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Leisure Time Sedentary Behavior, Occupational/Domestic Physical Activity and Metabolic Syndrome in U.S. Men and Women

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Abstract

Background—This study examines leisure time sedentary behavior (LTSB) and usual occupational/domestic activity (UODA) and the relationship with metabolic syndrome and individual cardiovascular disease (CVD) risk factors, independent of physical activity level.

Methods—NHANES 2003–2006 data from men (n=1868) and women (n=1688) with fasting measures were classified as having metabolic syndrome by the AHA/NHLBI definition. LTSB was determined from self-reported TV viewing and computer usage. UODA was self-reported daily behavior (sitting, standing, walking, carrying loads).

Results—LTSB ≥ 4 hr/day was associated with odds of having metabolic syndrome of 1.94 (95% CI:1.24, 3.03) in men compared to ≤ 1 hr/day. LTSB ≥ 4 hr/day was also associated with higher odds of elevated waist circumference (1.88, CI:1.03, 3.41), low HDL-cholesterol (1.84, CI:1.33, 2.51), and high blood pressure (1.55, CI:1.07, 2.24) in men. LTSB 2–3 hr/day was associated with higher odds of elevated glucose (1.32, CI:1.00, 1.75) in men. In women, odds of metabolic syndrome were 1.54 (CI:1.00, 2.37) with ≥ 4 hr/day LTSB, but LTSB was not associated with risk of the individual CVD risk factors. Higher LTSB was associated with metabolic syndrome in inactive men (1.50, CI: 1.07, 2.09), active men (1.74, CI:1.11, 2.71), inactive women (1.69, CI:1.24, 2.33), but not active women (1.62, CI:0.87,3.01). UODA was not associated with metabolic syndrome or CVD risk factors in either men or women.

Conclusions—In men, high LTSB is associated with higher odds of metabolic syndrome and individual CVD risk factors regardless of meeting physical activity recommendations. In women, high LTSB is associated with higher odds of metabolic syndrome only in those not meeting the physical activity recommendations.

Keywords

disease risk; leisure time; metabolic syndrome; risk factor clustering; TV viewing; screen time

INTRODUCTION

Sedentary behaviors include activities at the lowest spectrum of energy expenditure such as lying down, sitting, watching television (TV), using the computer and other media and screen-

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AUTHOR DISCLOSURE

No competing financial interests exist.

based past times (i.e., 1.0 to 1.5 METs)¹. TV viewing is the measure of leisure time sedentary behavior (LTSB) most often used in recent research² and is perhaps a stronger marker for an overall sedentary lifestyle in women than in men³. Analysis of accelerometer data revealed that approximately 55% of waking hours is spent in sedentary behavior in adults and children in the U.S.⁴. Furthermore, as people age a larger percent of the day is spent in sedentary pursuits.

There is a growing body of literature highlighting the health risks associated with acute exposure to a sedentary behavior, such as bouts of sitting⁵. Furthermore, a habitual sedentary lifestyle has been associated with a plethora of risk factors; they include a higher risk for obesity⁶ and type 2 diabetes⁷, in addition to an elevated cardiovascular disease (CVD) risk factor profile^{8,9}. Not only has sedentary behavior been associated with individual CVD risk factors¹⁰, but it has also been associated with the clustering of risk factors and the metabolic syndrome^{11–14}.

Metabolic syndrome is a constellation of several cardiovascular disease and diabetes risk factors including obesity, high triglycerides, low HDL-cholesterol, high blood pressure, and high fasting glucose classified by the American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI) criteria¹⁵. According to the National Health and Nutrition Examination Survey (NHANES) 1999–2004, approximately 36% of the United States (U.S.) adult population have metabolic syndrome as classified by the AHA/NHLBI criterion¹⁶. Recent studies have reported that physical activity level^{17–20} and physical fitness^{21, 22} are associated with lower prevalence and incidence of metabolic syndrome and individual CVD risk factors (e.g., high blood pressure, insulin resistance, abdominal adiposity, and dislipoproteinemia). Sedentary time and lack of exercise have also been related to metabolic syndrome and individual CVD risk factors in populations across the globe^{11–14}. Furthermore, it appears that the influence of LTSB on a number of individual CVD risk factors is evident even in those individuals who accumulate recommended amounts of moderate-to-vigorous physical activity¹⁰. Higher levels of occupational activity have also been associated with lower metabolic and CVD risk^{23, 24}.

Four or more hours of LTSB (in this case, computer and television viewing time) has been associated with a higher risk of metabolic syndrome compared to those reporting less than one hour per day (OR 2.10 (95% CI 1.27, 3.47)) in a nationally representative sample of Americans from 1999–2000¹⁴. Increments less than four or more hours (i.e., one, two, three hours/day) were not significantly different from the referent group, emphasizing a potential threshold effect. The purpose of this study is to examine leisure time sedentary behavior (LTSB) and usual occupational/domestic physical activity (UODA) independent of meeting current physical activity recommendations and the relationship with metabolic syndrome and individual CVD risk factors in U.S. men and women.

