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Contribution of Occupation to High Doses of Light-Intensity Activity and Cardiovascular Risk Factors among Mexican American Adults

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Abstract

Background—The association between light-intensity activity and cardiovascular disease risk is not well understood. The purpose of this study was to determine the association of light-intensity activity with census-based occupational activity classifications and cardiovascular risk factors among Mexican American adults.

Methods—118 Mexican American adults (68.6% female) provided cross-sectional accelerometer and biological data. Self-reported occupations were classified by activity level (sedentary, low, moderate). Participants were classified as At-Risk for BMI, glucose, triglycerides, HDL, blood pressure, waist circumference, and percent body fat.

Results—Participants engaged in > 5 hours of light-intensity activity on average, and those in sedentary occupations engaged in fewer light-intensity activity minutes than low-active or moderately active workers ($P < .001$). Self-reported occupation explained 14% of the variation in light-intensity activity ($P < .001$). Participants in moderately active occupations were at increased risk for high %body fat than other workers ($P = .01$), but no other associations between occupation and cardiovascular risk were detected.

Conclusion—Early work in physical activity underscored the importance of occupational activity. This study presents evidence of a dose-response association for light-intensity activity by occupational category such that workers in sedentary occupations had less light-intensity activity than employees in more active occupations. Future research on how light-intensity activity derived

from occupation may reduce the risk of chronic disease will contribute to improved interventions as light-intensity activity participation may be more feasible than meeting current physical activity guidelines.

Keywords

physical activity; Latinos; cardiovascular disease; metabolic syndrome; occupation

Previous research provides substantial evidential support about the association between physical activity and health outcomes; with greater physical activity (PA) being associated with a lower risk of all-cause mortality, cardiovascular disease, diabetes mellitus, and obesity.¹ The US national guidelines for physical activity recommend at least 150 minutes of moderate-intensity physical activity per week, to reduce risk of chronic diseases.² The minimal intensity recommendation of moderate (at least 3 metabolic equivalents [METs]) is thought to be associated with the minimal physiologic stimulus necessary to generate health benefits. Light-intensity physical activity (less than 3 METs and more than 1 MET) is not included in the guidelines because of a lack of evidence regarding its association with health outcomes.^{1,2} At present, the benefits of light-intensity physical activities are less clear, and knowledge is limited regarding the adequate dose to yield positive health outcomes.

There is a paucity of evidence relating to the health effects of light-intensity PA. This study seeks to understand this relationship within the context of occupation, a domain of PA conducive to light-intensity activity.³ Of the few studies that examine occupational activity, the activity is generally self-reported. For example, when measuring perceived physical exertion among men in the Harvard Alumni Study, those reporting less intense exertion had greater relative risk of coronary heart disease than men reporting moderate-to-strong exertion.⁴ However, Lee and Paffenbarger Jr. found no association between self-reported light-intensity activity and longevity among men in the same cohort.⁵ One challenge regarding studying the association between light activity and disease outcomes is the inconsistency in measuring light-intensity activity. Low-income populations may spend a greater amount of time engaging in light-intensity activities that are associated with occupation, transportation or in the household with less time devoted to leisure-time or recreational PA,^{6,7} which is the primary domain of moderate-to-vigorous intensity physical activity (MVPA).⁸ Findings by Murakami and Young⁷ support this notion as low-income individuals were almost twice as likely to have low levels of leisure-time physical activity compared with higher income groups who walk less for work. Individuals with low-paying jobs are 50% less likely to meet the activity guidelines for physical activity compared with individuals earning a greater salary.^{9–11} This lower likelihood of meeting guidelines may be attributed to a higher proportion of physical activity from light-intensity physical activity from occupations, walking and use of public transportation.

Further evidence that low-income populations may accumulate all intensities of activity in domains other than leisure is the discrepancy between national surveillance datasets such as National Health and Nutrition Examination Survey (NHANES) and Behavioral Risk Factor Surveillance System (BRFSS).¹⁰ Hispanics, who rank among the most impoverished in the US, consistently have lower prevalence of meeting physical activity guidelines than non-

Hispanic whites in self-reported BRFSS data (44.1% versus 51.4% respectively).¹² Yet an examination of the NHANES accelerometer data¹³ revealed that compared with non-Hispanic peers, Mexican Americans accumulated the most total activity counts, and a comparable dose of MVPA (mean minutes for males: 45.7 for Mexican Americans vs. 34.6 for whites; for females: 22.1 for Mexican Americans vs. 19.7 for whites). Because BRFSS only asks participants to self-report leisure-time activity, other domains such as occupation may be missed, but would be recorded in the NHANES accelerometer data. Though historically light-intensity physical activity has been difficult to measure through self-reporting measures, the use of accelerometry increases the ability to objectively capture activity at all intensity levels across domains.

