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Relationships Between Time Use and Obesity in a Representative Sample of Americans

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Abstract

Objective—To provide a nationally representative analysis of time use in America for insight into behaviors associated with obesity.

Methods—This study utilized 28,503 observations of individuals aged 22–70 from the ATUS, a continuous cross sectional survey on time use in America. Linear and logistic regressions were performed to analyze sociodemographic characteristics, determine activity participation levels and time spent in activities, understand non-linear associations between activity time and BMI, and appreciate differences in activity timing between BMI categories.

Results—Short and long sleep and work were associated with increased BMI. On weekdays, individuals with obesity were more likely to be working at night, and sleeping during the day. They were less likely to participate in sports/exercise/recreation, but those that participated did so for amounts of time not different than normal BMI individuals. Those with obesity were more likely to watch television almost all hours of the day. Further differences are detailed for health-related, sedentary, and household activities.

Conclusions—Both short and long sleep, as well as the timing of sleep and work activity, are associated with obesity. Motivation to exercise non-zero amounts may be an appropriate target for intervention. Television is chief amongst sedentary activities in their association with obesity.

Keywords

American Time Use Survey (ATUS); time use; obesity; work; sleep; exercise

Introduction

After remaining relatively stable from 1960–1980, the prevalence of obesity in the U.S. has increased dramatically in the past 30 years; recent population studies estimate that two-thirds of Americans are overweight or obese (1). Obesity is a risk factor for a variety of

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chronic conditions including type-2 diabetes, hypertension, and high cholesterol and the direct and indirect costs of obesity have been estimated to be as high as \$147 billion annually (2,3). Considering the significant physiological and financial costs of obesity, uncontrolled weight gain poses a serious problem in the U.S. As such, research has focused on elucidating the mechanisms underlying the recent increase in prevalence of obesity and obesity-related disorders and has implicated increased consumption of calorically dense foods and increasingly sedentary lifestyles as significant factors (4,5).

Given the significant implication of lifestyle factors, time use analyses can offer insight into which behaviors in particular might be associated with obesity. In the American Time Use Survey (ATUS) respondents report their activities on a minute-by-minute basis during a 24-hour period. The ATUS data set has not yet been utilized to *comprehensively* study the relationships between obesity and time use. The USDA, which sponsored the Eating and Health Module that collected data on BMI, described how Americans spend their time eating food, but did not analyze relationships between obesity and *all* uses of time (6). Similarly, studies have looked at the relationships between obesity and specific activities such as exercising and viewing television (7). Further, studies frequently utilize metabolic equivalents to group activities based on energy expenditure in order to analyze how individuals in different BMI categories might participate differently in energy expensive activities (8). This paper is unique in that it provides an analysis of activities that account for 99.1% of available time.

Our study has four objectives. We first measured sociodemographic associations with obesity. Second, we aimed to understand how activity participation and activity time differs in individuals who are overweight or who have obesity compared to normal weight individuals. Third, we examined non-linear associations between BMI and activity time for each activity. Finally, we assessed how the *timing* of activity participation differed across individuals in different BMI categories.

Methods

American Time Use Survey

The American Time Use Survey is a continuous cross sectional survey on time use in America; it is sponsored by the Bureau of Labor Statistics and administered by the U.S. Census Bureau. The ATUS aims to provide nationally representative estimates of how Americans, aged 15 and older, spend their time. It involves a computer assisted telephone interview in which survey participants are asked how they spent their time from 4am the previous day to 4am the day of the interview. Details of ATUS and its survey and sampling methods are readily available in the literature and in the ATUS User Guide (9).

ATUS codes activities using a three tier coding system that utilizes 17 first tier categories; we combined first, second, and third tier levels of details to create 40 activities which, together, account for 99.1% of time-use within the 24h period. Detail of these activities and respective coding can be found in Supplemental Table 1 and the ATUS Coding Lexicon (<http://www.bls.gov/tus/lexicons.htm>).

While ATUS has been administered continuously since 2003, only data collected from January 2006- December 2008 (which included the Eating and Health Module, sponsored by the United States Department of Agriculture) were used in the current study. The Eating and Health Module collected self-reported height and weight measurements, which enabled the calculation of BMI. Further details of this module can be found in the ATUS Eating and Health Module documentation. We limited our original sample (n= 37,832) to respondents aged 22 to 70 yrs (2,195 excluded) with complete BMI data (7,625 excluded) for a final sample of 28,403 observations.

Data Analysis

Data analyses were conducted using SAS (v. 9.3, SAS Institute, Carey NC). Appropriate ATUS weights and replicate weights were obtained from the Eating and Health module to calculate representative estimates. Details for the use of weights and replicate weights, and the appropriate adjustments necessary for variance estimation, are provided in the ATUS documentation. World Health Organization Classifications were used to group respondents into categories (Normal and Underweight Combined: BMI < 25, Overweight: 25 ≤ BMI < 30; Obese (BMI ≥ 30). As there were very few observations with BMI < 18.5 (n=374), we folded these observations into the normal BMI category.

We first assessed the relationships of BMI with sociodemographic variables and with survey region and year. Separate linear regression models with BMI as the outcome were estimated for each sociodemographic category; a further regression was estimated that included all sociodemographic variables. These results are presented in Table 1 as “Univariate” and “Controlled for All Covariates,” respectively. All subsequent analyses were controlled using covariates found to be significant from the analysis controlled for all covariates.

The distribution of time spent participating in many activities revealed a large cluster at zero; however, non-zero activity times consistently followed a normal distribution. Given such a distribution, a two-part model is utilized to separately analyze the decision to participate in a given activity (activity time > 0) and the decision on amount of time to spend participating (10–12). In the two-part model, first a logistic regression was estimated with indicator variables for the overweight and obese categories to determine odds ratios for activity participation compared to the normal BMI category. Then, utilizing observations with non-zero activity time, a linear regression was estimated to determine differences between BMI categories in the time spent participating. Other methods were also explored to analyze such data; Tobit specification has been shown to produce biased estimates for our particular type of data, and OLS was not appropriate due to the aforementioned distribution of the data (13). These relationships were also analyzed by splitting the dataset into working and non-working days (for employed observations) and weekdays and weekends (for unemployed observations), but no substantially different results were found with this approach (data not shown). Both models were adjusted for age, race, sex, family income, education, employment characteristics and census region. Analyses were conducted separately for weekdays and weekends/holidays as behavior varies considerably between these two segments of the week; results are presented in Table 2a and 2b.