METHODS

Analyses were conducted using data from the U.S. National Health and Nutrition Examination Survey²⁵ (NHANES) cycles 2003–04 and 2005–06 combined to increase the sample size. NHANES uses a complex, multistage, probability sampling design to select participants who are representative of the civilian, non-institutionalized U.S. population. Race or ethnicity was derived from questions about race and Hispanic origin [European American (EA), Mexican American (MA), African American (AA)]. For these analyses, “other Hispanic” and other were combined into the “other” category. For LTSB, participants were asked “Over the past 30 days, on average how many hours per day did you sit and watch TV or videos?” and “Over the past 30 days, on average about how many hours per day did you use a computer or play computer games [outside of work]?” Response categories included “none”, “<1 hr”, “1 hr”, “2 hr”, “3

hr”, “4 hr”, and “5 or more hours”. The questions regarding TV and computer did not specify that the behavior in question be the primary activity. These variables were combined to create a total “screen time” outcome variable, which serves as our primary measure of LTSB; which has been done in similar studies^{11, 14}. Once total LTSB was created it was collapsed into two (≤ 2 and ≥ 3 hr/day) and three (≤ 1 , 2–3, and ≥ 4 hr/day) categories for analyses in order to maintain sufficient sample sizes. For UODA, participants were asked “Which of the four sentences best describe your usual daily activities?” Response categories included “sit during the day and do not walk about very much”, “stand or walk about quite a lot during the day but do not have to lift or carry things very often”, “lift or carry light loads or have to climb stairs or hills often”, and “heavy work or carries heavy loads”. For the analyses, stands or walks, lifts or carries, and heavy work were combined into one category to be compared against the mostly sitting category in order to examine the risk of a sedentary lifestyle. UODA was selected as a measure of domestic and occupational activity since the sample of participants include students, homemakers, retirees, as well as employed individuals. Participation in moderate and vigorous physical activity were categorized as meeting or not meeting current physical activity recommendations defined as at least 150 minutes per week of leisure-time moderate-to-vigorous physical activity.

Weight, height, waist circumference and blood pressure were measured in the mobile exam center²⁵. Blood was typically drawn from an antecubital vein of the left arm following an overnight fast. Diagnosis of metabolic syndrome was made using the AHA/NHLBI guidelines¹⁵. The guidelines state that for a person to be diagnosed with metabolic syndrome they must have three or more of the following five risk factors: 1) high waist circumference (≥ 102 cm for men and ≥ 88 cm for women); 2) high triglycerides (≥ 150 mg/dL or on drug treatment); 3) low HDL-cholesterol (< 40 mg/dL for men and < 50 mg/dL in women or on drug treatment); 4) high blood pressure (≥ 130 mmHg systolic or ≥ 85 mmHg diastolic or on drug treatment); 5) high fasting glucose (≥ 100 mg/dL or on drug treatment)¹⁵. The collection procedures for NHANES were reviewed and approved by the National Center for Health Statistics’ (NCHS) Institutional Review Board. Documentation on informed consent can be located on the NHANES website²⁵.

Data analysis followed the guidelines of the NCHS for analysis of NHANES data due to complex sampling design and methods²⁶. Participants younger than 20 years of age, those that were pregnant or breast feeding, those physically unable to be active, or having responded “don’t know” or refused or having a missing response for the questions on LTSB were excluded from the present analysis. Two participants were removed due to extreme values (BMI ≥ 100 kg/m² and total cholesterol ≥ 600 mg/dL). For the primary outcome analyses, all continuous variables were standardized to a mean of zero and unit standard deviation to aid in the interpretation of the findings.

Descriptive statistics for the prevalence of spending ≥ 2 hours per day in LTSB were calculated using sampling weights so that estimates were representative of the adult U.S. population. Primary outcome analyses were performed with sex specific, sequential binary logistic regression models. The primary outcomes included the AHA/NHLBI metabolic syndrome and each of its five component risk factors. Covariates in the fully adjusted model included age (years), BMI (kg/m²), smoking status (current or past vs. never), education ($<$ high school (HS) or HS/or equivalent vs. $>$ HS), ethnicity (AA or MA or other vs. EA), and dietary fat intake (percent of total calories consumed from dietary fat). The first model included LTSB or UODA and age (years) only. Model two included LTSB or UODA, age, and the other covariates. Model three included variables from model two and sufficient physical activity. SAS 9.1 software was used for these analyses.

RESULTS

There were 1,868 men (n=645, 34.1% with metabolic syndrome) and 1,688 women (n=640, 32.7% with metabolic syndrome) included in the final analyses. The prevalence of U.S. adults spending ≥ 2 hours per day in LTSB was 51.9% for men and 48.9% for women. For men, 61.3% vs. 47.0% and for women 61.4% vs. 42.8% spend > 2 hours daily in LTSB for those with and without metabolic syndrome, respectively. Descriptive characteristics by sex and by presence (or not) of metabolic syndrome are presented in Table 1.