To better understand the amount, intensity and domain of physical activity among Mexican Americans, this paper addresses 3 primary aims: 1) characterize the objectively measured physical activity in Mexican Americans living along the US-Mexico border, 2) determine the association of light-intensity activity with occupation, and 3) test the associations between accelerometer-measured physical activity with metabolic syndrome and other cardiovascular risk factors including waist circumference, triglycerides, high-density lipoprotein (HDL), blood pressure, fasting blood glucose, body mass index (BMI) and body fat percentage. Because accelerometers do not discriminate among domains of activity (ie, transportation, household, etc), using accelerometry in conjunction with self-reported occupation may elucidate the link between light-intensity physical activity and health.

Methods

Study Population

Participants comprised a convenience sample from the Cameron County Hispanic Cohort.¹⁴ This cohort, begun in 2003, currently includes approximately 2600 Mexican origin adults living in south Texas, an area with more than one-third of residents below the poverty line.¹⁵ Starting in 2009, enrolled cohort participants were asked at a scheduled 5-year follow-up visit if they would like to participate in an additional study where they would wear an accelerometer. Exclusion criteria included being 18 years of age or older and willing to wear the accelerometer. Participants were informed of the study and, if interested, were asked to sign written informed consent before completion of a behavioral survey that included the Godin Leisure Time Exercise Questionnaire.^{16,17} Participants received a \$10 incentive in exchange for their time. All instruments and procedures were approved by the Committee for the Protection of Human Subjects at the University of Texas Health Science Center—Houston before the start of data collection. A total of 143 cohort participants agreed to wear the accelerometer during the study year.

Measures

Accelerometer—Study participants wore the Actigraph GT1M (Pensacola, FL) on their dominant side on the hip for 7 full days during waking hours using the provided adjustable belt. They were instructed to wear the accelerometer on the same side each day and complete a log indicating when they put the accelerometer on and took it off. Reminder phone calls were conducted by study personnel on the second or third day of the study week.

Participants who wore the accelerometer for a minimum of 10 hours¹³ on at least 3 days (2 week days and 1 weekend day) were included in the analyses.¹⁸ Raw data were summarized into the number of average daily minutes by intensity level using the Freedson cut points¹⁹ whether the participant met physical activity guidelines (meeting versus not meeting guidelines), and whether participants met the same guidelines but only using minutes accumulated in bouts of at least 10 minutes.²⁰ The proportion of wear time spent in light-intensity and MVPA was also computed.

Occupation—Participants self-reported their occupation. Occupations were then classified using the US Census Bureau's Indexes of Industry and Occupations. Established categories of Sedentary, low-active and moderately active occupations based on MET values were matched to each participant's self-reported job.³ The categories are defined by the relative amount of physical activity accumulated on the job based on assigning Compendium MET values²¹ proportionately to the reported occupational activities of employed adults in the American Time Use Survey.³ More specifically, a moderately active occupation is one where workers engage in activities that are assigned MET values ranging from 3 to 5.9, low-active occupations comprised activities with a range of 2.0 to 2.9 METs and Sedentary occupations with < 2.0 METs. One participant reported being unemployed and was excluded from the analysis. Stay-at-home mothers were classified as Personal Care and Service based on comparing daily activities to already classified occupations. No workers were classified as vigorously active; inclusive of fire fighters and logging workers and miners.³ Sedentary occupations included medical transcriptionist, secretary, and accountant. Examples of low-active occupations in this sample included secretary, teacher, medical records clerk, and shoe repair. Moderately active occupations included agricultural field worker, construction, and mason.

Demographics, Anthropometrics, and Medical History—As part of a scheduled cohort enrollment or follow-up visit, participants provided or confirmed age, sex, education, and medical history.

Height was measured to the nearest tenth of a centimeter and weight to the nearest tenth of a kilogram. BMI was calculated as weight (kg) / height (m²) and participants were classified as normal for a BMI between 18.50 and 24.99 kg/m², overweight if the BMI was 25.00 but less than 29.99 kg/m² and obese if BMI was 30.00 kg/m². Body fat percentage was estimated using the resistance values from the Quantam X bioelectric body composition analyzer with the sex-specific equations from Sun et al.²² To measure systolic and diastolic blood pressure (mmHg), participants were asked to sit quietly for 5 minutes before measurements using a Random Zero blood pressure machine (MK2 Random Zero, Hawksley, England). Three total measurements were taken and the mean of the second and third systolic and diastolic reading were used. Fasting blood glucose (mg/dL) was measured using a Glucostat analyzer (Model 27, YSI Select 2300 Biochemistry Analyzer, Yellow Springs, OH).²³ Measures were done twice and the mean taken. Triglycerides (mg/dL) and high-density lipoprotein cholesterol (mg/dL) were assessed as part of a lipid panel estimation obtained from a CLIA-approved clinical laboratory.

