Women's Health Issues 29-1 (2019) 23–30

ELSEVIER

WOMEN'S HEALTH ISSUES

www.whijournal.com

Health Disparities

The Role of Time Use Behaviors in the Risk of Obesity among Low-Income Mothers

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Article history: Received 19 December 2017; Received in revised form 5 October 2018; Accepted 8 October 2018

A B S T R A C T

Objectives: Childrearing responsibilities create additional demands on women's time and effort, especially in low-income families. We explore whether childrearing demands and differences in time use increase the risk of overweight and obesity for women in different income brackets.
Methods: We use data for women ages 18–55 years from the 2006–2008 and 2014–2015 American Time Use Surveys ($N = 17{,}914$). We predict whether women engage in particular activities using logistic regression and, among those who do particular activities, we predict the minutes spent in various activities using ordinary least squares models. We also predict women's risk of overweight or obesity using logistic regression. All models examine conditional relationships between income level and motherhood status.
Results: Replicating prior research, we find a greater risk of overweight and obesity for mothers with low (odds ratio, 1.66; $p < .001$) and subpoverty (odds ratio, 1.93; $p < .001$) incomes compared with mothers with moderate/upper incomes and all child-free women. Motherhood and income status jointly predict women's time use, but including these time use behaviors in models of overweight and obesity does not attenuate the significantly higher risks for mothers with low and subpoverty incomes.
Conclusions: Mothers experiencing economic hardship are at greater risk of overweight and obesity relative to other women. Additional research is warranted, however, because differences in time use do not explain this important health disparity.

The increase in adult obesity is among the most well-documented population health trends of the twentieth century. Among American women, roughly 36% have obesity and another 28% have overweight (Flegal, Carroll, Kit, & Ogden, 2012). This finding is concerning, because obesity is associated with cardiovascular disease (Lavie, Milani, & Ventura, 2009), certain cancers (Renehan, Tyson, Egger, Heller, & Zwahlen, 2008), and reduced life expectancy—especially for women (Masters et al., 2013).

Prior work identifies multiple behavioral predictors of women's risk for overweight and obesity, and the prevalence of these behaviors has also shifted over time. First, women's engagement in physical activity has declined, and time in sedentary behavior has increased (Archer et al., 2013a,b). Further, the consumption of prepared meals and food away from home has increased (Smith, Ng, & Popkin, 2013), which likely raised women's risk for obesity because such foods typically contain more calories, sugar, and sodium than homemade meals (Wolfson & Bleich, 2015).

These historical shifts in behavior are embedded within larger macroeconomic shifts. Since the late 1970s, women have increased their paid work hours (Spain & Bianchi, 1996), and prior research demonstrates the importance of rising employment for declines in women's housework (Bianchi, Milkie, Sayer, & Robinson, 2000). Reductions in meal preparation are also linked to women's employment given increased time constraints (Cawley & Liu, 2012). These simultaneous historical trends reinforce the importance of assessing the social factors that place women "at risk for health risk behaviors" (Glass & McAtee, 2006).

The work of Adam M. Lippert was partially supported by the National Institutes of Health (grant number NIA 5R01AG040248-05).

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1049-3867/$ - see front matter © 2018 Jacobs Institute of Women's Health. Published by Elsevier Inc.
https://doi.org/10.1016/j.whi.2018.10.002

Moen and Chermak's (2005) model of strategic selection details how historically and institutionally grounded gendered norms create unequal life course opportunities and constraints, which lead to gendered differences in health behaviors and risks. They note that gender is central to systems of resource distribution and socialization, particularly in relation to men's and women's paid work and unpaid family responsibilities. Traditional norms emphasized parenting roles for women's fulfillment (Friedan, 1963) and employment roles for men's. These traditional gender systems, although outdated, continue to shape women's and men's life course trajectories, such that women experience more frequent family-related disruptions to employment (Damaske & Frech, 2016), higher poverty rates (National Women's Law Center, 2015), and more—and more intense—childrearing responsibilities, although this can vary by social class (Clawson & Gerstel, 2014).

Moen and Chermak's (2005) strategic selection model emphasizes women's performance of multiple, interlocking roles that, in turn, create different time and effort demands. A key distinction is whether or not women are caring for children. Traditional gender norms and modern intensive parenting norms (Hays, 1996) stress the importance of mothers prioritizing their children, which creates unique social and economic pressures on mothers.