The results of the analyses of LTSB and metabolic syndrome outcome are presented in Table 2 and each of the individual CVD risk factors are located in Table 3. The highest category of LTSB (≥ 4 hr/day) was associated with 1.95 greater odds (95% CI: 1.25, 3.04) of having metabolic syndrome in men compared to ≤ 1 hr/day (Model 2). The intermediate category (2–3 hr/day) of LTSB was not associated with an increase in odds of metabolic syndrome. When sufficient physical activity (yes/no for engaging in > 150 minutes or more per week of moderate-to-vigorous physical activity) was added to the regression analyses (Model 3), the relationship between LTSB and metabolic syndrome was unchanged (1.94 increased odds, 95% CI: 1.24, 3.03). Interpretation of the results of Model 3 is that the odds of having metabolic syndrome is approximately 94% higher in those men who spend four or more hours in LTSB daily compared to those spending one hour or less independent of their physical activity level. For the individual CVD risk factors in the fully adjusted models, LTSB was associated with significantly higher risk for high waist circumference, low HDL-cholesterol, high blood pressure, and high glucose (Table 3). UODA was not significantly associated with metabolic syndrome or any of the individual CVD risk factors in the fully adjusted model, although it was a significant predictor for metabolic syndrome and for high waist circumference in men in model 1 (adjusted only for age) (Table 4).

In women, odds of having metabolic syndrome were 1.56 higher (95% CI: 1.00, 2.41) in those who spent four or more hours in LTSB daily compared to those spending one hour or less (Model 2). The intermediate category of LTSB (2–3 hr/day) was not associated with higher odds of metabolic syndrome. Once sufficient physical activity level was included in the model (Model 3) the relationship of the highest category of LTSB with increased likelihood of metabolic syndrome remained unchanged (1.54 increased odds; 95% CI: 1.00, 2.37). Thus the odds of having metabolic syndrome were approximately 54% higher in those women who spent four or more hours in LTSB daily compared to those spending one hour or less. For the individual CVD risk factors in the fully adjusted models, LTSB was not associated with an increased risk for any of the outcome variables (Table 3). However, in the unadjusted models, LTSB was associated with increased odds of low HDL-cholesterol, high triglycerides, high blood pressure, and high glucose (Table 3). UODA was not significantly associated with metabolic syndrome or any of the individual CVD risk factors in the fully adjusted model (Model 3), although in model 1 it was a significant predictor of high waist circumference (Table 4).

When the sample was stratified by physical activity level (meeting or not current recommendation) (Figure 1), the influence of LTSB on likelihood of metabolic syndrome remained significant, especially in the men. In men meeting the physical activity recommendations, the odds of having metabolic syndrome were 1.74 (95% CI: 1.11, 2.71) and in inactive men 1.50 (95% CI: 1.07, 2.09) for men spending ≥ 3 vs. ≤ 2 hr/day in LTSB when adjusted for other covariates. In women meeting the physical activity recommendations, the odds of having metabolic syndrome were not significant at 1.62 (95% CI: 0.87, 3.01) between those spending ≥ 3 vs. ≤ 2 hr/day in LTSB. However, those women achieving insufficient levels of physical activity (i.e., inactive), the odds ratio for having metabolic syndrome was significant

1.69 (95% CI: 1.24, 2.33) for those spending ≥ 3 vs. ≤ 2 hr/day in LTSB when adjusted for other covariates.

DISCUSSION

Similar to previous findings¹⁶, over one third of the U.S. population met the criteria for diagnosis of metabolic syndrome according to the AHA/NHLBI definition. It is important to note that caution be used when comparing studies examining LTSB since different definitions and measures are used in different studies. The primary findings of the present study indicate that higher levels of LTSB (≥ 4 vs. ≤ 1 hr/day) are associated with a higher prevalence of metabolic syndrome and with some of the individual CVD risk factors as shown in previous studies^{11–14}. The odds of having metabolic syndrome in men and women increased by 94% and 54%, respectively, in those spending more than four versus less than one hour per day in LTSB. Ford et al.¹⁴ also reported this relationship in the overall sample using 1999–2000 NHANES, however when stratified, only women showed the similar relationship (OR 2.76 (95% CI: 1.19, 6.41))¹⁴. Furthermore, our analyses of UODA did not appear to influence the odds of exhibiting metabolic syndrome or individual CVD risk factors in men or in women.

Previous reports note that LTSB in women has a stronger association with metabolic syndrome than men^{11, 13, 14}, inconsistent with our findings. One study, however, showed a relationship between LTSB and metabolic syndrome in both women and men¹² which is congruent with our findings. In our study, differences between men and women were apparent when stratified by physical activity level (sufficient vs. insufficient physical activity); the increased risk of higher levels of LTSB was independent of physical activity level in men, but not in women. In those women that met the current physical activity recommendation, higher levels of LTSB did not significantly impact metabolic syndrome. In an Australian study, the relationship between LTSB and metabolic syndrome was independent of meeting physical activity recommendations in both men and women¹⁰. In relation to the individual CVD risk factors, our study shows that higher LTSB was associated with 32–88% higher odds of increased risk factors, similar to previous research¹⁰; our findings, however, were stronger in men than in women.

