell Sage Foundation.

Bianchi, S. M., Sayer, L. C., Milkie, M. A., & Robinson, J. P. (2012). Housework: Who did, does or will do it, and how much does it matter? *Social Forces, 91*(1), 55–63.

Bumpus, M. F., Crouter, A. C., & McHale, S. M. (1999). Work demands of dual-earner couples: Implications for parents' knowledge about children's daily lives in middle childhood. *Journal of Marriage and Family, 61*(2), 465–475. http://dx.doi.org/10.2307/353762.

Callero, P. L. (1985). Role-identity salience. *Social Psychology Quarterly, 48*(3), 203–215. http://dx.doi.org/10.2307/3033681.

Cawley, J., & Liu, F. (2012). Maternal employment and childhood obesity: A search for mechanisms in time use data. *Economics Human Biology, 10*(4), 352–364.

Champion, S. L., Rumbold, A. R., Steele, E. J., Giles, L. C., Davies, M. J., & Moore, V. M. (2011). Parental work schedules and child overweight and obesity. *International Journal of Obesity, 36*, 573–580.

Christopher, K. (2012). Extensive mothering employed mothers' constructions of the good mother. *Gender Society, 26*(1), 73–96. http://dx.doi.org/10.1177/0891243211427700.

Cobb-Clark, D. A., & Schurer, S. (2012). The stability of big-five personality traits. *Economics Letters, 115*(1), 11–15. http://dx.doi.org/10.1016/j.econlet.2011.11.015.

Cook, B. G., Li, D., & Heinrich, K. M. (2015). Obesity, physical activity, and sedentary behavior of youth with learning disabilities and ADHD. *Journal of Learning Disabilities, 48*(6), 563–576. http://dx.doi.org/10.1177/0022219413518582.

Correll, S. J., Kelly, E. L., O'Connor, L. T., & Williams, J. C. (2014). Redesigning, redefining work. *Work and Occupations, 41*(1), 3–17. http://dx.doi.org/10.1177/0730888413515250.

Damaske, S. (2011). *For the family?: How class and gender shape women's work.* USA: Oxford University Press.

Damaske, S., Smyth, J. M., & Zawadzki, M. J. (2014). Has work replaced home as a haven? Re-examining Arlie Hochschild's Time Bind proposition with objective stress data. *Social Science Medicine, 115*, 130–138. http://dx.doi.org/10.1016/j.socscimed.2014.04.047.

Datar, A. (2017). The more the heavier? Family size and childhood obesity in the U.S. *Social Science Medicine, 180*, 143–151. http://dx.doi.org/10.1016/j.socscimed.2017.03.035.

Datar, A., Nicosia, N., & Shier, V. (2014). Maternal work and children's diet, activity, and obesity. *Social Science Medicine, 107*, 196–204. http://dx.doi.org/10.1016/j.socscimed.2013.12.022.

Davis, K. D., Lawson, K. M., Almeida, D. M., Kelly, E. L., King, R. B., Hammer, L., & McHale, S. M. (2015). Parents' daily time with their children: A workplace intervention. *Pediatrics, 135*(5), 875–882. http://dx.doi.org/10.1542/peds.2014-2057.

Davison, K. K., & Birch, L. L. (2001). Childhood overweight: A contextual model and recommendations for future research. *Obesity Reviews, 2*(3), 159–171.

Dhurandhar, N. V., Schoeller, D., Brown, A. W., Heymsfield, S. B., Thomas, D., Sørensen, T. I. A., & Allison, D. B. (2014). Energy balance measurement: When something is not better than nothing. *International Journal of Obesity*. http://dx.doi.org/10.1038/ijo.2014.199.

Duncan, S. C., Duncan, T. E., & Strycker, L. A. (2002). Risk and protective factors influencing adolescent problem behavior: A multivariate latent growth curve analysis. *Annals of Behavioral Medicine, 22*, 103–109.

Eisenmann, J. C., Bartee, R. T., & Wang, M. Q. (2002). Physical activity, TV viewing, and weight in U.S. youth: 1999 Youth Risk Behavior Survey. *Obesity Research, 10*, 379–385.

Fertig, A., Glomm, G., & Tchernis, R. (2009). The connection between maternal employment and childhood obesity: Inspecting mechanisms. *Review of Economic Households, 7*, 227–255.