Linear regression was utilized to assess how BMI may be non-linearly associated with activity time. Observations were placed into categories of activity time and a linear regression was estimated with BMI as the outcome and indicator predictor variables for each activity time category; the time category with lowest BMI was utilized as reference. The model was adjusted for age, race, gender, family income, educational attainment, employment characteristics and census region, and the analysis was separated for weekdays and weekends/holidays. Significant results are presented in Figure 1.

Finally, we investigated if obese and overweight individuals participated in particular activities at different times of day than normal-weight individuals. For each activity, a logistic regression with a binary outcome variable for activity participation was run for every 30-minute interval of the 24h day. The models were adjusted for age, race, sex, family income, educational attainment, employment characteristics and census region, and were estimated separately for weekdays and weekends/holidays. Odds ratios for participation were calculated (with normal BMI group serving as reference) for each 30-minute time interval. Results are presented in Figure 2.

Results

Sociodemographic, Geographic, and Temporal Characteristics

Individual associations between BMI and various sociodemographic, geographic, and temporal characteristics, as well as associations after including all these variables in one model are presented in Table 1. In the model adjusted for all covariates, younger age; female sex; Asian race; higher levels of education; family income >\$75k; self-employment; and residence in the West or Northeast census regions were all associated with a lower BMI relative to reference categories whereas age 50–59 yrs; Black, Hispanic or ‘Other’ race; and not being in the labor force were associated with a higher BMI.

Activity Participation, Duration and Timing

Sleep—There were no substantial differences amongst BMI categories in participation or time spent sleeping, but overweight individuals experienced almost 20 fewer minutes of sleeplessness on weekends/holidays than normal-weight individuals (Table 2). There exists a U-shaped relationship between BMI and sleep duration such that BMI was lowest when sleep duration was approximately 8 hours/day and increased as sleep duration became both shorter and longer. On weekends/holidays, 5–7 hours of sleep are associated with higher BMI than 8–9 hours (Figure 1A).

Individuals with obesity, relative to normal weight individuals, were less likely to be asleep on weekdays between 9:30 PM–5:30 AM and on weekends/holidays from 10:30 PM to midnight, but were more likely to be asleep on weekdays between 8:00 AM–10:00 AM, and 1:00 PM–3:00 PM, and on weekends/holidays between noon–4:00 PM (Figure 2A). No significant or substantial differences in sleep time or timing were found between normal weight and overweight BMI categories.

Work—There were no differences appreciated between BMI categories in the odds of participating in work or in the amount of time working. The relationship between work time

and BMI is non-linear, particularly on weekends/holidays where 3–4 hours of work is associated with lower BMI than any lesser or greater amount of work (Figure 1B). There were no differences in the timing of work between the overweight and normal BMI categories, but individuals with obesity were more likely to be working between 3:30 AM–7:00 AM (Figure 2C) on weekdays than normal BMI individuals. It was also observed that individuals with obesity spent half the time searching and interviewing for jobs on weekdays compared to individuals in the normal BMI category.

Food/drink Preparation and Consumption—Individuals with obesity were less likely to participate in food and drink preparation than normal-weight individuals on weekdays (Table 2a). No differences were observed between categories in either the timing of, or the amount of time spent, eating or drinking (Figure 2D).

Self-Care—Individuals with obesity were more likely than normal-weight individuals to participate in health-related self-care, and overweight individuals spent over one hour more on weekdays than normal weight individuals on health-related self-care and also spent 15 more minutes (almost double the time) on professional and personal care services (Table 2).

Sports, Exercise and Recreation—Overweight individuals and individuals with obesity were less likely to participate in sports, exercise and recreation on weekdays and weekends/holidays compared to normal-weight individuals; however, those who did participate did not differ from normal-weight individuals in the amount of time spent participating. Overweight individuals were more likely to attend sports/recreation events during the week and spent 47 more minutes (almost 25% more) on this activity than normal-weight individuals (Table 2).

Sedentary Activities—Both on weekends/holidays and weekdays, individuals with obesity were both more likely to watch television/movies and spent an average of 15 more minutes on this activity than normal-weight individuals (Table 2). There was a positive and generally linear association between time spent viewing television/movies and BMI (Figure 1D). Further, relative to normal-weight individuals, individuals with obesity were more likely to watch television almost all hours of the day during the week and weekend except between 3:00 PM–10:00 AM and 10:00 PM – midnight on weekdays and between 1:00 AM–8:00 AM and 1:00 – 3:00 PM during weekends/holidays (when there were no differences between groups) (Figure 2B). Overweight and normal-weight individuals did not differ in the timing of television/movie viewing.

In general, individuals with overweight or obesity were found to be more likely to participate in and/or spend more time on arts and crafts, playing games, and utilizing the computer for leisure, but were less likely to read for personal interest on weekends/holidays and spend less time on arts and entertainment during the week.

Household Activities—During the week, individuals with overweight or obesity were less likely to participate in housework and individuals with obesity spent a third of the time caring for pets compared to normal-weight individuals. During the weekend/holidays, individuals with obesity were less likely to participate in housework, lawn care, or animal

and pet care than normal-weight individuals (Table 2). On weekends/holidays, individuals with obesity were more likely to participate in care for household children and household adults. It was also observed that individuals with obesity spend fifteen more minutes on religious and spiritual activities on weekends/holidays, compared to normal BMI individuals (who spend 116 minutes).