The reason for the discrepancies between genders pertaining to LTSB and metabolic syndrome stratified by physical activity level and LTSB and individual CVD risk factors is not clearly understood. We hypothesize that it could be due to subtle differences in daily patterns of behavior. A recent study highlighted the apparent benefits of breaks (i.e., standing up, walking down the hall, etc.), regardless of physical activity level or energy expenditure of breaks, during sedentary time as a way to reduce a number of individual CVD risk factors²⁷. The latter study, however, did not differentiate between patterns of behavior and breaks between men and women. The small effects of breaks during sedentary time cannot be captured by a gross measure of sedentary lifestyle behavior and are therefore missed in the present study and others. It is plausible that women may multitask and engage in alternate light or moderate activities while they are watching TV such as attending to household chores. This would artificially inflate LTSB by reporting the period as time spent watching TV, but they were not actually fully sedentary for the entire duration or were perhaps taking breaks from sedentary behavior to engage in light or moderate activity. Another possible explanation for these findings is that men and women recall their LTSB differently; the questions asked pertained to their typical daily behavior over the past 30 days.

There are strengths and limitations in this study that warrant discussion. A clear strength of our study was the quality of the data; NHANES data were collected using rigorous standards allowing for extrapolation to the U.S. national population. Even though the NHANES data are collected and released in large samples of about 10,000 people every two year cycle, the adult

sample that was available for analysis with all necessary variables was substantially smaller (approximately 1900 men and 1700 women) even when two waves were combined. The smaller sample size does not allow for multiple stratifications to examine differences in LTSB and metabolic syndrome in different subpopulations. The primary limitation is that it is cross-sectional rather than longitudinal or prospective in nature and therefore causality cannot be determined. Another limitation to our study is that only LTSB that included self-reported TV viewing and non-work computer usage were analyzed. Although TV time is the most often reported measure of LTSB^{2, 5} used in current research, people may engage in a breadth of sedentary activities at work and during leisure time. Furthermore, the questions did not specify that the sedentary behavior in question be the primary activity potentially allowing for the misclassification of sedentary time via TV watching, for example, when the participant could have been simultaneously engaging in other household chores requiring bodily movement. Different sedentary behaviors may impact metabolic syndrome and individual risk factors differently; for example, reading has not been associated with increases in metabolic risk¹¹. However, we did include UODA patterns which would capture daily occupational activity and personal chores but these findings were not significantly associated with any metabolic indicators. We could speculate that a more sensitive measure of occupational/domestic activity and sedentary patterns would improve the probability of finding associations if they exist.

Future research in this area is necessary to increase the robustness of the field and lead to greater clinical application and development of specific recommendations to decrease sedentary behavior. Several prospective studies have examined the effects of physical fitness and physical activity on risk of metabolic syndrome^{21, 22}, but more sedentary behavior research is clearly warranted on the role of the time spent in sedentary behavior on the development of metabolic syndrome and individual CVD risk factors. A large prospective study on women reported that LTSB and sitting at work were both associated with increased risk of obesity and type 2 diabetes; each 2-hour/day increment in TV watching was associated with a 14% increase in diabetes risk⁷. The Physical Activity Guidelines for Americans recommend that adults should limit sedentary behavior²⁸. However, before clear guidelines can be applied to support public health recommendations and clinical practice, randomized controlled trials (RCT) will be necessary to fully quantify the strengths of these epidemiologic findings and to define the dose-response profile. Television viewing has been associated with snacking and increased caloric intake in adults^{29, 30} although more research is necessary. While the percent of dietary fat consumed was not a significant predictor of metabolic syndrome in our study, the influence of dietary intake, especially during LTSB, on cardiovascular disease risk factors is an important area for future investigations.

In summary, self-reported LTSB is associated with metabolic syndrome and some individual CVD risk factors in men and women. These associations are present regardless of meeting physical activity recommendations in men, while this relationship is less clear in women. UODA (as described in this study) does not appear to influence metabolic syndrome or individual CVD risk factors in our study. It would be prudent to consider recommending limiting LTSB in addition to being physically active at the recommended level for the primary prevention of metabolic syndrome and individual CVD risk factors. More research is necessary before definitive conclusions about the risk of leisure time and occupational/domestic sedentary behavior on metabolic disease can be determined.