We speculate that these demands limit mothers' options for managing their health relative to child-free women. Mothers indicate that childcare activities limit their time to eat nutritious meals and exercise (Welch et al., 2009). Indeed, Zick, Stevens, and Bryant (2011) found that the number of children in a woman's care was inversely associated with her minutes of daily exercise, net of socioeconomic status and family structure. Additionally, women report less sleep as the number of children increases (Burgard & Ailshire, 2013; Zick et al., 2011). Together, these behavioral differences indicate that caring for children may be a risk factor for obesity (Anic et al., 2010; Bjorvatn et al., 2007; Lauderdale et al., 2009).

We build on the strategic selection model by highlighting the importance of stratified economic resources for women's health and health behaviors. Like most preventable conditions, women's risk for obesity is inversely associated with household income (Sanchez-Vaznaugh, Kawachi, Subramanian, Sanchez, & Acevedo-Garcia, 2009). Household income is also correlated with behaviors associated with weight. For example, low income is associated with reduced physical activity and greater sedentary behavior (Rhodes, Mark & Temmel, 2012), greater food insecurity (Sarlio-Lahteenkorva & Lahelma, 2001), and poor diet quality (Beydoun & Wang, 2008).

We hypothesize that caregiving roles and economic austerity intersect to create cumulative health disadvantages for women (Willson, Shuey & Elder, 2007). We argue that the intersection of economic hardship and childrearing responsibilities impacts mothers' health by depleting access to material resources and limiting discretionary time. This view is consistent with findings from Martin and Lippert (2012), who found that mothers experiencing poverty and food insecurity in the Panel Study of Income Dynamics were more likely to have overweight or obesity relative to child-free women with subpoverty incomes, mothers with moderate/upper incomes, and all men. In other words, women's risk for obesity is not a simple function of poverty or motherhood, but the combination of the two.

Several behavioral patterns could underlie this risk. First, these patterns may be partially rooted in food management practices. Traditional norms define food management—shopping, storing, and cooking food—as women's work (Monsivais, Aggarwal, & Drewnowski, 2014) and mothers spend more time preparing meals than child-free women (Sayer, 2005). Food management practices become difficult in the face of economic hardship. Qualitative research demonstrates that mothers engage in "shielding" behaviors with their children in response to material hardship: low-income mothers prioritize their children's food security before their own when household food resources are limited. This "managed practice" may include maternal meal skipping or the adoption of energy-dense diets—risk factors for obesity—to allocate food options viewed as healthier to children (DeVault, 1991; Stevens, 2010; Wright, Maher, & Tanner, 2015).

To decrease food expenses, low-income households also consume fewer meals away from home versus high-income households (Smith et al., 2013). The relationship between food preparation time and weight is unclear. Low-income mothers' greater time spent in meal preparation could provide greater control over the nutritional profile of meals, and meals prepared at home feature smaller portions, fewer calories, and less salt and sugar than restaurant meals (Wolfson & Bleich, 2015). In fact, one time use study found that women's time in food preparation was negatively associated with body mass (Zick et al., 2011). In contrast, given the relative costs of "healthy" and "unhealthy" foods today, "budget diets" are typically higher in fat, sodium, and carbohydrates (Drewnowski, 2010), which may expose low-income mothers to energy-dense diets.

Second, differences in physical activity by motherhood and economic standing could generate greater risks for overweight and obesity among mothers with insufficient income. Physically active lifestyles are often supported through costly gym memberships, personal training, and fitness classes. Even the most spartan exercise regimen requires some equipment, like walking shoes, that may be luxury purchases for women with limited incomes. Given these costs, it is unsurprising that exercise frequency is positively correlated with socioeconomic status (Stringhini et al., 2010). However, exercise also makes claims on one's time, and women frequently report that time pressures interfere with fitness (Welch et al., 2009). Thus, we expect poverty to be negatively associated with exercise, especially among mothers.

In sum, many studies have investigated links between the rise in women's obesity and other historical changes, like women's increasing work hours, changing diets, and declining physical activity. These studies show that poverty and motherhood independently predict health behaviors linked to body weight, but it is unclear whether motherhood and poverty are jointly associated with such behaviors. We speculate that mothers with less income face time and financial constraints that interfere with their ability to live healthy, active lives. In turn, these behaviors could partially explain the greater risk for overweight and obesity for mothers with subpoverty incomes as documented previously (Martin & Lippert, 2012).