Friedman, H. S., & Kern, M. L. (2014). Personality, well-being, and health. *Annual Review of Psychology, 65*(1), 719–742. http://dx.doi.org/10.1146/annurev-psych-010213-115123.

Galinsky, E., Aumann, K., & Bond, J.T. (2011). *Times are Changing: Gender and Generation at Work and at Home*. Families and Work Institute. Retrieved from ⟨http://familiesandwork.org/site/research/reports/Times_Are_Changing.pdf⟩.

Gassman-Pines, A. (2013). Daily spillover of low-income mothers' perceived workload to mood and mother–child interactions. *Journal of Marriage and Family, 75*(5), 1304–1318. http://dx.doi.org/10.1111/jomf.12068.

Golden, L. (2001). Flexible work schedules which workers get them? *American Behavioral Scientist, 44*(7), 1157–1178. http://dx.doi.org/10.1177/00027640121956700.

Goodman, E., Hinden, B. R., & Khandelwal, S. (2000). Accuracy of teen and parental reports of obesity and body mass index. *Pediatrics, 106*, 52–58.

Gottfried, A.E., Gottfried, A.W., & Bathurst, K. (2002). Maternal and dual-earner employment status and parenting. In *Handbook of Parenting, 2: Biology and Ecology of Parenting* (pp. 206–229).

Hallal, P. C., Victora, C. G., Azevedo, M. R., & Wells, J. C. K. (2006). Adolescent physical activity and health. *Sports Medicine, 36*(12), 1019–1030. http://dx.doi.org/10.2165/00007256-200636120-00003.

Han, W.-J. (2006). Maternal work schedules and child outcomes: Evidence from the National Survey of American Families. *Children and Youth Services Review, 28*, 9.

Harris, K. M. (2010). An integrative approach to health. *Demography, 47*(1), 1–22.

Harris, K.M., Florey, F., Tabor, J., Bearman, P.S., Jones, J., & Udry, J.R. (2003). *The national longitudinal study of adolescent health: Research design*. Retrieved from ⟨http://www.cpc.unc.edu/projects/addhealth/design⟩.

Harris, K. M., Gordon-Larsen, P., Chantala, K., & Udry, J. R. (2006). Longitudinal trends in race/ethnic disparities in leading health indicators from adolescence to young adulthood. *Archives of Pediatrics & Adolescent Medicine, 160*(1), 74–81. http://dx.doi.org/10.1001/archpedi.160.1.74.

Hays, S. (1996). *The cultural contradictions of motherhood.* Yale University Press.

Jacobs, J. A., & Gerson, K. (2005). *The time divide: Work, family, and gender inequality.* Cambridge, Mass.; London: Harvard University Press.

Johnson, D. (2005). Two-wave panel analysis: Comparing statistical methods for studying the effects of transitions. *Journal of Marriage and Family, 67*(4), 1061–1075. http://dx.doi.org/10.1111/j.1741-3737.2005.00194.x.

Jung, H., & Chang, C. (2016). Is mothers' work related to childhood weight changes in the United States? *Journal of Family and Economic Issues, 37*(4), 581–593. http://dx.doi.org/10.1007/s10834-016-9484-5.

Kimm, S. Y., Glynn, N. W., Kriska, A. M., Barton, B. A., Kronsberg, S. S., Daniels, S. R., & Kiang, L. (2002). Decline in physical activity in black girls and white girls during adolescence. *New England Journal of Medicine, 347*(10), 709–715.

Kurz, D. (2000). Work–family issues of mothers of teenage children. *Qualitative Sociology, 23*(4), 435–451. http://dx.doi.org/10.1023/A:1005526808830.

Lawson, K. M., Davis, K. D., McHale, S. M., Hammer, L. B., & Buxton, O. M. (2014). Daily positive spillover and crossover from mothers' work to youth health. *Journal of Family Psychology, 28*(6), 897–907. http://dx.doi.org/10.1037/fam0000028.

Lee, H. E., Lee, D., Guo, G., & Harris, K. M. (2011). US trends in body mass in adolescence and young adulthood, 1959–2002. *The Journal of Adolescent Health, 49*(6), 601–608. http://dx.doi.org/10.1016/j.jadohealth.2011.04.019.