Statistical Analysis

Descriptive Statistics—Means and standard deviations were calculated for average daily minutes of sedentary, light-intensity and MVPA, age, waist circumference, triglycerides, HDL, blood pressure, fasting blood glucose, BMI and body fat percentage, as were frequencies for occupational physical activity classification (sedentary workers, low-active workers and moderately active workers), meeting physical activity guidelines by minutes and through bouts ≥ 10 minutes, the proportion of wear time spent in light-intensity and MVPA, and whether participants were classified as having metabolic syndrome (at risk for at least 3 of the 5 metabolic criteria).²⁴ Residual plots first were checked for curvilinear patterns of cardiovascular risk factors by minutes of physical activity. Independent samples *t* tests were conducted for physical activity and cardiovascular risk factors by gender, and chi-square tests of proportions were conducted for occupational activity classification by gender.

Differences in Activity and Cardiovascular Risk Factors by Occupational Activity Classification—Separate one-way ANOVAs were conducted to test for differences in sedentary behavior, light-intensity physical activity, and MVPA, as well as cardiovascular risk factors by occupational activity categories (sedentary workers, low-active workers, and moderately active workers). Tukey's procedure for multiple comparisons was used to examine differences across occupational activity classification. The proportion of variance explained in sedentary, light-intensity, and MVPA wear time was determined through separate OLS regression analyses controlling for wear time, age, gender and BMI. The model for light-intensity activity also controlled for MVPA. Similarly, the model for MVPA controlled for light-intensity activity. Fasting blood glucose was transformed to the log to account for skewness and kurtosis.

Cardiovascular Risk Factor Associations—A two-step approach was employed to assess associations between physical activity and cardiovascular risk factors. First, unadjusted Pearson's correlation coefficients were calculated between mean daily minutes of sedentary behavior, light-intensity physical activity and MVPA. Second, participants were classified as either At-Risk or Not At-Risk for overweight (BMI 25.00 to 29.99) or obese (BMI ≥ 30.00),²⁵ impaired fasting blood glucose (≥ 100 mg/dL), high triglycerides (≥ 150 mg/dL), low HDL (< 40 mg/dL), and high blood pressure (systolic blood pressure ≥ 130 mmHg or diastolic blood pressure ≥ 85 mmHg)²³ based on established cut points. Risk classifications were also generated using gender-specific cut points for above average waist circumference (88cm for females and 102cm for males),²⁴ and gender- and age-specific cut points for above normal body fat percentage.²⁶ Separate chi-square tests of association were conducted to assess the association between occupational activity classification (sedentary workers, low-active workers or moderately active workers) with BMI, body fat percentage, waist circumference, fasting blood glucose, HDL, triglycerides, and blood pressure risk categories.

Results

Descriptive Statistics

Of the 143 accelerometer participants, nearly two-thirds of the accelerometer participants were female (68.9%), with an average age of 48.2 years (± 13.0 years). Similar to the larger cohort population, fewer than half (47.5%) had completed a high school education.¹⁴ One hundred eighteen participants were included in the final analyses. Twenty-five participants did not meet the criteria for valid wear days. Based on accelerometry data slightly more than one-quarter (26.3%) of the sample accumulated enough physical activity to meet national guidelines of 150 minutes or more of MVPA. Sample characteristics are provided in Table 1. Men engaged in more minutes of MVPA (26.14 ± 19.26) than women (17.79 ± 16.64 , $t = 2.40$, $P = .02$), and spent a greater proportion of wear time in MVPA (3.4% to 2.3% respectively, $t = 2.46$, $P = .02$). Men also had lower HDL (45.44 ± 9.59 mg/dL) on average than women (50.25 ± 10.61 mg/dL, $t = 2.01$, $P = .05$). No differences by gender were detected in the mean minutes of light-intensity physical activity or sedentary behavior, nor were differences by gender detected in the remaining cardiovascular risk factors. The median annual household income of the accelerometer participants was \$13,471.

Differences in Activity and Cardiovascular Risk Factors by Occupational Activity Classification

Sedentary workers participated in significantly fewer minutes of light-intensity physical activity (mean = 262.22 ± 75.02) on average than low-active (mean = 321.69 ± 67.74) or moderately active workers (338.53 ± 70.44 ; $P < .001$ using Tukey's post hoc procedure) as shown in Table 2. No differences were detected for sedentary time or MVPA. There were also no significant differences in mean values of cardiovascular risk factors across occupational activity classifications.