To our knowledge, no study has explored the relative contribution of these health behaviors for the observed, conditional relationship between poverty and motherhood for the risk of overweight and obesity. We study these patterns using data from the American Time Use Survey (ATUS) with three main aims. Given our use of a different dataset, we first attempt to replicate findings indicating a heightened risk for overweight/obesity among mothers with low incomes documented in the Panel Study of Income Dynamics (Martin & Lippert, 2012). Second, we assess whether we observe similar, heightened risks of poor health behaviors among mothers at or below the poverty

line relative to mothers with moderate/upper income and child-free women. Specifically, we examine women's time spent in meal preparation, physical activity, sleep, and watching television. Third, we assess whether associations among motherhood, poverty, and overweight/obesity are partially explained by differences in these time use behaviors.

Methods

We use data from the 2006–2008 and 2014–2015 waves of the nationally representative ATUS, the years for which we can calculate individuals' body mass index (BMI) via the Eating and Health Module (Bureau of Labor Statistics, 2017). Time diary data have the advantage of providing detailed estimates of time spent in activities (Zick et al., 2011). Technical details of ATUS sample selection and the Eating and Health Module are available from the Bureau of Labor Statistics (2017). Data were extracted from ATUS-X (Hofferth, Flood, & Sobek, 2013) and include women ages 18–55 years to correspond with child-rearing ages. The study uses de-identified secondary data and was exempt from Institutional Board Review review at the University of La Verne.

Missingness is relatively minor. We omitted observations with missing data on the analytic variables ($n = 2{,}708$ observations; 13% of all original ATUS observations), with most missingness coming from weight status ($n = 1{,}721$ observations). There was minor item nonresponse for household income ($n = 824$ observations) and urban residence ($n = 163$ observations). The final analytic sample includes 17,914 women.

Dependent Variables

The first dependent variable is a binary measure of overweight/obesity (reference = normal/underweight). BMI was based on self-reports in the Eating and Health Module and calculated as weight (kg)/[height (m)]^2 (Centers for Disease Control and Prevention, 2017). We used Centers for Disease Control and Prevention-based cutoffs to determine weight categories: less than 25 as normal/underweight; 25.0 to 29.9 as overweight; and 30 or greater as obese. Results are robust to alternative BMI categorizations, namely 1) exclusion of women with underweight ($n = 402$), 2) exclusion of both women with underweight and women with a BMI of 40 or greater ($n = 1{,}358$), and 3) predicting overweight and obesity separately. Our final models collapse overweight and obesity categories to improve statistical power and because both are associated with health risks over the life course (National Center for Health Statistics, 2008; Stommel & Schoenborn, 2010).

We also predict four time use behaviors related to body weight: physical activity, food preparation, watching television, and sleeping. Given the complexity of measuring physical activity, we use three measures: 1) time in sports/exercise activities generating metabolic equivalents of more than 6 ("vigorous" physical activity; National Institutes of Health, 2018; World Health Organization, 2018), 2) generating between 3 and 6 metabolic equivalents ("moderate" physical activity; National Institutes of Health, 2018; World Health Organization, 2018), and 3) generating at least 2.5 metabolic equivalents ("total" physical activity; National Institutes of Health, 2018). For most time use behaviors, we create two indicators to capture a woman's activity: 1) a dichotomous indicator for whether the woman performed the activity, given the low participation rates for many activities, and 2) among those who performed the activity, a count of the total minutes spent in each activity. For sleep, we create a dichotomous measure of limited nighttime sleep, equal to 1 if the woman sleeps less than 6 hours at night in accordance with the threshold for risk shown in prior studies (Anic et al., 2010; Bjorvatn et al., 2007). Supplementary models used a three-category measure of sleep duration (<6 hours, 6 to <9 hours, ≥9 hours) to test for potential nonlinear relationships (Anic et al., 2010; Chaput, Després, Bouchard, & Tremblay, 2007), but we found no significant association between excess sleep (i.e., ≥9 hours) and the risk of having overweight or obesity (results available upon request).

Independent Variables

Key independent variables include household income and motherhood. We use the following ATUS-created household income categories: 1) moderate/upper income = 1 when household income was at least 185% of the poverty line (reference group); 2) low income = 1 for a household income of less than 185% but greater than or equal to 130% of the poverty line; and 3) poor = 1 for a household income of less than 130% of the poverty line. The 185% and 130% cutoffs link to eligibility requirements for means-tested government programs such as WIC and SNAP (U.S. Department of Agriculture, 2017a,b). Motherhood status is a binary indicator (1 for women who report having a socially or biologically related child under the age of 18 living in the household; 0 otherwise).

Controls

Fully adjusted models include age, marital status, education, urban residence, region, race/ethnicity, immigrant status, employment status, year, and timing of survey administration (weekend/weekday). Education includes categories of less than high school (or GED), high school diploma, some college, and college degree. Race/ethnicity includes categories for White, Black, Hispanic, and other. Employment status includes categories for full-time employment, part-time employment, out of the labor force, and unemployed (and looking for work).