Discussion

In addition to the overconsumption of calorically dense foods and an increasingly sedentary lifestyle, reduced sleep duration has been identified as a lifestyle factor associated with the increased prevalence of obesity and obesity-related disorders (14,15). Prospective cohort studies have demonstrated that habitual short sleep duration is associated with increased future weight gain/obesity (16,17). Paradoxically, some cross-sectional studies have also revealed a relationship between long sleep duration and risk for obesity (18,19). Our analysis supports this U-shaped relationship where higher BMI is associated with both short and long amounts of sleep. Importantly, the average sleep times did not differ between those with obesity and the normal weight; this suggests that comparisons of average sleep time may not be appropriate due to the association of obesity with *both long and short* sleep. Causality or its direction cannot be determined from our data, but our results support the growing body of literature providing biologic plausibility for a causal role of short sleep in the genesis of weight gain (20,21). The role of long sleep is less clear, but reverse causation is a strong possibility as obesity has been identified as a significant risk factor for excessive daytime sleepiness (22).

While the literature is replete with studies about length of sleep and its impact on health, fewer studies analyze the *timing* of sleep. Our results show that on weekdays, those with obesity are significantly less likely to be sleeping at night, and significantly more likely to be sleeping during the day relative to normal-weight individuals. This is consistent with studies showing that daytime sleepiness is a comorbid characteristic of those with obesity. Sleep disorders prevalent amongst the obese (i.e. sleep apnea) may contribute to this pattern of behavior, but it has been shown that obesity, independent of sleep apnea, is still associated with daytime sleepiness (23).

The significance of the results regarding the timing of sleep is emphasized by our analysis of work time and timing. Work and employment activity are the activities that take the most amount of time away from sleep (9). Our study finds that individuals with obesity are more likely to work during hours typically devoted to sleep (2:00 AM to 7:00 AM). This finding contributes to the growing body of literature linking shift work, short sleep, and obesity; though the existing evidence is insufficient, this study contributes by providing these findings in nationally representative data (24,25). In America, shift work amongst nurses is linked with increased BMI, and shift work amongst truck drivers is associated with poor sleep quality (26,27). Furthermore, night-shift work is associated with increased risk for hypertension, diabetes, and metabolic syndrome in America, particularly in the African American population (28,29). The mechanism behind the association between shift work and obesity is unclear, but a study has shown a simulated night shift was associated with a predilection for high fat-content foods and another study proposes poor sleep quality as a

mediator (30,31). Our findings extend the evidence describing the relationship between night shift and obesity in showing that obesity is significantly associated with night-work behavior in nationally representative data that is adjusted for age, race, gender, income, education, employment characteristics and census region. Our analysis further showed that work hours longer than 3–4 hours on weekends/holidays are associated with higher BMI; this supports literature showing long work hours, particularly during weekend/holiday days, are associated with adverse mental and cardiovascular health outcomes (32). Given the significant financial and physiologic costs of obesity and short sleep, this relationship should be explored in further detail and further mechanisms should be elucidated.

Given that energy expenditure plays an important role in weight management, we examined time spent on both sedentary and active behaviors. It has been estimated that on an average day, only 1 in 4 American adults participate in sports, exercise or recreational activities; among those that do participate, sessions typically last more than 10 minutes per session, and accumulate to over 60 minutes per day (33). We found individuals with obesity are less likely to participate in sports, exercise and recreation, but those who participated engaged in these activities for non-trivial amounts of time. In fact, the time spent on these activities did not differ between BMI groups. Previous studies have shown that individuals who are overweight or obese are less physically active than normal weight individuals, and spend less time engaged in moderate or higher intensity activity, but our separation of the study sample into participants and non-participants for each activity elucidated that the number of non-participants might skew average exercise time (34). Our findings suggest that participation in these activities differs between BMI groups but among those who do engage, participation time does not differ. This is supported by literature finding that individuals who are trying to lose or maintain weight are more likely to be regularly active than those not trying to lose or maintain weight (35). Our findings suggest that the *motivation* to exercise is a meaningful target for lifestyle change.

Associations between sedentary activities, particularly television viewing, and obesity are well established (36). We found that individuals with obesity watch significantly more television than normal-weight individuals, and are more likely to watch television during both weekday and weekend/holiday days. In addition to television viewing, we also observed significant differences between BMI groups in game playing, arts and crafts, arts and entertainment, reading for personal interest, and engaging in religious activities. These findings are particularly interesting given models were controlled for age, race, sex, income, education, employment characteristics and census region.

Eating and drinking habits are also naturally worth considering. The existing literature finds that individuals with overweight or obesity spend less time eating and drinking than normal weight individuals; this relationship was observed in our results when models were only adjusted for age, race, gender, family income and education, but did not persist when also controlled for employment characteristics and census region (37). Further, no associations were found in the timing of eating and drinking activities across the groups; this is inconsistent with evidence exhibiting associations between weight loss effectiveness and the timing of caloric intake (38).

Our findings that individuals with obesity and the overweight are less likely to participate in housework activities support a growing body of literature that suggests the decrement in household management energy expenditure may have contributed to the increased prevalence of obesity (39). Other household activities, such as caring for adults and children, housework, food preparation, caring for pets, and lawn and garden work also exhibit different participation rates and time spent by BMI category and warrant further analysis.

Given the cross-sectional nature of the ATUS data it is difficult to infer causality. While we limited bias by utilizing statistical methods most appropriate to the data and question at hand and by adjusting each analysis with all covariates significantly associated with obesity, unaccounted characteristics of the excluded observations without BMI data subject the study to potential bias. Further, the survey questions lend themselves to digit preference bias; self-report for certain activities tend to be rounded to convenient numbers leading to response clusters around 15, 30, and 60-minute intervals(40). Moreover, certain activities have low participation rates or may not be partaken every day; the exact minute estimates for amount of time spent are thus not as meaningful as are the *differences* between BMI groups. For example, ATUS tends to overestimate sleep time; the usefulness of the findings are thus likely limited to differences between groups, rather than elucidating exact amount of time spent (9).