Figure 1 displays differences in proportion of accelerometer wear time by intensity and occupational activity category. Moderately active workers spent more accelerometer wear time in light-intensity activities ($P = .004$ for trend; $P < .05$ for between group difference) and less time in sedentary activities ($P = .001$ for trend; $P < .05$ for between group difference) than Sedentary occupation participants. Participants in low-active occupations also spent more time in light-intensity physical activity than did sedentary workers ($P < .05$ for between group difference). There were no differences in wear time of MVPA by occupation.

Occupation explained a small amount of variation in time spent in sedentary behavior ($R^2 = .03$, $P = .194$) and light-intensity physical activity ($R^2 = .14$, $P < .001$). However, occupation explained less than 1% the variation in MVPA ($R^2 = .00$, $P = .76$).

Cardiovascular Risk Factor Associations

Table 3 presents the Pearson's correlation coefficients between mean daily physical activity variables and cardiovascular risk factors. No significant unadjusted associations were detected for minutes of sedentary behavior and light-intensity activity. For MVPA, percent body fat was inversely associated, but no other significant correlations were found.

Participants were also classified as At Risk or Not At Risk for risk factors for cardiovascular disease and as At Risk or Not At Risk for metabolic syndrome: 79.7% had a waist circumference greater than 88cm for females and 102cm for males; 19.5% of participants had systolic blood pressure $\geq$ 130 mmHg or diastolic blood pressure $\geq$ 85 mmHg; 58.5% had a fasting blood glucose $\geq$ 100 mg/dL; 25.4% had elevated triglycerides $\geq$ 150 mg/dL, 56.8% had HDL lower than 40 mg/dL for men and 50 mg/dL for women; 79.7% were classified as overweight or obese; and 70.7% had a percent body fat above normal for age and sex.²⁶ Nearly half of the participants (44.9%) were classified as having metabolic syndrome. Figure 2 illustrates the proportion of participants within each occupational activity classification categorized as At Risk by cardiovascular risk factor. Separate chi-square tests of proportion indicated that a greater proportion of moderately active workers were categorized as having an above average body fat percentage for age and gender ($P = .01$) compared with sedentary workers. No other significant associations were detected between occupational and At-Risk categories.

Discussion

The purpose of this paper was to describe the amount of physical activity by intensity-level in relation to occupation and examine differences in cardiovascular risk factors by occupational activity levels in a low-income Mexican American sample. The findings indicate a dose-response relationship between occupation and light-intensity physical activity but no differences in MVPA. Lower income adults may accumulate greater amounts of light-intensity physical activity from occupation and transportation domains.⁶ Proportionally more Hispanics in this sample (50.7%) and nationally (56.1%) work in labor sectors that may require physical activity (eg, Service, Construction, Maintenance, Production) compared with their non-Hispanic White (36.5%) and Black peers (47.1%).²⁷ However, the findings were consistent with the literature surrounding light-intensity physical activity and potential health benefits of engaging in activity under the 3-MET threshold in that they were inconclusive.

Adults in the current study participated in fewer minutes of MVPA (average = 20.4 min/day) compared with Mexican Americans ages 20 to 59 years in the NHANES data (average = 45.7 min/day).¹³ However, a similar proportion met physical activity guidelines in this sample (26.3%) as with the NHANES data (26.6%) when considering all minutes of MVPA.¹⁰ Even though the prevalence of meeting guidelines was similar for the 2 samples, the mean daily minutes of MVPA was less than half in the current study. One possible explanation may be that adults in the current sample who do engage in MVPA are participating in shorter bouts of $\leq$ 10 minutes compared with the NHANES sample. Another distinction may be the lack of variability in MVPA within the present sample.

Interestingly this sample participated in relatively low amounts of MVPA minutes but a high amount of light-intensity minutes compared with accelerometer-measured PA among 765 English-speaking older adults participants in the Senior Neighborhood Quality of Life Study (270.0 minutes on average).²⁸ Participants in this study engaged in more than 5 hours of daily light-intensity physical activity on average, with the minimum number of minutes of light-intensity physical activity nearing 2 hours. Sixty-seven men and 106 women without

diabetes from the Australian Diabetes Study participated in similar amounts of light-intensity activity.²⁹ Differences were found by occupational activity, such that sedentary workers engaged in 59 fewer minutes of light-intensity physical activity than low-active workers, and 76 fewer minutes than moderately active workers, suggesting that adults in moderately active occupations may engage in more constant activity during the workday. However, occupational activity classification accounted for only 14% of light-intensity physical activity in the regression analysis, and given the large dose of light-intensity physical activity in Low Active Workers, it is clear that other domains such as household or transportation may be the source of the light-intensity physical activity. Future studies may collect more detailed logs of time spent in occupational, household, and transportation activities to better elucidate the variation within light-intensity physical activity.