Supplementary models further adjust for SNAP participation, as this has previously been linked to obesity risk (Larson & Story, 2011). Our key findings are statistically and substantively identical regardless of whether we control for SNAP participation. We report the more parsimonious model, but results are available upon request.

Analysis

We first predicted whether women had overweight or obesity. Model 1 is an additive, logistic regression model including household income, motherhood status, and controls. Model 2 is a conditional logistic regression model, with an interaction between household income and motherhood status. We next predicted whether women spent any time in each time use behavior using logistic regression. For those who did the activity, we then predicted their minutes in each activity using ordinary least squares regression. Preliminary t tests indicated that all but two of the time use behaviors and model covariates (day of the week and watching any television) were significantly different between mothers and child-free women. Therefore, we estimated separate models for mothers and child-free women, and focused on income differences within these two groups. To compare coefficients across mothers and child-free women, we

estimated a fully interacted model and conducted Wald tests. Finally, we explored whether time use behaviors helped to explain the conditional association between household income and motherhood for the risk of overweight/obesity. To capture potential nonadditive associations resulting from low participation rates for many activities, we include both binary indicators for participating in each activity and a measure of activity minutes. Preliminary analyses revealed these two measures are differentially related to income and body weight. To address the possibility of correlated errors across time use measures, we tested models using seemingly unrelated regression; these models produced identical results, so we report on our original linear and logistic regression results. Models were weighted to be representative of the U.S. population using the eating and health module weights provided by ATUS and estimated in Stata 13 (StataCorp, College Station, TX).

Results

Sample demographics are shown in Appendix Table 1. Descriptive statistics for the key independent and dependent variables are shown in Table 1. Fifty-three percent of the sample had overweight or obesity. With respect to categories of motherhood and household income, the modal group was child-free women with a moderate/upper income (36%) followed by mothers with a moderate/upper income (34%), mothers living with poverty (14%), child-free women living with poverty (7%), mothers with low income (6%), and child-free women with low income (4%). Sixteen percent of women in the sample engaged in physical activity, 65% in food preparation, and 76% in watching television. Among those engaging in each activity, on average, women spent 74 minutes per day in physical activity, 54 minutes preparing food, and 167 minutes watching television. For the years studied, these averages are fairly consistent with those found in the ATUS sample overall (ATUS, 2007, 2008, 2009, 2015, 2016), although women in our sample spent less time exercising (approximately -0.4 hours) and watching television (approximately -0.6 hours). Approximately 13% of women slept less than 6 hours at night.

We estimated the additive associations between motherhood and low income for having overweight/obesity in model 1 of Table 2. The odds of overweight/obesity were significantly greater for women with low income (odds ratio [OR], 1.36; $p < .001$) and poverty (OR, 1.51; $p < .001$) compared with women with a moderate/upper income. In contrast, motherhood was not significantly associated with a risk of overweight/obesity.

Second, we estimated the conditional relationships between motherhood and household income for the odds of having overweight/obesity. Similar to Martin and Lippert's (2012) results, we found the risk of overweight/obesity was greatest for mothers with low (OR, 1.47; $p < .05$) and subpoverty (OR, 1.50; $p < .01$) incomes but absent for moderate/upper income mothers and all child-free women.

Table 3 presents results predicting mothers' and child-free women's time use. We focus our discussion on mothers. Columns 1 through 4 show the ORs for whether women spent any time in physical activity, food preparation, television, and sleeping fewer than 6 hours per night. Results indicate that mothers with low ($p < .05$) and subpoverty ($p < .001$) incomes were approximately 30%–40% less likely than mothers with moderate/upper income to engage in any physical activity. However, mothers with low (OR, 1.38; $p < .01$) and subpoverty

Table 1
Descriptive Statistics—Sample Means and Percentages for Time Use and Key Predictor and Outcome Variables, American Time Use Survey, Sample Weighted

	Mean (SE)	Range
Weight status		
Underweight/normal weight	47%	
Overweight/obese	53%	
Motherhood by poverty status		
Child-free and moderate/upper income	36%	
Child-free and low income	4%	
Child-free and subpoverty income	7%	
Mother and moderate/upper income	34%	
Mother and low income	6%	
Mother and subpoverty income	14%	
Any physical activity	16%	
Minutes in total physical activity	73.56 (52.58)	1–240
Minutes in moderate physical activity	43.80 (52.35)	0–180
Minutes in vigorous physical activity	14.98 (23.60)	0–65
Any food preparation	65%	
Minutes preparing food	54.38 (43.35)	1–210
Any television viewing	76%	
Minutes in television viewing	167.01 (129.31)	1–625
Nighttime sleep <6 hours	0.13	
N	17,914	

Notes: Estimates are weighted using the eating and health module sample and replicate weights using *svy* procedures in Stata 13. These are the applicable weights because the body mass index measures come from the eating and health module.