While previous analyses have been conducted on individual or a few activities, we were able to comprehensively analyze time use and its relationship to obesity. Importantly, the U-shaped relationship between sleep-time and BMI and between work-time and BMI, as well as the finding that individuals with obesity are more likely to work during the night and sleep during the day, underline the significance of the relationships amongst sleep, work, and BMI. Further investigation into the nature of these interactions is warranted. Our finding that individuals with obesity are less likely to participate in sports recreation or physical activity than normal BMI individuals, but spend similar times if they do participate, also warrants further investigation as it more clearly defines the nature of physical activity participation by those with obesity. The findings suggest that the motivation to exercise at all might be a more effective target for lifestyle change than amount of exercise. The findings for eating and drinking, television viewing, and household activities further suggest the importance of daily activities and lifestyle in health promotion. We hope in presenting the data for the remainder of our comprehensive analysis, there is opportunity for further investigation into the other significant associations found.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What is already known about this subject?

- Increasing caloric consumption and increasingly sedentary lifestyle are implicated in the increased prevalence of obesity and obesity related disorders.
- Existing evidence shows that individuals with obesity, on average, spend less time participating in physical activity and/or exercise and, in particular, spend less time participating in moderate to vigorous physical activity.
- Existing evidence on the relationship between obesity and sleep and work timing, particularly night-work, is deemed insufficient partly due to the lack of nationally representative samples.

What does this study add?

- This study provides an analysis of activities that account for 99.1% of time use in a nationally representative American sample.
- We divide time use analysis for activities into both participation and time spent in activity. In doing so we find individuals with obesity are less likely to participate in sports, exercise and recreation but, if participating, do so for times not different from individuals with normal BMI.
- We find evidence, in a nationally representative sample, of associations between obesity and the timing of work and sleep hours.

Figure 1. Analysis for Non-Linear Trends

Activities were analyzed for differences in BMI between a reference time category (chosen as the category with lowest BMI) and remaining time categories. Error bars represent 95% confidence intervals. Models were adjusted for age, race, gender, education, family income, employment characteristics, and census region.

Figure 2. Activity Timing Analysis

Each point and corresponding 95% confidence interval (error bars) represents the odds ratio for participation in the given activity at the corresponding half-hour time interval. The green line represents individuals with obesity, whereas the red line represents individuals who are overweight; both are in reference to normal BMI individuals, who are represented by the dark black line at value=1. Error bars were not included for the overweight population as the overwhelming majority of time-intervals showed no statistically significant difference in participation for overweight individuals compared to normal BMI individuals. Each regression was adjusted for age, race, gender, income, education, employment characteristics and census region.

Table 1

Sociodemographic Characteristics

This table details the sociodemographic associations with obesity. The first column indicates the percentage of the total population falling within each category of each sociodemographic variable. The second, third, and fourth columns show the percentage of each category of sociodemographic variable that fall into either normal BMI, overweight BMI, or obese BMI categories, respectively. The fifth column is an unadjusted estimate of the difference in BMI for each category within a sociodemographic variable compared to the reference category from the same variable; these were obtained from linear regression of only the indicated sociodemographic variable on BMI and are presented with their 95% confidence intervals. The right-most column is much the same but is the result of one regression of all sociodemographic variables on BMI and is thus an adjusted estimate. Statistically significant estimates are shown in bold.

Variable	Pop %	% Norm	% Ovwt	% Obese	Univariate BMI Estimate	BMI Controlled for All Covariates
Population	100%	34.5%	36.7%	28.8%	27.67 (27.58, 27.77)	29.11 (28.64, 29.58)
Age [years]						
22–29	17.6%	43.9%	33.4%	22.7%	-1.41 (-1.71, -1.10)	-1.67 (-1.99, -1.34)
30–39	21.6%	37.4%	34.7%	27.9%	-0.37 (-0.63, -0.12)	-0.35 (-0.61, -0.10)
40–49	24.5%	32.8%	37.2%	30.0%	27.89 (27.71, 28.06)	Reference
50–59	21.4%	28.9%	40.1%	31.0%	0.29 (0.05, 0.53)	0.37 (0.10, 0.63)
60–70	14.8%	29.8%	37.9%	32.3%	0.36 (0.10, 0.62)	0.32 (-0.05, 0.70)
Sex						
Male	51.1%	26.0%	43.8%	30.2%	28.13 (28.01, 28.26)	Reference
Female	48.9%	43.4%	29.3%	27.3%	-0.94 (-1.09, -0.79)	-1.11 (-1.26, -0.96)
Race/Ethnicity						
White	70.0%	36.0%	36.9%	27.1%	27.43 (27.31, 27.54)	Reference
Black	11.5%	24.2%	36.6%	39.2%	2.01 (1.70, 2.32)	1.67 (1.35, 2.00)
Hispanic	12.9%	28.8%	38.4%	32.8%	0.82 (0.58, 1.06)	0.62 (0.36, 0.89)
Asian	3.6%	61.9%	28.3%	9.8%	-3.07 (-3.51, -2.64)	-2.37 (-2.84, -1.90)
Other	2.1%	27.2%	35.1%	37.7%	1.12 (0.42, 1.81)	1.08 (0.39, 1.76)
Education						
Less than High School	10.9%	26.5%	38.6%	34.8%	0.34 (0.02, 0.67)	-0.10 (-0.45, 0.25)
High School Graduate	48.1%	30.1%	36.6%	33.3%	28.32 (28.18, 28.47)	Reference
College graduate	30.1%	40.4%	36.6%	23.1%	-1.51 (-1.71, -1.32)	-1.07 (-1.27, -0.87)