The lack of differences in MVPA across occupational activity classifications suggests that the categorization system may not be optimal. Occupations classified as moderately active are theoretically comprised of activities with MET values of 3.0 to 5.9. However, the differences across occupations were found in light-intensity activity and sedentary behavior. This is possibly due to the way occupations are classified using MET values.³ While we may perceive occupations to include moderate-intensity activities, the proportion of work time spent in those activities is not accounted for in the current classification system. A study that accounts for the full range of activities weighted by the proportion of time spent in sedentary, light- or moderate-intensity may better elucidate the amount of activity accumulated during work hours.

Although the amount of light-intensity physical activity was more than 5 hours in this sample of Mexican American adults (mean = 323.76 minutes for men; mean = 312.69 minutes for women), few associations were seen between minutes of activity or occupation. A higher proportion of moderately active Workers having above average body fat percentage may indicate an exchange between leisure-time and occupational activity that is detrimental to weight management.³⁰ This finding may have relevance for interventions research. Although a low proportion of the light-intensity physical activity was attributable to occupation in the current study ($R^2 = 19.4\%$), participants engaged in more than 5 hours of light-intensity activity on average (Table 1). Individuals who accumulate greater doses of leisure-time and occupation activity in combination may attain health benefits.

Mixed associations with cardiovascular risk exist within the broader physical activity literature. No associations between light-intensity and coronary heart disease⁴ or longevity⁵ are seen among 7337 and 13,485 primarily white men respectively who self-reported intensity and perceived exertion of activities in analysis of the Harvard Alumni Study data.^{4,5} However, in the Australian Diabetes, Obesity and Lifestyle study, light-intensity activity measured with accelerometers was correlated with 2-hour plasma glucose measured spectrophotometrically in men and women ($N = 173$, 61.3% female) without diabetes after adjustment for MVPA.²⁹ In a cohort of nearly 40,000 women enrolled in the Women's Health study, walking at either light or moderate-to-vigorous intensity was associated with lower risk of coronary heart disease.³¹ Contrary to our hypothesis, no significant associations were found between light-intensity physical activity and cardiovascular risk factors in the current study. This may be due to the small sample size in general as well as

within occupational categories. In addition the inability to isolate work schedules precluded a direct link between occupational activity and health in this sample. Little is known about the associations between light-intensity PA and health outcomes. Future research in this area may clarify whether PA at lower intensities can reduce chronic disease risk, and if so, at what dose.

While the findings of this study are novel including an examination of occupational PA with cardiovascular disease risk factors among a population at increased risk for chronic disease, there are several limitations that should be considered. First the sample size was small and did not have enough power to conduct logistic or OLS regression analyses adjusting for potential confounders of the relation of physical activity with occupation and cardiovascular outcomes. Second, the sample included only Mexican Americans living along the US/Mexico border in southern Texas and may not generalize to other Mexican American populations. Minimum accelerometer wear time was set at 10 hours per day and work schedules were not collected as part of the cohort visit. While this wear time represents less than half of usual waking hours, 61.0% wore the meter for at least 12 hours each day, and the use of proportion of wear time rather than only minutes of activity by intensity level adjusts for the variation in wear time. This does not eliminate the possible error resulting from the lack of work schedules during accelerometer wear. Light-intensity activity and MVPA may occur during work or nonwork hours, and the available data do not allow for partition into domains of physical activity. Finally, the study design was cross-sectional, precluding assumptions of causality. However this is an important step for linking light-intensity occupational activity to health effects.

Conclusion

This study presents evidence that light-intensity activity may be associated with occupation among a sample of Mexican Americans. Many US adults spend nearly 8 hours a day on average at work.³² However, little is known about the health effects of high doses of occupational light-intensity physical activity as the evidence is limited to MVPA and health outcomes.² The field of physical activity and public health arguably began with Jeremy Morris' study of occupational activity of the London Busmen.³³ However, there has been a shift in focus over the last 20 to 30 years away from occupational activity to leisure-time activity almost exclusively. This study is a step in reestablishing the importance of occupation in daily physical activity, and to understanding the contribution of light-intensity activity to health outcomes. Light-intensity activity may be the intermediate step toward increased MVPA among sedentary adults. Two recent studies have examined a reduction in sitting time by substituting light-intensity activity, rather than MVPA, as a means to increase caloric expenditure.^{34,35}

Future research may consider an examination of light-intensity physical activity across racial and ethnic groups, and whether favorable disparities for Mexican Americans^{10,13} in activity levels are a function of activity domain or income. Although existing evidence is mixed on the association between light-intensity and cardiovascular disease risk, activities of light-intensity may be more feasible for sedentary adults trying to meet physical activity guidelines. This may lead to future studies of occupational activity as a source of light-

intensity physical activity, with more detailed data regarding work tasks, strenuousness and schedules. This line of research has implications for conducting interventions to increase physical activity with low-income populations or those not meeting physical activity guidelines. Light-intensity may or may not have the same health benefits of MVPA, but it may serve as the intermediate step toward MVPA for so many adults who need to decrease time spent in sedentary behavior.