Table 2
Odds Ratios from Logistic Regression Models Predicting Having Overweight/Obesity

	Model 1		Model 2	
	OR	95% CI	OR	95% CI
Mother	1.07	0.97–1.18	0.96	0.86–1.07
Low income	1.36*	1.18–1.57	1.09	0.84–1.42
Subpoverty income	1.51*	1.33–1.72	1.18	0.95–1.47
Mother × low income	—		1.47†	1.09–1.99
Mother × subpoverty income	—		1.50‡	1.17–1.92
Age	1.03*	1.03–1.04	1.03*	1.03–1.04
Married	1.10†	1.00–1.22	1.10§	1.00–1.22
Education (less than high school omitted)				
High school diploma	0.98	0.82–1.17	0.98	0.82–1.17
Some college	0.83†	0.70–0.99	0.84†	0.70–1.00
College or more	0.50*	0.42–0.60	0.50*	0.42–0.60
Race/ethnicity (Non-Hispanic White omitted)				
Non-Hispanic Black	2.67*	2.33–3.06	2.65*	2.31–3.03
Hispanic	1.63*	1.42–1.88	1.61*	1.40–1.85
Non-Hispanic, other race	0.81†	0.67–0.99	0.82§	0.67–1.00
Employment status (full time omitted)				
Part time	0.74*	0.65–0.83	0.75*	0.66–0.84
Out of the labor force	0.85‡	0.76–0.95	0.86†	0.77–0.97
Unemployed	0.92	0.74–1.15	0.92	0.74–1.15
Nonimmigrant	1.60*	1.34–1.91	1.63*	1.37–1.94
Urban residence	0.81‡	0.72–0.92	0.82†	0.72–0.92
Year (2006 omitted)				
2007	1.14§	1.00–1.29	1.14†	1.00–1.30
2008	1.17†	1.03–1.33	1.17†	1.03–1.33
2014	1.25‡	1.09–1.43	1.25‡	1.09–1.43
2015	1.27‡	1.11–1.46	1.28*	1.11–1.47
Constant	0.24*	0.18–0.34	0.25*	0.18–0.34
N	17,914		17,914	

Notes: Models are weighted using the Eating and Health Module sample weights.
* $p < .001$.
† $p < .05$.
‡ $p < .01$.
§ $p < .10$.

Table 3
Key Odds Ratios and Coefficients from Logistic and Linear Regression Models Predicting Time Use Behavior[*]

	Logistic Regression Results for Any Activity Occurrence, OR (95% CI)				Minutes in Specific Activities Conditional on Any Activity, *b* (SE)				
	1. Any Physical Activity	2. Any Food Preparation	3. Any Television Time	4. Less than 6 Hours Sleep	5. Minutes of Physical Activity	6. Minutes of Moderate Activity	7. Minutes of Vigorous Activity	8. Minutes of Food Preparation	9. Minutes of Television Time[†]
Panel 1. Mothers									
Low income	0.72[‡] (0.57, 0.93)	1.38[§] (1.15–1.65)	1.12 (0.93–1.35)	1.08 (0.84–1.37)	−6.25 (4.80)	2.19 (4.85)	−2.65 (2.52)	3.28[‖] (1.91)	10.23[‖] (5.44)
Subpoverty income	0.60[¶] (0.48–0.76)	1.64 (1.39–1.94)	1.00 (0.85–1.18)	1.15 (0.92–1.43)	−5.16 (4.67)	2.48 (4.58)	−5.19[‡] (2.19)	8.16[*] (1.83)	20.36[¶] (5.35)
Panel 2. Child-free women									
Low income	0.81 (0.55–1.19)	1.16 (0.89–1.51)	1.25 (0.92–1.70)	1.25 (0.89–1.78)	1.13 (9.13)	−7.78 (7.38)	−5.22 (3.85)	2.94 (3.21)	8.57 (9.60)
Subpoverty income	0.65[‡] (0.46–0.92)	1.07 (0.86–1.35)	1.04 (0.80–1.38)	1.03 (0.73–1.44)	−13.41 (8.72)	1.69 (9.57)	−7.36[‡] (3.03)	4.91 (3.40)	34.52[¶] (9.07)