Variable	Pop %	% Norm	% Owht	% Obese	Univariate BMI Estimate	BMI Controlled for All Covariates
Marital Status						
Master's degree or higher	10.9%	45.2%	36.0%	18.8%	-2.12 (-2.39, -1.85)	-1.63 (-1.92, -1.34)
Married	62.7%	33.4%	37.7%	28.9%	27.68 (27.57, 27.79)	Reference
Divorced/Separated	13.2%	32.7%	36.5%	30.8%	0.37 (0.15, 0.60)	-0.31 (-0.70, 0.08)
Widowed	2.6%	29.9%	35.0%	35.1%	1.09 (0.61, 1.58)	0.28 (-0.30, 0.87)
Never married	21.6%	39.2%	34.2%	26.5%	-0.37 (-0.62, -0.11)	-0.13 (-0.54, 0.27)
Presence of spouse or unmarried partner						
Spouse or unmarried partner present	66.6%	33.5%	37.8%	28.7%	27.64 (27.53, 27.75)	Reference
No spouse or unmarried partner present	33.4%	36.4%	34.6%	29.0%	0.10 (-0.10, 0.30)	0.06 (-0.31, 0.42)
Presence of Household Children						
No children	58.9%	34.2%	37.0%	28.8%	27.70 (27.57, 27.83)	Reference
1 child	16.2%	35.7%	35.1%	29.2%	-0.06 (-0.29, 0.18)	0.22 (-0.04, 0.49)
2 children	15.9%	35.5%	37.4%	27.1%	-0.24 (-0.45, -0.04)	0.10 (-0.16, 0.36)
3 or more children	9.1%	32.4%	36.6%	31.0%	0.22 (-0.07, 0.50)	0.28 (-0.06, 0.63)
Family Income						
< \$25,000	15.9%	32.5%	33.3%	34.2%	0.37 (0.10, 0.65)	0.13 (-0.16, 0.42)
\$25,000 < \$50,000	23.3%	30.8%	37.3%	31.9%	28.11 (27.93, 28.28)	Reference
\$50,000 < \$75,000	18.2%	32.8%	37.7%	29.5%	-0.32 (-0.60, -0.05)	-0.08 (-0.36, 0.20)
\$75,000 < \$100,000	12.2%	36.4%	38.0%	25.6%	-0.87 (-1.18, -0.57)	-0.43 (-0.74, -0.11)
\$100,000 < \$150,000	10.3%	37.3%	38.5%	24.2%	-1.13 (-1.42, -0.85)	-0.55 (-0.84, -0.27)
\$150,000	6.6%	44.9%	39.6%	15.5%	-2.23 (-2.55, -1.92)	-1.45 (-1.78, -1.11)
No family income information available	13.6%	36.3%	34.5%	29.2%	-0.45 (-0.78, -0.13)	-0.44 (-0.77, -0.11)
Employment						
Private Sector employee	51.2%	34.4%	37.6%	28.0%	27.56 (27.45, 27.68)	Reference
Government employee	11.0%	33.0%	38.3%	28.6%	0.10 (-0.15, 0.36)	0.25 (0.00, 0.51)
Self-employed or Employed Without Pay	8.2%	34.5%	43.0%	22.5%	-0.64 (-0.93, -0.34)	-0.77 (-1.06, -0.48)
Employed but absent from work	2.8%	34.2%	36.4%	29.5%	0.27 (-0.23, 0.76)	0.27 (-0.23, 0.77)
Full time college or university student	3.1%	47.0%	27.4%	25.6%	-0.98 (-1.65, -0.31)	0.04 (-0.61, 0.69)
Unemployed	3.4%	34.2%	35.3%	30.5%	0.41 (-0.09, 0.90)	-0.04 (-0.55, 0.46)
Retired	7.7%	28.5%	39.2%	32.2%	0.69 (0.40, 0.98)	-0.04 (-0.41, 0.33)
Not in labor force	12.7%	36.5%	29.1%	34.4%	0.86 (0.55, 1.18)	0.53 (0.20, 0.85)

Variable	Pop %	% Norm	% Ovwt	% Obese	Univariate BMI Estimate	BMI Controlled for All Covariates
Multiple Job Status						
Not working multiple jobs	92.6%	34.4%	36.7%	28.9%	27.69 (27.59, 27.79)	Reference
Working multiple jobs	7.4%	35.5%	36.6%	27.9%	-0.18 (-0.50, 0.13)	0.14 (-0.17, 0.45)
Census Region						
South	36.1%	32.5%	36.2%	31.3%	27.97 (27.81, 28.13)	Reference
West	21.5%	37.2%	36.8%	26.0%	-0.75 (-1.01, -0.49)	-0.35 (-0.60, -0.11)
Midwest	24.4%	33.0%	37.3%	29.7%	-0.13 (-0.36, 0.10)	0.10 (-0.13, 0.33)
Northeast	18.0%	37.0%	37.0%	26.0%	-0.57 (-0.83, -0.31)	-0.24 (-0.49, 0.02)
Season						
Winter	24.7%	33.8%	36.7%	29.5%	27.80 (27.61, 27.98)	Reference
Spring	25.1%	34.6%	37.0%	28.3%	-0.13 (-0.38, 0.12)	-0.19 (-0.43, 0.06)
Summer	25.3%	34.4%	36.9%	28.6%	-0.16 (-0.41, 0.10)	-0.18 (-0.43, 0.07)
Fall	24.9%	34.9%	36.3%	28.7%	-0.19 (-0.44, 0.05)	-0.24 (-0.48, 0.00)
Survey Year						
2006	33.0%	35.1%	36.5%	28.5%	27.63 (27.46, 27.79)	Reference
2007	33.2%	34.5%	36.7%	28.8%	0.06 (-0.16, 0.28)	0.07 (-0.15, 0.30)
2008	33.8%	33.8%	37.0%	29.1%	0.08 (-0.15, 0.31)	0.15 (-0.08, 0.37)

Activity Participation and Time

Table 2

Each activity category is listed along with the percentage of the overall sample that has spent non-zero amounts of time in said activity. The difference in the likelihood individuals in the overweight or obese BMI categories participate in an activity (non-zero amounts of time spent) compared to individuals in the normal BMI category are presented as odds ratios with their respective 95% confidence intervals. The average number of minutes spent on an activity by participating individuals in the normal BMI category is also presented. The difference in the average number of minutes spent by individuals in the overweight and obese BMI categories compared to individuals in the normal BMI category and the corresponding 95% confidence intervals are also presented for each activity category. All models are adjusted for age, race, gender, family income, educational attainment, employment characteristic and census region. Significant results are presented in bold.