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References

1. Haskell WL, Lee IM, Pate RR, et al. Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *Med Sci Sports Exerc.* 2007; 39(8):1423–1434. PubMed doi:10.1249/mss.0b013e3180616b27. [PubMed: 17762377]
2. U.S. Department of Health and Human Services. Physical Activity Guidelines Advisory Committee Report. 2008 ODPHP Publication No. U0036.
3. Tudor-Locke C, Ainsworth BE, Washington TL, Troiano R. Assigning metabolic equivalent values to the 2002 census occupational classification system. *J Phys Act Health.* 2011; 8(4):581–586. PubMed. [PubMed: 21597131]
4. Lee I-M, Sesso HD, Oguma Y, Paffenbarger RS. Relative intensity of physical activity and risk of coronary heart disease. *Circulation.* 2003; 107(8):1110–1116. [PubMed: 12615787]
5. Lee IM, Paffenbarger RS Jr. Associations of light, moderate, and vigorous intensity physical activity with longevity. the Harvard Alumni Health Study. *Am J Epidemiol.* 2000; 151(3):293–299. PubMed doi:10.1093/oxfordjournals.aje.a010205. [PubMed: 10670554]
6. Craig CL, Brownson RC, Cragg SE, Dunn AL. Exploring the effect of the environment on physical activity: a study examining walking to work. *Am J Prev Med.* 2002; 23(2, Suppl):36–43. PubMed doi:10.1016/S0749-3797(02)00472-5. [PubMed: 12133736]
7. Murakami, E.; Young, J. Paper presented at Nationwide Personal Transportation Survey Symposium. Washington, DC: U.S.: 1997. Daily travel by persons with low income..
8. Hamilton MT, Hamilton DG, Zderic TW. Role of low energy expenditure and sitting in obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease. *Diabetes.* 2007; 56(11):2655–2667. PubMed doi:10.2337/db07-0882. [PubMed: 17827399]
9. Burton NW, Turrell G. Occupation, hours worked, and leisure-time physical activity. *Prev Med.* 2000; 31(6):673–681. PubMed doi:10.1006/pmed.2000.0763. [PubMed: 11133334]
10. Ham SA, Ainsworth BE. Disparities in data on Healthy People 2010 physical activity objectives collected by accelerometry and self-report. *Am J Public Health.* 2010; 100(Suppl 1):S263–S268. PubMed doi:10.2105/AJPH.2009.180075. [PubMed: 20147669]
11. Kirk MA, Rhodes RE. Occupation correlates of adults' participation in leisure-time physical activity: a systematic review. *Am J Prev Med.* 2011; 40(4):476–485. PubMed doi:10.1016/j.amepre.2010.12.015. [PubMed: 21406284]
12. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System survey data. Department of Health and Human Services, Centers for Disease Control and Prevention; Atlanta, GA: 2009.