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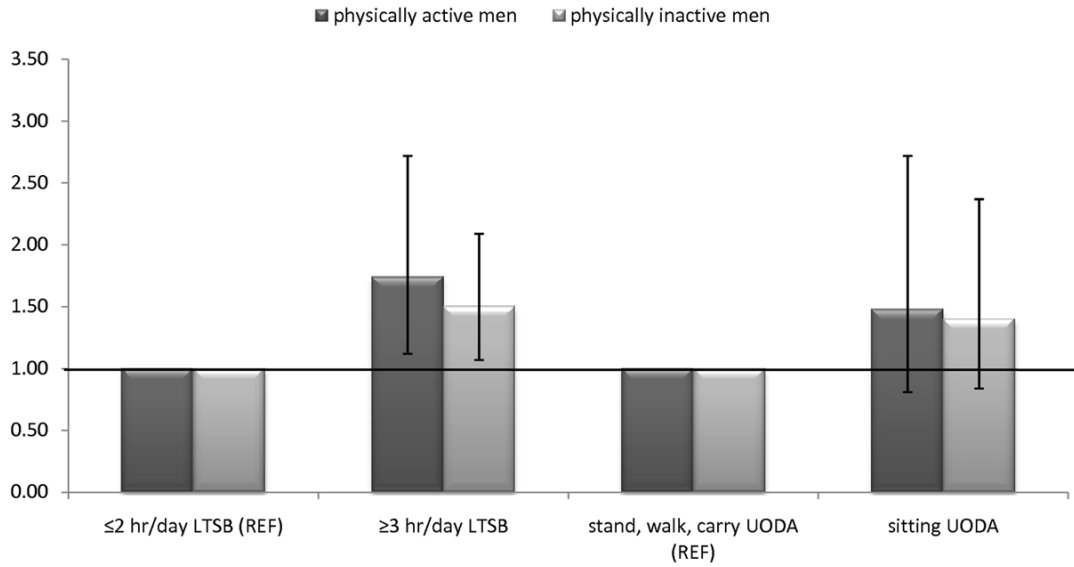
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A) Men



B) Women

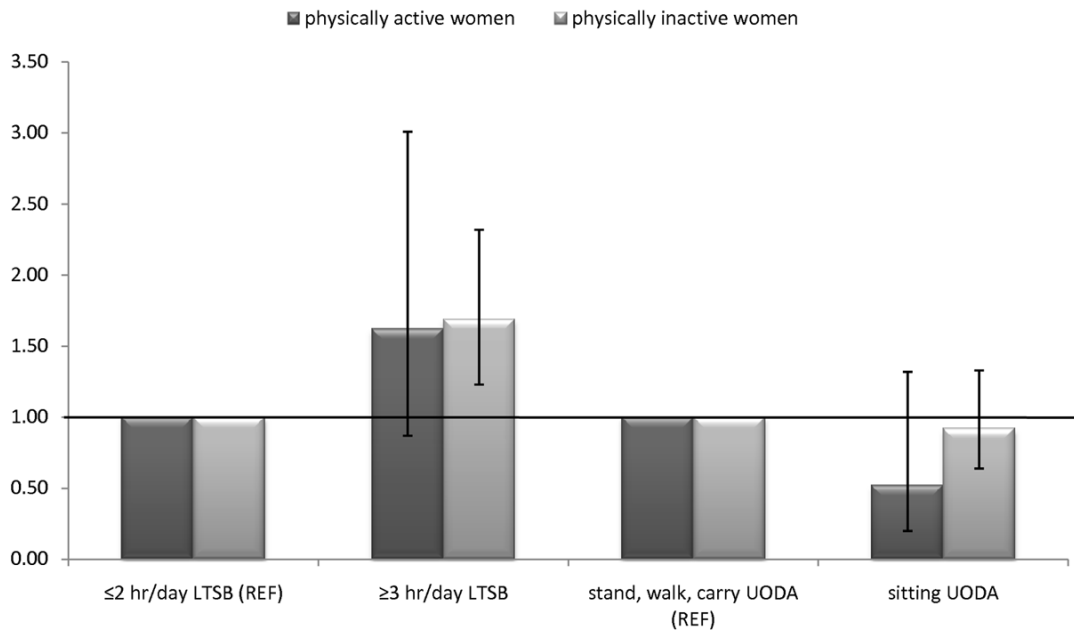


Figure 1.

Odds ratios and 95% confidence intervals for leisure time sedentary behavior (LTSB) and usual occupational/domestic activity (UODA) and metabolic syndrome, stratified by meeting or not meeting physical activity recommendations (>150 minutes/week of moderate-to-vigorous physical activity) for men (A) and women (B) from the National Health and Nutrition Examination Survey 2003–04 and 2005–06. Referent was ≤ 2 hr/day versus ≥ 3 hr/day for LTSB and referent was stand, walk, carry loads vs. sitting for usual occupational/domestic activity categories. Covariates included: age, smoking (current vs. never and past vs. never), education (<high school degree vs. >high school degree and high school or GED vs. >high school degree),

ethnicity (African American vs. European American, Mexican American, other vs. European American) and percent of fat in diet.

Table 1

Descriptive characteristics (mean \pm SE) of sample from National Health and Nutrition Examination Survey 2003–04 and 2005–06 for males and females *with* and *without* metabolic syndrome as classified by the AHA/NHLBI