Livingstone, M. B. E., & Robson, P. J. (2000). Measurement of dietary intake in children. *Proceedings of the Nutrition Society, 59*, 279–293. http://dx.doi.org/10.1017/S0029665100000318.

MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science, 1*(4), 173–181. http://dx.doi.org/10.1023/A:1026595011371.

Martin, M. A., Frisco, M. L., Nau, C., & Burnett, K. (2012). Social stratification and adolescent overweight in the United States: How income and educational resources matter across families and schools. *Social Science Medicine, 74*(4), 597–606.

McGill, B. S. (2014). Navigating new norms of involved fatherhood: employment, fathering attitudes, and father involvement. *Journal of Family Issues, 35*, 1089–1106. http://dx.doi.org/10.1177/0192513X14522247.

McMenamin, T. M. (2007). A time to work: Recent trends in shift work and flexible schedules. *Monthly Labor Review*, 3–15.

Milkie, M. A., Nomaguchi, K. M., & Denny, K. E. (2015). Does the amount of time mothers spend with children or adolescents matter? *Journal of Marriage and Family, 77*(2), 355–372. http://dx.doi.org/10.1111/jomf.12170.

Miller, D., & Han, W. J. (2008). Maternal nonstandard work schedules and adolescent overweight. *American Journal of Public Health, 98*, 1495–1502.