13. Troiano RP, Berrigan D, Dodd KW, Masse LC, Tilert T, McDowell M. Physical activity in the United States measured by accelerometer. *Med Sci Sports Exerc.* 2008; 40(1):181–188. PubMed doi:10.1249/mss.0b013e31815a51b3. [PubMed: 18091006]
14. Fisher-Hoch SP, Rentfro AR, Salinas JJ, et al. Socioeconomic status and prevalence of obesity and diabetes in a Mexican American community, Cameron County, Texas, 2004–2007. *Prev Chronic Dis.* 2010; 7(3):A53. PubMed. [PubMed: 20394692]
15. U.S. Census Bureau. [1/4/2011] American Fact Finder: Cameron County. 2011. http://factfinder2.census.gov/faces/tableservices/jsf/pages/product-view.xhtml?pid=ACS_11_1YR_S1701&prodType=table.
16. Godin G, Shephard RJ. A simple method to assess exercise behavior in the community. *Can J Appl Sport Sci.* 1985; 10(3):141–146. PubMed. [PubMed: 4053261]
17. Godin G, Shephard RJ. Godin leisure-time exercise questionnaire. *Med Sci Sports Exerc.* 1997; 29(6, Suppl):S36–S38.
18. Trost SG, McIver KL, Pate RR. Conducting accelerometer-based activity assessments in field-based research. *Med Sci Sports Exerc.* 2005; 37(11, Suppl):S531–S543. PubMed doi: 10.1249/01.mss.0000185657.86065.98. [PubMed: 16294116]
19. Freedson PS, Melanson E, Sirard J. Calibration of the Computer Science and Applications, Inc. accelerometer. *Med Sci Sports Exerc.* 1998; 30(5):777–781. PubMed doi: 10.1097/00005768-199805000-00021. [PubMed: 9588623]
20. Loustalot F, Carlson SA, Fulton JE, Kruger J, Galuska DA, Lobelo F. Prevalence of self-reported aerobic physical activity among U.S. States and territories—Behavioral Risk Factor Surveillance System, 2007. *J Phys Act Health.* 2009; 6(Suppl 1):S9–S17. PubMed. [PubMed: 19998845]
21. Ainsworth BE, Haskell WL, Whitt MC, et al. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc.* 2000; 32(9):S498–S516. PubMed doi: 10.1097/00005768-200009001-00009. [PubMed: 10993420]
22. Sun SS, Chumlea WC, Heymsfield SB, et al. Development of bioelectrical impedance analysis prediction equations for body composition with the use of a multicomponent model for use in epidemiologic surveys. *Am J Clin Nutr.* 2003; 77(2):331–340. PubMed. [PubMed: 12540391]
23. Burmeister JJ, Arnold MA. Accuracy of the YSI Stat Plus Analyzer for Glucose and Lactate. *Anal Lett.* 1995; 28(4):581–592. doi:10.1080/00032719508001119.
24. Grundy SM, Cleeman JI, Daniels SR, et al. Diagnosis and management of the metabolic syndrome: an American Heart Association/ National Heart, Lung, and Blood Institute Scientific Statement. *Circulation.* 2005; 112(17):2735–2752. PubMed doi:10.1161/CIRCULATIONAHA.105.169404. [PubMed: 16157765]
25. WHO. Physical status: the use and interpretation of anthropometry. Geneva: 1995.
26. American College of Sports Medicine. Health-Related Physical Fitness Assessment Manual. 2nd ed.. Lippincott Williams & Wilkins; Philadelphia: 2007.
27. Spalter-Roth, R.; Lowenthal, TA. Sydney S. Spivack Program in Applied Social Research and Social Policy. American Sociological Association; 2005. Race, ethnicity, and the American labor market: What's at work?.
28. Buman MP, Hekler EB, Haskell WL, et al. Objective light-intensity physical activity associations with rated health in older adults. *Am J Epidemiol.* 2010; 172(10):1155–1165. 2010. [PubMed: 20843864]
29. Healy GN, Dunstan DW, Salmon J, et al. Objectively measured light-intensity physical activity is independently associated with 2-h plasma glucose. *Diabetes Care.* 2007; 30(6):1384–1389. PubMed doi:10.2337/ dc07-0114. [PubMed: 17473059]
30. King GA, Fitzhugh EC, Bassett DR Jr, et al. Relationship of leisure-time physical activity and occupational activity to the prevalence of obesity. *Int J Obes Relat Metab Disord.* 2001; 25(5): 606–612. PubMed doi:10.1038/sj.ijo.0801583. [PubMed: 11360141]
31. Lee IM, Rexrode KM, Cook NR, Manson JE, Buring JE. Physical activity and coronary heart disease in women: is “no pain, no gain” passe? *JAMA.* 2001; 285(11):1447–1454. PubMed doi: 10.1001/jama.285.11.1447. [PubMed: 11255420]
32. Bureau of Labor Statistics, American Time Use Survey. [June 4, 2012] Time use on an average work day for employed persons ages 25 to 54 with children. 2011. <http://www.bls.gov/tus/charts/>.

33. Morris JN, Heady JA, Raffle PA, Roberts CG, Parks JW. Coronary heart-disease and physical activity of work. *Lancet*. 1953; 265(6796):1111–1120. PubMed doi:10.1016/S0140-6736(53)91495-0. [PubMed: 13110075]
34. Evans RE, Fawole HO, Sheriff SA, Dall PM, Grant PM, Ryan CG. Point-of-choice prompts to reduce sitting time at work: a randomized trial. *Am J Prev Med*. 2012; 43(3):293–297. PubMed doi:10.1016/j.amepre.2012.05.010. [PubMed: 22898122]
35. Reiff C, Marlatt K, Denge DR. Difference in caloric expenditure in sitting versus standing desks. *J Phys Act Health*. 2012; 9(7):1009–1011. PubMed. [PubMed: 22971879]

Figure 1.

Proportion of wear time spent in sedentary, light-intensity, and moderate-to-vigorous physical activity (MVPA) by occupational category.

Figure 2.