Variables	Males			Females		
	Total	w/MeTSx	w/oMeTSx	Total	w/MeTSx	w/oMeTSx
N	1868	645 (34.1%)	1223 (65.9%)	1688	640 (32.7%)	1048 (67.3%)
Age (yrs)	45.1 \pm 0.6	50.5 \pm 0.6	42.3 \pm 0.7	47.9 \pm 0.6	54.8 \pm 0.7	44.6 \pm 0.6
Ethnicity						
Mexican American (%)	8.9 \pm 1.3	6.8 \pm 1.4	10.0 \pm 1.4	6.6 \pm 1.1	7.3 \pm 1.7	6.2 \pm 0.9
European American (%)	72.4 \pm 2.4	80.2 \pm 2.9	68.4 \pm 2.3	72.0 \pm 2.3	72.1 \pm 3.2	72.0 \pm 2.2
African American (%)	10.2 \pm 1.3	6.3 \pm 0.9	12.3 \pm 1.6	12.1 \pm 1.4	12.5 \pm 2.0	11.9 \pm 1.2
Other (%)	8.4 \pm 1.2	6.7 \pm 1.7	9.3 \pm 1.3	9.3 \pm 1.2	8.1 \pm 1.4	9.9 \pm 1.5
Body Mass Index (kg/m ²)	28.6 \pm 0.1	32.4 \pm 0.3	26.5 \pm 0.1	28.6 \pm 0.2	32.9 \pm 0.4	26.6 \pm 0.2
Waist Circumference (cm)	101.2 \pm 0.4	113.2 \pm 0.7	94.9 \pm 0.5	94.7 \pm 0.5	106.2 \pm 0.7	89.1 \pm 0.5
Systolic blood pressure (mmHg)	123.1 \pm 0.6	129.4 \pm 0.9	119.7 \pm 0.6	120.4 \pm 0.6	129.9 \pm 0.8	115.9 \pm 0.6
Diastolic blood pressure (mmHg)	71.2 \pm 0.4	75.5 \pm 0.6	69.0 \pm 0.5	69.1 \pm 0.4	71.4 \pm 0.7	68.0 \pm 0.5
HDL-Cholesterol (mg/dL)	49.2 \pm 0.5	41.9 \pm 0.7	52.9 \pm 0.5	59.9 \pm 0.5	50.8 \pm 0.7	64.4 \pm 0.6
Triglycerides (mg/dL)	156.9 \pm 3.4	227.6 \pm 9.6	120.0 \pm 2.8	131.7 \pm 3.7	199.8 \pm 11.8	97.9 \pm 1.6
Glucose (mg/dL)	103.9 \pm 0.7	115.4 \pm 1.2	97.9 \pm 0.7	100.1 \pm 0.9	115.5 \pm 1.7	92.5 \pm 0.5
Education (>HS)	55.1 \pm 1.7	52.0 \pm 2.4	56.8 \pm 2.0	57.4 \pm 1.9	47.5 \pm 3.1	62.2 \pm 1.9
Household Income (\geq \$45K)	48.1 \pm 1.8	46.0 \pm 2.7	49.2 \pm 2.0	42.8 \pm 1.9	33.5 \pm 2.9	47.3 \pm 1.9
Dietary fat (%)	33.7 \pm 0.3	34.7 \pm 0.6	33.1 \pm 0.3	34.0 \pm 0.3	34.2 \pm 0.5	33.9 \pm 0.4
Sufficient physical activity (%)	41.7 \pm 1.4	38.6 \pm 2.0	43.3 \pm 1.5	35.0 \pm 1.4	23.3 \pm 2.0	40.6 \pm 1.8
Screen time						
\leq 1 hr/day (%)	25.3 \pm 1.1	18.8 \pm 2.2	28.6 \pm 1.6	27.8 \pm 1.3	20.2 \pm 1.9	31.5 \pm 1.7
2–3 hr/day (%)	42.3 \pm 1.7	41.6 \pm 2.3	42.6 \pm 1.9	41.1 \pm 1.2	37.7 \pm 3.1	42.7 \pm 1.5
\geq 4 hr/day (%)	32.5 \pm 1.8	39.6 \pm 3.3	28.7 \pm 1.6	31.1 \pm 1.4	42.0 \pm 2.9	25.8 \pm 1.6
Usual daily physical activity						
Sitting (%)	19.8 \pm 0.9	25.5 \pm 1.8	16.8 \pm 1.2	24.9 \pm 1.4	27.3 \pm 2.3	23.7 \pm 1.4
Standing (%)	45.0 \pm 1.6	45.1 \pm 2.6	45.0 \pm 2.1	57.3 \pm 2.0	57.5 \pm 2.6	57.2 \pm 2.1
Light loads & stairs (%)	21.7 \pm 1.3	19.7 \pm 1.6	22.7 \pm 1.6	15.0 \pm 1.5	13.0 \pm 2.5	15.9 \pm 1.3

Variables	Males			Females		
	Total	w/MetSx	w/oMetSx	Total	w/MetSx	w/oMetSx
Heavy work or loads (%)	13.5 ± 1.3	9.6 ± 1.8	15.5 ± 1.4	2.8 ± 0.6	2.1 ± 0.8	3.2 ± 0.7

Table 2

Odds ratios for leisure time sedentary behavior (LTSB) as a predictor of metabolic syndrome with all continuous variables standardized to a mean of zero and unit standard deviation for men and women in a sample from the National Health and Nutrition Examination Survey 2003–04 and 2005–06