a: Weekdays						
Activity (% Participating)	OR of Participating (Ref: Normal BMI)		Minutes Spent on Activity (If Participating)			
	Overweight	Obese	Normal (ref.)	Overweight	Obese	
Sleeping	99.9%	0.75 (0.18, 3.12)	7.81 (0.42, 143.92)	461 (452, 471)	-6.6 (-12.5, -0.7)	-3.6 (-9.8, 2.6)
Sleeplessness	5.3%	0.98 (0.80, 1.22)	1.03 (0.81, 1.32)	65 (45, 85)	8.1 (-7.7, 23.9)	-0.9 (-15.4, 13.5)
Grooming	83.2%	1.06 (0.92, 1.21)	1.06 (0.91, 1.25)	43 (41, 45)	-0.6 (-2.0, 0.8)	-1.7 (-3.2, -0.1)
Health-related Self Care	5.5%	1.09 (0.86, 1.39)	1.91 (1.49, 2.43)	59 (1, 116)	60.3 (12.2, 108.5)	-15.6 (-49.1, 17.9)
Personal Activities	0.7%	1.46 (0.76, 2.78)	1.70 (0.87, 3.31)	96 (31, 161)	27.7 (-40.8, 96.3)	-17.2 (-75.7, 41.4)
Housework	35.3%	0.88 (0.79, 0.98)	0.88 (0.78, 0.99)	55 (44, 66)	-0.2 (-7.3, 6.8)	-0.5 (-8.6, 7.6)
Food & Drink Preparation, Presentation, & Clean Up	55.2%	0.95 (0.85, 1.07)	0.83 (0.75, 0.92)	35 (30, 39)	-2.2 (-5.5, 1.0)	-3.7 (-7.6, 0.1)
Interior Maintenance, Repair & Decoration	9.0%	0.99 (0.84, 1.17)	0.94 (0.77, 1.15)	139 (108, 169)	-2.3 (-26.2, 21.6)	-6.9 (-32.1, 18.3)
Lawn, Garden, and Houseplants	9.0%	0.93 (0.78, 1.11)	0.83 (0.70, 1.00)	93 (70, 117)	1.0 (-15.7, 17.8)	-8.9 (-24.5, 6.7)
Animals and Pets	15.6%	0.94 (0.81, 1.08)	0.87 (0.74, 1.02)	31 (24, 38)	-2.6 (-7.5, 2.4)	-9.6 (-14.2, -5.1)
Household Management	29.6%	1.03 (0.92, 1.16)	1.07 (0.95, 1.21)	31 (24, 38)	5.7 (1.4, 10.0)	4.6 (-0.3, 9.5)

<i>a: Weekdays</i>						
<i>Activity (% Participating)</i>	<i>OR of Participating (Ref: Normal BMI)</i>		<i>Minutes Spent on Activity (If Participating)</i>			
	<i>Overweight</i>	<i>Obese</i>	<i>Normal (ref.)</i>	<i>Overweight</i>	<i>Obese</i>	
Caring for & Helping Household Children	27.2%	1.12 (0.99, 1.24)	1.09 (0.97, 1.23)	57 (44, 70)	-2.6 (-10.2, 4.9)	-2.2 (-10.4, 6.1)
Caring for Household Adults	5.6%	1.24 (0.98, 1.58)	1.23 (0.97, 1.56)	29 (-11, 69)	-3.5 (-21.3, 14.2)	15.5 (-14.3, 45.3)
Caring for & Helping Non-Household Children	5.1%	1.30 (0.99, 1.68)	1.15 (0.90, 1.48)	63 (27, 100)	10.0 (-12.3, 32.3)	-6.3 (-30.2, 17.6)
Caring for Non-Household Adults	7.4%	1.13 (0.95, 1.33)	1.16 (0.95, 1.41)	56 (31, 81)	-8.2 (-24.0, 7.6)	-9.1 (-30.1, 12.0)
Working	65.2%	1.03 (0.87, 1.23)	1.02 (0.85, 1.22)	520 (507, 533)	2.1 (-7.0, 11.2)	4.0 (-5.6, 13.5)
Job Search and Interviewing	1.6%	0.76 (0.46, 1.24)	1.03 (0.63, 1.68)	102 (6, 198)	-40.7 (-85.5, 4.1)	-51.6 (-99.2, -4.0)
Taking Class	2.6%	0.86 (0.56, 1.31)	0.69 (0.47, 1.01)	170 (105, 236)	-11.5 (-48.5, 25.5)	31.0 (-11.9, 74.0)
Research/Homework	2.9%	0.67 (0.45, 1.00)	0.69 (0.46, 1.05)	170 (97, 243)	-21.4 (-68.9, 26.1)	-9.6 (-55.5, 36.3)
Consumer Purchases	40.4%	1.00 (0.90, 1.11)	1.06 (0.95, 1.18)	33 (26, 40)	3.5 (-0.8, 7.9)	3.2 (-1.6, 8.0)
Professional & Personal Care Services	10.4%	0.99 (0.84, 1.17)	1.04 (0.87, 1.24)	21 (7, 36)	14.9 (5.9, 23.8)	4.5 (-4.3, 13.3)
Household Services	2.3%	0.84 (0.62, 1.13)	0.98 (0.73, 1.32)	16 (-7, 39)	2.8 (-10.9, 16.4)	8.2 (-8.0, 24.3)
Government Services & Civic Obligations	1.0%	1.18 (0.74, 1.89)	1.50 (0.93, 2.45)	47 (-10, 104)	-4.5 (-42.5, 33.5)	0.6 (-29.6, 30.9)
Eating and Drinking	95.9%	1.09 (0.84, 1.41)	0.97 (0.74, 1.29)	65 (62, 68)	-2.4 (-4.9, 0.1)	-2.5 (-4.9, -0.1)
Socializing and Communicating	35.3%	1.04 (0.94, 1.16)	1.04 (0.93, 1.16)	71 (58, 83)	-0.4 (-7.9, 7.1)	3.9 (-3.3, 11.2)
Relaxing, Thinking	22.0%	0.99 (0.87, 1.12)	1.05 (0.91, 1.21)	64 (48, 80)	2.5 (-6.6, 11.6)	-3.1 (-11.9, 5.7)
Tobacco and Drug Use	2.8%	1.04 (0.77, 1.40)	0.76 (0.55, 1.04)	22 (14, 30)	0.3 (-8.3, 8.9)	-4.0 (-10.9, 2.9)