Miller, D. P. (2011). Maternal work and child overweight and obesity: The importance of timing. *Journal of Family and Economic Issues, 32*(2), 204–218.
Mishel, L. (2013). *Vast majority of wage earners are working harder, and for not much more: Trends in U.S. work hours and wages over 1979–2007* (Economic Policy Institute No. 348). Washingon, DC. Retrieved from ⟨http://www.epi.org/publication/ib348-trends-us-work-hours-wages-1979-2007/⟩.
Mitchell, J. A., Pate, R. R., Beets, M. W., & Nader, P. R. (2013). Time spent in sedentary behavior and changes in childhood BMI: A longitudinal study from ages 9 to 15 years. *International Journal of Obesity, 37*(1), 54–60. http://dx.doi.org/10.1038/ijo.2012.41.
Moen, P., Fan, W., & Kelly, E. L. (2013). Team-level flexibility, work–home spillover, and health behavior. *Social Science Medicine, 84*, 69–79. http://dx.doi.org/10.1016/j.socscimed.2013.02.011.
Moen, P., Kelly, E. L., Tranby, E., & Huang, Q. (2011). Changing work, changing health can real work-time flexibility promote health behaviors and well-being? *Journal of Health and Social Behavior, 52*(4), 404–429. http://dx.doi.org/10.1177/0022146511418979.
Molnar, B. E., Gortmaker, S. L., Bull, F. C., & Buka, S. L. (2004). Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. *American Journal of Health Promotion, 18*(5), 378–386. http://dx.doi.org/10.4278/0890-1171-18.5.378.
Morrissey, T. W. (2013). Trajectories of growth in body mass index across childhood: Associations with maternal and paternal employment. *Social Science Medicine, 95*, 60–68. http://dx.doi.org/10.1016/j.socscimed.2012.05.038.
Morrissey, T. W., Dunifon, R. E., & Kalil, A. (2011). Maternal employment, work schedules, and children's body mass index. *Child Development, 82*(1), 66–81.
Must, A., & Strauss, R. S. (1999). Risks and consequences of childhood and adolescent obesity. *International Journal of Obesity, 23*, S2–S11. http://dx.doi.org/10.1038/sj.ijo.0800852.
Must, A., & Tybor, D. J. (2005). Physical activity and sedentary behavior: A review of longitudinal studies of weight and adiposity in youth. *International Journal of Obesity, 29*, S84–S96.
Nelson, M. C., Gordon-Larsen, P., Adair, L. S., & Popkin, B. M. (2005). Adolescent physical activity and sedentary behavior: Patterning and long-term maintenance. *American Journal of Preventive Medicine, 28*(3), 259–266. http://dx.doi.org/10.1016/j.amepre.2004.12.006.
Nelson, M. C., Neumark-Stzainer, D., Hannan, P. J., Sirard, J. R., & Story, M. (2006). Longitudinal and secular trends in physical activity and sedentary behavior during adolescence. *Pediatrics, 118*(6), e1627–e1634. http://dx.doi.org/10.1542/peds.2006-0926.
Offer, S., & Schneider, B. (2011). Revisiting the gender gap in time-use patterns multitasking and well-being among mothers and fathers in dual-earner families. *American Sociological Review, 76*(6), 809–833. http://dx.doi.org/10.1177/0003122411425170.
Ogden, C., & Carroll, M.D. (2010). *Prevalence of obesity among children and adolescents: United States, trends 1963–65 through 2007–2008*. Retrieved from ⟨http://www.cdc.gov/nchs/data/hestat/obesity_child_07_08/obesity_child_07_08.pdf⟩.
Ogden, C. L., Kuczmarski, R. J., Flegal, K. M., Mei, Z., Guo, S., Wei, R., ... Johnson, C. L. (2002). Centers for Disease Control and Prevention 2000 growth charts for the United States: Improvements to the 1977 National Center for Health Statistics version. *Pediatrics, 109*, 45–60.
Olshansky, S. J., Passaro, D. J., Hershow, R. C., Layden, J., Carnes, B. A., Brody, J., & Ludwig, D. S. (2005). A potential decline in life expectancy in the United States in the 21st century. *New England Journal of Medicine, 352*(11), 1138–1145.
Peart, T., Velasco Mondragon, H. E., Rohm-Young, D., Bronner, Y., & Hossain, M. B. (2011). Weight status in US Youth: The role of activity, diet, and sedentary behaviors. *American Journal of Health Behavior, 35*, 756–764. http://dx.doi.org/10.5993/AJHB.35.6.11.
Perry-Jenkins, M., Repetti, R. L., & Crouter, A. C. (2000). Work and family in the 1990s. *Journal of Marriage and Family, 62*(4), 981–998. http://dx.doi.org/10.1111/j.1741-3737.2000.00981.x.
Porterfield, S. L. (2002). Work choices of mothers in families with children with disabilities. *Journal of Marriage and Family, 64*(4), 972–981. http://dx.doi.org/10.1111/j.1741-3737.2002.00972.x.
Presser, H. B. (2005). *Working in a 24/7 economy: Challenges for American families.* New York: Russell Sage Foundation.
Rakow, L. F., & Navarro, V. (1993). Remote mothering and the parallel shift: Women meet the cellular telephone. *Critical Studies in Mass Communication, 10*(2), 144–157. http://dx.doi.org/10.1080/15295039309366856.
Rau, B.L. (2003). Flexible Work Arrangements. In *Sloan Online Work and Family Encyclopedia*. Sloan Work and Family Research Network, Chestnut Hill, MA. Retrieved from ⟨http://wfnetwork.bc.edu/encyclopedia_entry.php?id=240&area=All⟩.
Repetti, R. L., & Wood, J. (1997). Effects of daily stress at work on mothers' interactions with preschoolers. *Journal of Family Psychology, 11*(1), 90–108. http://dx.doi.org/10.1037/0893-3200.11.1.90.