Variable	Men			Women		
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Screen time						
≤1 hr/day	1.00	1.00	1.00	1.00	1.00	1.00
2–3 hr/day	1.41 (0.99, 2.02)	1.39 (0.93, 2.08)	1.39 (0.93, 2.07)	1.20 (0.82, 1.77)	1.04 (0.67, 1.61)	1.05 (0.68, 1.61)
≥4 hr/day	2.09 (1.37, 3.20)§	1.95 (1.25, 3.04)§	1.94 (1.24, 3.03)§	2.15 (1.51, 3.05)§	1.56 (1.00, 2.41)§	1.54 (1.00, 2.37)§
Age	1.66(1.49, 1.84)§	1.90 (1.61, 2.243)§	1.90 (1.61, 2.24)§	1.85(1.66, 2.05)§	2.18 (1.86, 2.56)§	2.13 (1.81, 2.51)§
BMI		3.84 (3.21, 4.59)§	3.84 (3.21, 4.59)§		2.84 (2.41, 3.35)§	2.79 (2.36, 3.30)§
Smoke						
never	1.00	1.00	1.00	1.00	1.00	1.00
current		1.02 (0.75, 1.40)	1.01 (0.74, 1.39)		1.30 (0.96, 1.75)	1.24 (0.92, 1.68)
past		1.06 (0.79, 1.42)	1.05 (0.78, 1.42)		1.15 (0.79, 1.68)	1.19 (0.80, 1.77)
Education						
>HS	1.00	1.00	1.00	1.00	1.00	1.00
<HS		1.18 (0.79, 1.76)	1.16 (0.77, 1.75)		1.61 (1.02, 2.53)§	1.48 (0.92, 2.36)
HS/GED		1.31 (0.93, 1.83)	1.29 (0.92, 1.83)		1.20 (0.88, 1.62)	1.17 (0.86, 1.59)
Ethnicity						
EA	1.00	1.00	1.00	1.00	1.00	1.00
AA		0.32 (0.21, 0.46)§	0.31 (0.21, 0.46)§		0.62 (0.46, 0.86)§	0.61 (0.44, 0.84)§
MA		0.80 (0.57, 1.12)	0.79 (0.56, 1.11)		1.33 (0.74, 2.38)	1.24 (0.68, 2.26)
Other		0.76 (0.41, 1.40)	0.76 (0.41, 1.41)		1.14 (0.66, 1.95)	1.14 (0.67, 1.93)
Dietary fat		0.94 (0.81, 1.10)	0.94 (0.81, 1.09)		0.98 (0.86, 1.12)	0.98 (0.86, 1.12)
Sufficient activity (yes vs. no)		0.92 (0.70, 1.20)	0.92 (0.70, 1.20)			0.61 (0.45, 0.83)§

Significant predictors ($p < 0.05$) are noted with §. Predictors included in Model 1: screen time and age (SD = men 24.6 yrs; women 24.2 yrs). Predictors included in Model 2: screen time, age, body mass index (SD = men 6.0 kg/m²; women 8.6 kg/m²), smoking (current vs. never and past vs. never), education (<high school degree vs. >high school degree and high school or GED vs. >high school degree), ethnicity (African American vs. European American, Mexican American vs. European American, and other vs. European American) and percent of fat in diet (SD = men 12.3%; women 13.7%). Predictors included in Model 3: all variables from Models 1 and 2 and sufficient physical activity (yes vs. no ≥150 minutes per week of moderate-to-vigorous physical activity).

Table 3

Odds ratios for L.TSB as a predictor of **individual risk factors** for men and women in a sample from the National Health and Nutrition Examination Survey 2003–04 and 2005–06

Variable	Men			Women		
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
High Waist Circumference						
≤1 hr/day	1.00	1.00	1.00	1.00	1.00	1.00
2–3 hr/day	1.32 (0.97, 1.81)	1.60 (1.10, 2.35)§	1.56 (1.08, 2.27)§	1.23 (0.91, 1.66)	1.07 (0.66, 1.74)	1.07 (0.67, 1.70)
≥4 hr/day	1.73 (1.28, 2.35)§	1.90 (1.05, 3.44)§	1.88 (1.03, 3.41)§	1.93 (1.42, 2.61)	1.41 (0.70, 2.84)	1.39 (0.69, 2.80)
Low HDL-Cholesterol						
≤1 hr/day	1.00	1.00	1.00	1.00	1.00	1.00
2–3 hr/day	1.52 (1.10, 2.12)§	1.49 (1.06, 2.10)§	1.48 (1.06, 2.06)§	1.14 (0.87, 1.49)	0.95 (0.74, 1.22)	0.96 (0.74, 1.24)
≥4 hr/day	2.00 (1.44, 2.77)§	1.90 (1.40, 2.59)§	1.84 (1.35, 2.51)§	1.67 (1.28, 2.17)§	1.10 (0.82, 1.47)	1.08 (0.81, 1.44)
High Triglycerides						
≤1 hr/day	1.00	1.00	1.00	1.00	1.00	1.00
2–3 hr/day	1.07 (0.79, 1.47)	1.05 (0.77, 1.44)	1.05 (0.77, 1.44)	1.09 (0.77, 1.54)	0.96 (0.66, 1.42)	0.97 (0.66, 1.42)
≥4 hr/day	1.34 (0.95, 1.89)	1.31 (0.96, 1.80)	1.29 (0.94, 1.78)	1.48 (1.05, 2.09)§	1.18 (0.81, 1.71)	1.17 (0.81, 1.68)
High Blood Pressure						
≤1 hr/day	1.00	1.00	1.00	1.00	1.00	1.00
2–3 hr/day	1.05 (0.82, 1.36)	1.03 (0.77, 1.37)	1.02 (0.77, 1.37)	1.05 (0.72, 1.53)	0.96 (0.62, 1.50)	0.97 (0.62, 1.51)
≥4 hr/day	1.73 (1.24, 2.43)§	1.56 (1.08, 2.26)§	1.55 (1.07, 2.24)§	1.61 (1.13, 2.29)§	1.15 (0.73, 1.80)	1.14 (0.73, 1.79)
High Glucose						
≤1 hr/day	1.00	1.00	1.00	1.00	1.00	1.00
2–3 hr/day	1.32 (1.02, 1.70)§	1.32 (1.00, 1.75)§	1.32 (1.00, 1.75)§	1.36 (0.99, 1.85)	1.24 (0.85, 1.79)	1.25 (0.87, 1.80)
≥4 hr/day	1.33 (0.98, 1.79)	1.22 (0.89, 1.68)	1.22 (0.89, 1.69)	1.70 (1.21, 2.39)§	1.37 (0.92, 2.02)	1.36 (0.92, 2.01)