a: Weekdays						
Activity (% Participating)	OR of Participating (Ref: Normal BMI)			Minutes Spent on Activity (If Participating)		
	Overweight	Obese	Normal (ref.)	Overweight	Obese	
Television and Movies	79.1%	1.11 (0.97, 1.27)	1.17 (1.03, 1.33)	171 (160, 183)	1.5 (−5.5, 8.5)	15.1 (7.3, 22.9)
Listening to the Radio	3.1%	0.80 (0.59, 1.07)	0.74 (0.54, 1.01)	56 (19, 93)	2.6 (−17.8, 22.9)	−6.5 (−26.8, 13.8)
Playing Games	6.3%	1.10 (0.87, 1.39)	1.52 (1.21, 1.92)	118 (80, 157)	6.0 (−20.6, 32.6)	5.9 (−19.4, 31.2)
Computer Use for Leisure (excluding Games)	9.4%	0.95 (0.81, 1.11)	1.05 (0.87, 1.27)	79 (57, 101)	2.0 (−8.7, 12.7)	16.9 (3.5, 30.2)
Arts and Crafts as a Hobby	1.3%	1.11 (0.66, 1.88)	1.97 (1.09, 3.57)	169 (91, 247)	−48.7 (−106.7, 9.3)	−23.6 (−80.3, 33.1)
Reading for Personal Interest	24.0%	0.99 (0.88, 1.11)	0.91 (0.81, 1.03)	54 (39, 69)	6.0 (−2.5, 14.5)	6.1 (−3.1, 15.2)
Arts and Entertainment (other than Sports)	2.1%	1.10 (0.79, 1.53)	1.04 (0.72, 1.49)	228 (173, 284)	−51.1 (−79.3, −23.0)	−54.5 (−85.0, −24.0)
Participating in Sports, Exercise, and Recreation	17.0%	0.78 (0.69, 0.89)	0.52 (0.45, 0.61)	111 (92, 130)	1.6 (−7.4, 10.5)	4.6 (−7.3, 16.5)
Attending Sports/Recreational Events	0.8%	2.92 (1.59, 5.35)	1.01 (0.51, 2.00)	196 (116, 276)	47.5 (11.1, 83.8)	43.3 (−4.9, 91.4)
Religious and Spiritual Activities	5.2%	0.91 (0.73, 1.14)	0.91 (0.74, 1.12)	51 (29, 73)	4.0 (−12.6, 20.7)	−4.7 (−16.9, 7.6)
Volunteer Activities	6.5%	1.01 (0.84, 1.22)	0.90 (0.73, 1.10)	158 (119, 196)	−7.1 (−32.2, 18.0)	−21.9 (−45.1, 1.4)
Telephone Calls	14.2%	0.91 (0.79, 1.05)	0.91 (0.78, 1.06)	21 (12, 30)	1.1 (−4.3, 6.6)	0.8 (−5.7, 7.3)
Travel	90.5%	1.07 (0.90, 1.28)	0.93 (0.78, 1.11)	80 (74, 87)	3.8 (0.5, 7.0)	2.0 (−1.9, 5.9)

b: Weekends						
Activity (% Participating)	OR of Participating (Ref: Normal BMI)		Minutes Spent on Activity (If Participating)			
	Overweight	Obese	Normal (ref.)	Overweight	Obese	
Sleeping	99.9%	1.75 (0.31, 9.86)	0.79 (0.18, 3.43)	549 (538, 560)	−3.5 (−10.7, 3.7)	−2.6 (−10.1, 4.9)

b: Weekends						
Activity (% Participating)	OR of Participating (Ref: Normal BMI)			Minutes Spent on Activity (If Participating)		
	Overweight	Obese	Normal (ref.)	Overweight	Obese	
Sleeplessness	4.3%	0.89 (0.67, 1.18)	1.04 (0.78, 1.40)	63 (38, 88)	-19.7 (-36.8, -2.7)	-6.4 (-23.2, 10.4)
Grooming	72.0%	1.00 (0.88, 1.13)	0.96 (0.83, 1.10)	44 (42, 47)	0.1 (-1.7, 1.8)	-1.0 (-3.0, 1.0)
Health-related Self Care	4.5%	1.03 (0.78, 1.37)	1.27 (0.98, 1.65)	186 (86, 285)	25.8 (-26.6, 78.2)	-4.5 (-55.1, 46.1)
Personal Activities	0.8%	0.72 (0.41, 1.24)	0.64 (0.36, 1.16)	252 (86, 418)	-22.8 (-97.3, 51.8)	-39.1 (-91.2, 13.0)
Housework	40.7%	0.97 (0.87, 1.08)	0.88 (0.79, 0.99)	107 (96, 119)	0.8 (-7.5, 9.1)	-2.2 (-10.6, 6.2)
Food & Drink Preparation, Presentation, & Clean Up	52.6%	0.98 (0.89, 1.08)	0.98 (0.87, 1.10)	51 (43, 58)	0.2 (-5.1, 5.5)	-2.2 (-7.1, 2.8)
Interior Maintenance, Repair & Decoration	12.5%	1.04 (0.91, 1.18)	0.94 (0.79, 1.11)	164 (134, 194)	-10.2 (-28.7, 8.4)	-2.1 (-23.5, 19.4)
Lawn, Garden, and Houseplants	13.1%	0.91 (0.79, 1.04)	0.77 (0.65, 0.91)	204 (176, 232)	-19.0 (-38.4, 0.4)	-7.8 (-32.9, 17.2)
Animals and Pets	13.7%	0.93 (0.81, 1.06)	0.83 (0.71, 0.96)	61 (49, 72)	-9.2 (-18.4, 0.1)	-13.9 (-22.2, -5.6)
Household Management	25.4%	0.90 (0.80, 1.00)	0.96 (0.84, 1.11)	39 (29, 49)	4.5 (-2.4, 11.5)	-0.5 (-7.2, 6.3)
Caring for & Helping Household Children	22.6%	1.11 (0.99, 1.23)	1.13 (1.00, 1.29)	83 (67, 98)	-5.2 (-14.1, 3.6)	-11.4 (-21.0, -1.7)
Caring for Household Adults	4.2%	1.00 (0.78, 1.28)	1.51 (1.17, 1.95)	39 (0, 78)	-3.8 (-24.8, 17.1)	-2.2 (-24.3, 19.9)
Caring for & Helping Non-Household Children	5.2%	1.21 (0.97, 1.52)	1.14 (0.87, 1.49)	73 (40, 106)	-1.2 (-24.5, 22.2)	-5.8 (-27.0, 15.3)
Caring for Non-Household Adults	9.7%	1.02 (0.85, 1.23)	0.98 (0.81, 1.17)	102 (70, 134)	2.5 (-15.0, 20.0)	-0.9 (-18.7, 16.9)
Working	26.6%	1.03 (0.90, 1.18)	1.01 (0.88, 1.16)	418 (384, 452)	8.4 (-11.4, 28.3)	18.7 (-4.8, 42.2)
Job Search and Interviewing	0.6%	0.98 (0.50, 1.92)	1.53 (0.73, 3.23)	60 (-41, 160)	-36.1 (-99.4, 27.2)	-10.4 (-70.3, 49.4)