Notes: Omitted category is moderate/upper income. Models adjust for respondent age, marital status, education, race/ethnicity, citizenship, employment, urban residence, weekend day, and year. Models are weighted using the Eating and Health Module sample weights. Minutes of activity are estimated on the sample reporting more than zero minutes of activity. Sample sizes are as follows: physical activity, $n_{mothers} = 1{,}753$, $n_{child\text{-}free} = 1{,}049$; food preparation, $n_{mothers} = 8{,}517$, $n_{child\text{-}free} = 3{,}198$; television viewing, $n_{mothers} = 9{,}012$, $n_{child\text{-}free} = 4{,}631$.
* The difference between mothers with low incomes and mothers with subpoverty incomes is statistically significant.
† The difference between mothers with subpoverty incomes and child-free women with subpoverty incomes is statistically significant.
‡ $p < .05$.
§ $p < .01$.
‖ $p < .10$.
¶ $p < .001$.

Table 4
Select Odds Ratios from Logistic Regression Models for Having Overweight/Obesity Controlling for Time Use Behaviors ($N = 17{,}914$)

	Mothers		Child-free Women	
	OR	95% CI	OR	95% CI
Baseline results from model 1				
Low income	1.66[*]	1.42 to 1.95	1.04	0.80 to 1.36
Subpoverty income	1.93[*]	1.66 to 2.23	1.02	0.80 to 1.30
Panel 1. Adding time in physical activity				
Low income	1.64[*]	1.40 to 1.93	1.03	0.79 to 1.35
Subpoverty income	1.88[*]	1.62 to 2.18	0.99	0.78 to 1.27
Any physical activity	0.62[*]	0.49 to 0.77	0.67[‡]	0.48 to 0.94
Minutes physical activity	1.00	1.00 to 1.00	1.00	0.99 to 1.00
Panel 2. Adding time in food preparation				
Low income	1.67[*]	1.42 to 1.96	1.04	0.80 to 1.36
Subpoverty income	1.94[*]	1.67 to 2.25	1.02	0.80 to 1.30
Any time in food preparation	1.02	0.89 to 1.17	0.98	0.81 to 1.18
Minutes food preparation	1.00	1.00 to 1.00	1.00	1.00 to 1.00
Panel 3. Adding time watching television[†]				
Low income	0.31[*]	0.21 to 0.41	0.01	−0.15 to 0.17
Subpoverty income	0.40[*]	0.31 to 0.49	0.00	−0.15 to 0.15
Any TV time	0.03	−0.05 to 0.12	0.13[‡]	0.01 to 0.26
Minutes TV time	0.00[§]	−0.00 to 0.00	0.00[‡]	0.00 to 0.00
Panel 4. Adding nighttime sleep <6 hours				
Low income	1.66[*]	1.42 to 1.95	1.04	0.80 to 1.36
Subpoverty income	1.92[*]	1.66 to 2.22	1.02	0.80 to 1.30
Less than 6 hours sleep at night	1.38[*]	1.17 to 1.62	1.10	0.88 to 1.37
Panel 5. Multifactorial model[‖]				
Low income	1.64[*]	1.39 to 1.92	1.01	0.77 to 1.32
Subpoverty income	1.88[*]	1.62 to 2.18	0.97	0.76 to 1.24
Any physical activity	0.63[*]	0.55 to 0.72	0.62[*]	0.51 to 0.75
Any food preparation	1.02	0.89 to 1.16	0.96	0.79 to 1.15
Any television time	1.08	0.94 to 1.24	1.29[‡]	1.04 to 1.59
Minutes food preparation	1.00	1.00 to 1.00	1.00	1.00 to 1.00
Minutes television time	1.00	1.00 to 1.00	1.00[‡]	1.00 to 1.00
Less than 6 hours of nighttime sleep	1.37[*]	1.16 to 1.61	1.10	0.88 to 1.38

Notes: Omitted category is moderate/upper income. Models are weighted using the Eating and Health Module sample weights and adjust for age, marital status, education, race/ethnicity, citizenship, urban residence, employment, weekend day, and year.
* $p < .001$.
† Models run as probit for convergence reasons. Coefficients reported.
‡ $p < .05$.
§ $p < .10$.
‖ Models omit minutes in physical activity due to collinearity with any physical activity (VIF = 2.72). Omitting minutes of physical activity does not change model fit.