Significant predictors ($p < 0.05$) are noted with §. Predictors included in Model 1: screen time and age (SD = men 24.6 yrs; women 24.2 yrs). Predictors included in Model 2: screen time, age, body mass index (SD = men 6.0 kg/m²; women 8.6 kg/m²), smoking (current vs. never and past vs. never), education (<high school degree and high school or GED vs. >high school degree), ethnicity (African American vs. European American, Mexican American vs. European American, other vs. European American) and percent of fat in diet (SD = men 12.3%; women 13.7%). Predictors included in Model 3: all variables from Models 1 and 2 and sufficient physical activity (yes vs. no ≥150 minutes per week of moderate-to-vigorous physical activity).

Table 4

Odds ratios for **usual daily physical activity** as a predictor of metabolic syndrome and all constituent individual risk factors for men and women in a sample from the National Health and Nutrition Examination Survey 2003–04 and 2005–06

Variable	Men			Women		
	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Metabolic syndrome						
Sitting	1.00	1.00	1.00	1.00	1.00	1.00
Stand, walk, loads	1.66 (1.23, 2.23)§	1.44 (1.00, 2.09)§	1.43 (0.99, 2.06)	1.17 (0.91, 1.51)	0.88 (0.65, 1.20)	0.82 (0.59, 1.13)
High waist circumference						
Sitting	1.00	1.00	1.00	1.00	1.00	1.00
Stand, walk, loads	1.58 (1.20, 2.09)§	1.20 (0.62, 2.32)	1.15 (0.60, 2.22)	1.40 (1.16, 1.69)§	1.09 (0.71, 1.67)	1.03 (0.66, 1.59)
Low HDL						
Sitting	1.00	1.00	1.00	1.00	1.00	1.00
Stand, walk, loads	1.31 (0.96, 1.79)	1.21 (0.84, 1.74)	1.14 (0.78, 1.66)	1.24 (0.96, 1.60)	1.08 (0.81, 1.45)	1.01 (0.75, 1.37)
High Triglycerides						
Sitting	1.00	1.00	1.00	1.00	1.00	1.00
Stand, walk, loads	1.25 (0.92, 1.72)	1.15 (0.84, 1.58)	1.20 (0.81, 1.54)	1.27 (0.99, 1.64)	1.25 (0.94, 1.68)	0.21 (0.91, 1.61)
High Blood Pressure						
Sitting	1.00	1.00	1.00	1.00	1.00	1.00
Stand, walk, loads	1.30 (0.93, 1.80)	1.15 (0.80, 1.64)	1.13 (0.78, 1.63)	1.06 (0.74, 1.51)	0.89 (0.60, 1.33)	0.87 (0.59, 1.28)
High Glucose						
Sitting	1.00	1.00	1.00	1.00	1.00	1.00
Stand, walk, loads	0.89 (0.66, 1.22)	0.75 (0.54, 1.03)	0.75 (0.54, 1.03)	1.19 (0.91, 1.56)	0.95 (0.70, 1.28)	0.90 (0.65, 1.24)

Significant predictors ($p < 0.05$) are noted with §. Predictors included in Model 1: usual daily physical activity and age (SD = men 24.6 yrs; women 24.2 yrs). Predictors included in Model 2: usual daily physical activity, age, body mass index (SD = men 6.0 kg/m²; women 8.6 kg/m²), smoking (current vs. never and past vs. never), education (<high school degree vs. >high school degree and high school or GED vs. >high school degree), ethnicity (African American vs. European American, Mexican American vs. European American, and other vs. European American) and percent of fat in diet (SD = men 12.3%; women 13.7%). Predictors included in Model 3: all variables from Models 1 and 2 and sufficient physical activity (yes vs. no ≥ 150 minutes per week of moderate-to-vigorous physical activity).