Proportion of participants classified as at risk for cardiovascular disease risk factors by occupational activity classification.

Table 1

Sample Characteristics of 118 Accelerometer Participants in the Cameron County Hispanic Cohort

Variable	Males (n = 37)		Females (n = 81)		t or χ^2
	Mean or n	SD or %	Mean or n	SD or %	
Age	47.51	13.41	48.42	12.66	-0.35
Occupational activity classification					4.18
% Sedentary workers	9	24.3%	15	18.5%	
% Low-active workers	10	27.0%	38	46.9%	
% Moderately active workers	18	48.7%	28	34.6%	
Average daily physical activity (minutes)					
Sedentary	429.36	87.48	450.82	92.01	-1.19
Light-intensity	323.76	79.39	312.69	73.54	0.74
Moderate-to-vigorous physical activity (MVPA)	26.14	19.26	17.79	16.64	2.40 *
Proportion of time in light-intensity activity	41.5%	9.5%	40.1%	9.1%	0.75
Proportion of time in MVPA	3.4%	2.6%	2.3%	2.1%	2.46 *
% meeting guidelines	13	35.1%	18	22.2%	2.19
% meeting guidelines—10 minute bouts	3	8.1%	6	7.4%	0.02
Metabolic syndrome risk factors					
Systolic blood pressure, mmHg	115.08	12.09	115.86	17.79	-0.28
Diastolic blood pressure, mmHg	71.11	7.37	71.67	11.32	-0.32
Waist circumference, cm	103.75	9.78	102.79	12.93	0.40
Fasting blood glucose, mg/dL	103.41	10.48	103.65	15.38	-0.10
HDL, mg/dL	45.44	9.59	50.25	10.61	-2.01 *
Triglycerides, mg/dL	146.52	104.11	144.17	87.43	0.11
Additional cardiovascular risk factors					
BMI, kg/m ²	29.83	4.03	31.17	5.19	-1.35
Body fat (%)	27.0%	4.9%	39.4%	6.4%	-9.95 **

* $P < .05$ ** $P < .0001$.

Table 2

Comparison of Time Spent in Sedentary, Light-Intensity, and Moderate-to-Vigorous Physical Activity (MVPA) Minutes, and Cardiovascular Risk Factors by Occupational Category Among Participants in the Cameron County Hispanic Cohort

	<u>Sedentary workers</u>		<u>Low-active workers</u>		<u>Moderately active workers</u>		<i>P</i>
	Mean	SD	Mean	SD	Mean	SD	
Daily sedentary minutes	468.17	83.38	447.84	85.68	427.61	98.03	0.194
Daily light-intensity minutes	262.22	75.02	321.69 ^a	67.74	338.53 ^b	70.44	0.0001
Daily MVPA minutes	22.75	19.83	19.49	18.64	20.14	16.14	0.763
Systolic blood pressure, mmHg	115.38	15.42	117.15	18.86	114.15	13.48	0.670
Diastolic blood pressure, mmHg	72.46	11.42	72.00	10.92	70.46	8.86	0.672
Waist circumference, cm	102.61	9.73	103.25	13.08	103.16	12.10	0.977
Fasting blood glucose, mg/dL	101.21	11.39	104.65	14.15	103.70	15.13	0.619
HDL, mg/dL	51.20	10.72	50.00	11.86	46.68	8.92	0.254
Triglycerides, mg/dL	126.67	90.61	157.39	89.52	141.26	96.31	0.542
BMI, kg/m ²	30.27	4.28	30.89	5.35	30.77	4.69	0.899
Body fat (%)	34.2%	9.3%	36.8%	8.2%	34.6%	8.0%	0.371

Note. Tukey's post hoc procedure was used to correct for multiple comparisons across Occupational Activity Classifications.

^a Mean minutes of light-intensity activity for Low-Active Workers is greater than for workers in Sedentary occupations.

^b Mean minutes of light-intensity activity for Moderately-Active Workers is greater than for workers in Sedentary occupations.

Table 3

Pearson's Correlation Coefficients for Average Daily Physical Activity and Cardiovascular Risk Factors

	Sedentary minutes	Light-intensity minutes	MVPA minutes
Systolic blood pressure	0.07	−0.12	−0.07
Diastolic blood pressure	−0.03	−0.09	−0.05
Waist circumference	−0.03	−0.04	−0.06
Fasting blood glucose	0.04	0.09	0.11
HDL	−0.01	−0.04	−0.10
Triglycerides	0.13	−0.07	0.08
BMI	0.00	−0.01	−0.13
Body fat (%)	0.06	−0.06	−0.22 *

Abbreviations: MVPA, moderate-to-vigorous physical activity.

*
 $P = .025$.