Riina, E. M., Lippert, A., & Brooks-Gunn, J. (2016). Residential instability, family support, and parent–child relationships among ethnically diverse urban families. *Journal of Marriage and Family, 78*(4), 855–870. http://dx.doi.org/10.1111/jomf.12317.
Roeters, A., Lippe, T., van der, Kluwer, E., & Raub, W. (2012). Parental work characteristics and time with children: The moderating effects of parent's gender and children's age. *International Sociology, 27*(6), 846–863. http://dx.doi.org/10.1177/0268580911423049.
Rubin, D. (1987). *Multiple imputation for nonresponse in surveys.* New York: Wiley.
Saguy, A. C. (2012). *What's wrong with fat?* New York: Oxford University Press.
Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine and Science in Sports and Exercise, 32*(5), 963–975.
Sayer, L. C., Bianchi, S. M., & Robinson, J. P. (2004). Are parents investing less in children? Trends in mothers' and fathers' time with children. *American Journal of Sociology, 110*(1), 1–43.
Shonkoff, J. P., & Phillips, D. (2000). *From neurons to neighborhoods: The science of early childhood development.* Washington, D.C.: National Academies Press.
Sisson, S. B., Sheffield-Morris, A., Spicer, P., Lora, K., & Latorre, C. (2014). Influence of family structure on obesogenic behaviors and placement of bedroom TVs of American children: National Survey of Children's Health 2007. *Preventive Medicine, 61*, 48–53. http://dx.doi.org/10.1016/j.ypmed.2014.01.010.
Spiegelman, B. M., & Flier, J. S. (2001). Obesity and the regulation of energy balance. *Cell, 104*, 531–543. http://dx.doi.org/10.1016/S0092-8674(01)00240-9.
Stattin, H., & Kerr, M. (2000). Parental monitoring: A reinterpretation. *Child Development, 71*, 1072–1085.
Steinberg, L. (2005). *Adolescence* (7th ed.). Boston, MA: McGraw Hill.
Strauss, R. S. (1999). Self-reported weight status and dieting in a cross-sectional sample of young adolescents: National Health and Nutrition Examination Survey III. *Archives of Pediatrics & Adolescent Medicine, 153*, 741–747.
Stern, S. (1989). Measuring the effect of disability on labor force participation. *The Journal of Human Resources, 24*(3), 361–395. http://dx.doi.org/10.2307/145819.
Stryker, S. (1968). Identity salience and role performance: The relevance of symbolic interaction theory for family research. *Journal of Marriage and Family, 30*(4), 558–564. http://dx.doi.org/10.2307/349494.
ten Brummelhuis, L. L., & Bakker, A. B. (2012). A resource perspective on the work–home interface: The work–home resources model. *American Psychologist, 67*(7), 545–556. http://dx.doi.org/10.1037/a0027974.
Udry, J.R. (2003). *The national longitudinal study of adolescent health (Add Health), Waves I & II, 1994–1996, Wave III, 2001–2002 [MRDF].*
U.S. Bureau of Labor Statistics (2013). *Table 5. Employment status of the population by sex, marital status, and presence and age of own children under 18, 2012–2013 annual averages*. Retrieved from ⟨http://www.bls.gov/news.release/famee.t05.htm⟩.
Utter, J., Neumark-Sztainer, D., Jeffery, R., & Story, M. (2003). Couch potatoes or French fries: Are sedentary behaviors associated with body mass index, physical activity, and dietary behaviors among adolescents? *Journal of the American Dietetic Association, 103*, 1298–1305. http://dx.doi.org/10.1016/S0002-8223(03)01079-4.
Weisskirch, R. S. (2009). Parenting by cell phone: Parental monitoring of adolescents and family relations. *Journal of Youth and Adolescence, 38*(8), 1123. http://dx.doi.org/10.1007/s10964-008-9374-8.
Wethington, H., Pan, L., & Sherry, B. (2013). The association of screen time, television in the bedroom, and obesity among school-aged youth: 2007 national survey of children's health. *Journal of School Health, 83*(8), 573–581. http://dx.doi.org/10.1111/josh.12067.
Williams, S., & Williams, L. (2005). Space invaders: The negotiation of teenage boundaries through the mobile phone. *The Sociological Review, 53*(2), 314–331. http://dx.doi.org/10.1111/j.1467-954X.2005.00516.x.
Wright, J., Maher, J., & Tanner, C. (2015). Social class, anxieties and mothers' foodwork. *Sociology of Health Illness, 37*(3), 422–436. http://dx.doi.org/10.1111/1467-9566.12202.
You, W., & Davis, G. C. (2010). Household food expenditures, parental time allocation, and childhood overweight: An integrated two-stage collective model with an empirical application and test. *American Journal of Agricultural Economics,* aap031. http://dx.doi.org/10.1093/ajae/aap031.
Zaslow, M., Jekielek, S., & Gallagher, M. (2005). Work-family mismatch through a child developmental lens. In S. M. Bianchi, L. M. Casper, & B. R. King (Eds.). *Work, family, health, and well-being* (pp. 259–278). Mahwah, NJ: US: Lawrence Erlbaum Associates Publishers.
Ziol-Guest, K. M., Dunifon, R. E., & Kalil, A. (2013). Parental employment and Children's body weight: Mothers, others, and mechanisms. *Social Science Medicine, 95*, 52–59. http://dx.doi.org/10.1016/j.socscimed.2012.09.004.