(OR, 1.64; $p < .001$) incomes were more likely to have spent some time in food preparation. Income status does not seem to differentiate the likelihood of watching television or sleeping fewer than 6 hours per night.

Columns 5 through 9 of Table 3 report results for models estimating the amount of time spent in each activity conditional on spending any time doing that activity. Among mothers who engaged in some physical activity (of various intensities), only their time spent in vigorous physical activity significantly differed by household income; mothers with a subpoverty income engaged in approximately 5 fewer minutes ($p < .05$) than mothers with a moderate/upper income. Among mothers who did some food preparation, mothers with a subpoverty income spent the most time preparing food—approximately 8 more minutes ($p < .001$)—than mothers with a moderate/upper income and 5 more minutes ($p < .05$) than mothers with low

income. For television time, mothers with a subpoverty income watched significantly more television ($b = 20.36$; $p < .001$) than mothers with moderate/upper income. Notably, child-free women with a subpoverty income ($b = 34.52$) watched significantly more television than their counterparts with children ($p < .05$).

Our final analyses explored whether these behaviors partially explained the differences in overweight/obesity by income and motherhood status. The top two rows of Table 4 replicate the base model, stratified by motherhood status, displaying the original odds ratios for overweight/obesity according to household income. Panels 1 through 4 include measures of each time use behavior individually, whereas panel 5 includes all time use behaviors. In panel 5, we do not include the minutes of physical activity because the variance inflation factor was 2.7, indicating possible multicollinearity.

We first focus on physical activity in panel 1. Although engagement in physical activity was negatively associated with the risk of overweight/obesity (OR, 0.62; $p < .001$), physical activity did not significantly attenuate the relationship between income and risk of overweight/obesity among mothers. For example, the predicted probabilities of having overweight/obesity do not vary significantly by physical activity levels; regardless of whether a woman's activity was relatively low (at the 10th percentile) or high (at the 90th percentile), the predicted probability for having overweight/obesity is 0.49 for mothers with moderate/upper incomes, 0.61 for mothers with low incomes, and 0.64 for mothers with subpoverty incomes. In panels 2 and 3, neither time in food preparation nor time watching television were significantly associated with the risk of overweight/obesity for mothers. In panel 4, sleeping fewer than 6 hours a night was strongly related to an increased risk of overweight/obesity (OR, 1.38; $p < .001$), such that the predicted probability of having overweight/obesity is approximately 0.08 lower among mothers who sleep more than 6 hours (i.e., for mothers with a moderate/upper income: 0.48 vs. 0.56; with a low income: 0.60 vs. 0.68; and with a subpoverty income: 0.64 vs. 0.71). However, accounting for mothers' sleep duration did not attenuate the associations between income and overweight/obesity among mothers. Finally, panel 5 provides the results for the model including all time use variables. As before, mothers reporting any physical activity and having slept more than 6 hours were at lower risk of overweight/obesity, but these variables did not attenuate the relationships initially shown in Table 2. Figure 1 depicts marginal–mean predicted probabilities of overweight/obesity with controls and adding time use behaviors.

Discussion

We had three aims: 1) to replicate findings from the Panel Study of Income Dynamics reported by Martin and Lippert (2012) using the ATUS; 2) to assess whether the interactions between motherhood and poverty were associated with time use behaviors linked to body weight; and 3) to assess whether differences in time use behaviors helped to explain the greater risk of overweight/obesity among mothers with low and subpoverty incomes. For aim 1, we found evidence consistent with Martin and Lippert (2012) in the ATUS data. For aim 2, we found that mothers with low and subpoverty incomes were less likely to engage in physical activity but more likely to perform food preparation than their counterparts with moderate/upper incomes. Among those who spent time in these activities, we found significant differences in the amount of time spent in vigorous activity, food preparation, and television viewing between mothers with subpoverty incomes and mothers with moderate/upper incomes. For aim 3, we found that time use patterns did not partially explain the greater risk of overweight/obesity among mothers with low incomes.