b: Weekends				
Activity (% Participating)	OR of Participating (Ref: Normal BMI)		Minutes Spent on Activity (If Participating)	
	Overweight	Obese	Normal (ref.)	Obese
Taking Class	0.63 (0.39, 1.01)	0.67 (0.43, 1.07)	54 (-27, 134)	-20.7 (-76.1, 34.6)
Research/Homework	0.94 (0.67, 1.31)	0.82 (0.55, 1.23)	269 (179, 360)	14.1 (-38.7, 67.0)
Consumer Purchases	1.07 (0.97, 1.17)	1.04 (0.93, 1.16)	70 (61, 78)	-1.6 (-6.4, 3.3)
Professional & Personal Care Services	1.03 (0.83, 1.27)	1.14 (0.90, 1.44)	29 (8, 51)	9.5 (-4.3, 23.2)
Household Services	0.94 (0.69, 1.28)	0.76 (0.53, 1.09)	66 (29, 103)	4.4 (-21.3, 30.1)
Government Services & Civic Obligations	0.45 (0.16, 1.25)	0.59 (0.19, 1.83)	-75 (-269, 119)	8.1 (-123.4, 139.7)
Eating and Drinking	1.09 (0.86, 1.38)	0.98 (0.76, 1.26)	71 (67, 76)	-1.6 (-4.5, 1.3)
Socializing and Communicating	1.09 (0.98, 1.22)	0.97 (0.86, 1.10)	135 (116, 154)	3.3 (-5.8, 12.4)
Relaxing, Thinking	1.01 (0.90, 1.13)	1.00 (0.86, 1.15)	91 (67, 115)	7.0 (-7.9, 21.9)
Tobacco and Drug Use	0.75 (0.49, 1.16)	0.46 (0.28, 0.75)	8 (-12, 28)	-9.0 (-31.1, 13.0)
Television and Movies	1.10 (0.96, 1.25)	1.30 (1.14, 1.48)	259 (246, 273)	0.3 (-9.4, 10.1)
Listening to the Radio	0.79 (0.59, 1.07)	0.71 (0.52, 0.97)	61 (14, 108)	6.8 (-21.7, 35.2)
Playing Games	1.02 (0.85, 1.23)	1.23 (0.99, 1.53)	137 (98, 176)	21.0 (-0.5, 42.4)
Computer Use for Leisure (excluding Games)	1.03 (0.85, 1.26)	1.21 (0.95, 1.54)	99 (75, 123)	-0.8 (-17.8, 16.1)
Arts and Crafts as a Hobby	1.27 (0.82, 1.98)	1.59 (1.08, 2.34)	165 (53, 278)	-16.0 (-69.2, 37.2)
Reading for Personal Interest	0.84 (0.75, 0.93)	0.75 (0.66, 0.85)	79 (63, 94)	-11.2 (-18.4, -4.0)
Arts and Entertainment (other than Sports)	1.04 (0.81, 1.32)	1.11 (0.88, 1.40)	166 (121, 211)	6.1 (-15.5, 27.6)

b: Weekends						
Activity (% Participating)	OR of Participating (Ref: Normal BMI)			Minutes Spent on Activity (If Participating)		
	Overweight	Obese	Normal (ref.)	Overweight	Obese	
Participating in Sports, Exercise, and Recreation	16.5%	0.77 (0.68, 0.87)	0.58 (0.48, 0.71)	153 (127, 178)	11.6 (−2.9, 26.2)	1.5 (−14.5, 17.5)
	1.6%	0.87 (0.62, 1.24)	0.98 (0.64, 1.51)	218 (146, 289)	−7.8 (−50.4, 34.8)	−0.3 (−62.3, 61.7)
Attending Sports/Recreational Events	15.0%	1.03 (0.90, 1.16)	1.04 (0.91, 1.19)	116 (97, 136)	4.9 (−3.9, 13.7)	14.8 (3.0, 26.6)
Religious and Spiritual Activities	7.0%	1.00 (0.84, 1.20)	1.21 (0.98, 1.50)	185 (144, 226)	−3.4 (−27.0, 20.2)	2.0 (−24.9, 29.0)
	12.7%	1.07 (0.92, 1.24)	0.97 (0.83, 1.13)	26 (18, 35)	3.7 (−1.3, 8.8)	6.0 (0.1, 11.9)
Telephone Calls	84.9%	1.15 (0.99, 1.32)	1.00 (0.87, 1.16)	82 (75, 89)	0.9 (−4.2, 6.1)	−1.2 (−6.4, 4.1)