Drawing on the strategic selection model by Moen and Chermak (2005), we expected that women who were "parenting under the poverty line" would face material deficits and time constraints to care for their own health. Demands on mothers with a low income to uphold traditional, gendered roles of domestic caretaking while managing household scarcity have been shown to negatively impact dietary behaviors (DeVault, 1991; Stevens, 2010; Wright et al., 2015), and potentially increase overweight/obesity risks (Martin & Lippert, 2012). We expected that these same material hardships and time

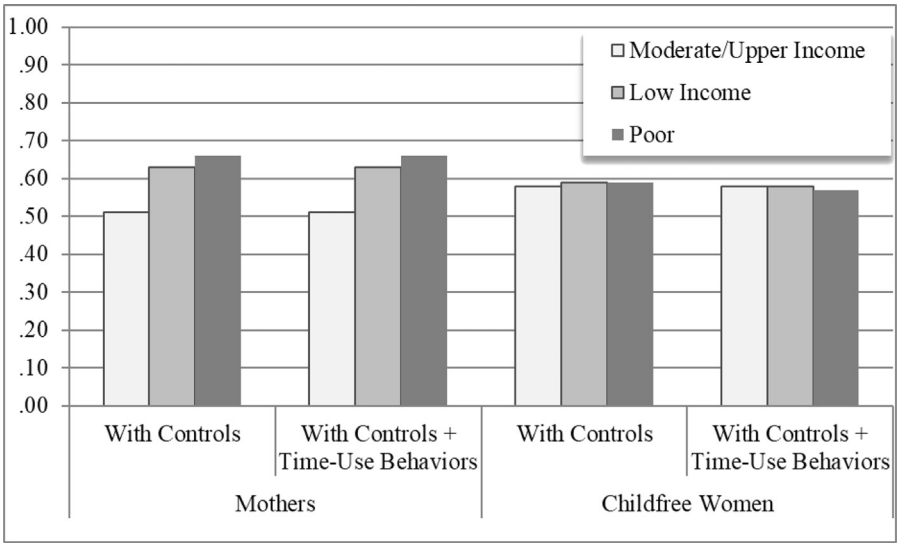

Figure 1. Predicted probabilities of having overweight/obesity by motherhood and poverty status, with controls and time use behaviors. Estimates are shown as fitted predicted marginal mean probabilities of having overweight/obesity. Models are weighted using the eating and health module sample weights and adjust for respondent age, marital status, education, race/ethnicity, citizenship, employment, urban residence, weekend day, and year.

constraints would correlate with lower engagement in physical activity and increase mothers' time spent watching television and preparing meals. This supposition was partially true: mothers with subpoverty incomes spent more time in meal preparation than mothers with moderate/upper incomes, although income did not differentiate time in meal preparation for child-free women. However, adjustments for mothers' time in these behaviors did not attenuate the associations between motherhood, income, and overweight/obesity.

A limitation of this study is its cross-sectional nature. Research has indicated a lagged effect of health behaviors on later weight (Spiegelman & Flier, 2001), but we are unable to test this possibility or whether time use behaviors and BMI are simultaneously determined (e.g., Zick et al., 2011). Second, we lack dietary information. Although there is a lack of consensus about the underlying causal dynamics, prior research documents correlations between poor heath and dietary practices such as meal skipping and all-day fasting—practices resource-constrained mothers frequently perform (DeVault, 1991; Stevens, 2010; Wright et al., 2015).

Implications for Practice and/or Policy

A contribution of this study is the replication of the conditional association between motherhood and poverty and risk of overweight/obesity. Now, two studies relying on different, nationally representative data sources find a greater risk of overweight/obesity among mothers with low income. This heightened risk, however, does not seem to result from differences in time use behaviors, like preparing meals, watching television, exercising, and sleeping.

Other pathways need further investigation, particularly mothers' differential exposure to various stressors. Prior research demonstrates a link between chronic stress and overweight/obesity (Drapeau, Therrien, Richard, & Tremblay, 2003; Garasky, Stewart, Gundersen, Lohman, & Eisenmann, 2009; Roberts, Troop, Connan, Treasure, & Campbell, 2007). Further, stress exposure, as measured by cortisol levels, is related to women's work and family experiences; time spent at work (and away from home) is associated with lower cortisol, whereas a lack of workplace resources is associated with higher cortisol (Damaske, Smyth, & Zawadzki, 2014; Damaske, Zawadzki, & Smyth, 2016). Thus, unemployment or precarious employment, coupled with childcare responsibilities, could undergird the greater risk of overweight/obesity among mothers with limited resources. In addition, some scholars hypothesize that food assistance programs—designed to supplement dietary resources for families with low income—increase the risk of obesity. We do not emphasize these results given our theoretical orientation, but our results were consistent irrespective of model adjustments for SNAP assistance.

Conclusions

The combination of motherhood and poverty is associated with an increased risk for overweight/obesity in two nationally representative samples. However, this association is not attributable to differences in time spent in meal preparation, physical activity, sedentary behaviors, or sleep available in the ATUS files. Future research is needed to identify the mechanisms connecting motherhood and poverty to a heightened risk for overweight/obesity.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.whi.2018.10.002.

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