Employment and Physical Activity in the U.S.

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Background: Physical inactivity is a risk factor for obesity, cardiovascular disease, hypertension, and other chronic diseases that are increasingly prevalent in the U.S. and worldwide. Time at work represents a major portion of the day for employed people.

Purpose: To determine how employment status (full-time, part-time, or not employed) and job type (active or sedentary) are related to daily physical activity levels in American adults.

Methods: Cross-sectional data from the National Health and Nutrition Examination Survey (NHANES) were collected in 2003–2004 and analyzed in 2010. Physical activity was measured using Actigraph uniaxial accelerometers, and participants aged 20–60 years with ≥4 days of monitoring were included (N=1826). Accelerometer variables included mean counts/minute during wear time and proportion of wear time spent in various intensity levels.

Results: In men, full-time workers were more active than healthy nonworkers ($p=0.004$), and in weekday-only analyses, even workers with sedentary jobs were more active ($p=0.03$) and spent less time sedentary ($p<0.001$) than nonworkers. In contrast with men, women with full-time sedentary jobs spent more time sedentary ($p=0.008$) and had less light and lifestyle intensity activity than healthy nonworkers on weekdays. Within full-time workers, those with active jobs had greater weekday activity than those with sedentary jobs (22% greater in men, 30% greater in women).

Conclusions: In men, full-time employment, even in sedentary occupations, is positively associated with physical activity compared to not working, and in both genders job type has a major bearing on daily activity levels.

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Introduction

There is strong evidence that physical activity is a key factor in maintaining a healthy body weight and reducing the risk of many health problems, including hypertension, cardiovascular disease, osteoporosis, and type 2 diabetes.[1] The link between physical activity and health is now well recognized. Widely accepted physical activity recommendations were introduced in 1995, calling for at least 30 minutes of moderate or higher intensity activity per day.[2] Half of Americans report activity levels that meet this recommendation,[3] but a recent study that used accelerometers reported vastly lower adherence—less than 5%.[4] One fourth of Americans report no regular leisure-time physical activity at all.[5]

Understanding the factors that affect physical activity is central to the goal of increasing activity levels and reducing the associated health risks. There are three main components of total daily physical activity: occupational, including activity at work as well as commuting; household, such as yard work and food preparation; and leisure time, such as structured exercise and participation in sports.[6] Occupational activity represents the greatest portion of daily time for most adults prior to retirement[7] and is therefore a promising target for physical activity research, especially as jobs have become increasingly sedentary.[8]

With increasing unemployment in many countries—particularly in America, where unemployment rose from

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4.6% in 2007 to 9.3% in 2009—the relationship between employment status and health is an important issue.[9] Unemployment is associated with depression[10] and all-cause mortality,[11] but it is not entirely clear whether unemployed people are more or less active than employed people. Nonworkers by definition do not accumulate any occupational physical activity nor any activity associated with daily commuting, which has been shown to be an appreciable source of activity in workers.[12] Conversely, nonworkers may have more discretionary time that they could use to achieve higher activity levels than workers, depending on the time demands of domestic and family responsibilities. Previous studies[13–16] suggest that nonworkers are equally or marginally less likely to get adequate physical activity, but these results are based on self-report questionnaires, which are prone to reporting bias and may not detect unstructured activities that people are likely to participate in at work.

The primary objective of the present study is to examine the relationship between employment status (full-time, part-time, or not employed) and objectively measured daily physical activity in American adults, and to assess the effect of job type (active, unclassified, or sedentary) on this relationship. Secondary aims are to compare weekday/weekend activity across employment groups and to examine activity patterns by time of day.

Methods

Data Source

The National Health and Nutrition Examination Survey (NHANES) is a continuous, ongoing study designed to assess the health of children and adults in the U.S.[17] NHANES combines interviews administered in the household with standardized physical examinations and testing performed in specially designed mobile examination centers to collect health information on a nationally representative sample of approximately 5000 people per year. The present analysis used data from NHANES 2003–2004, which included an occupational questionnaire and physical activity monitoring using accelerometers, and was conducted in 2010. At the time of this analysis, employment data from NHANES 2005–2006 were not available to link with the accelerometer data from that cycle.[17]

Study Population

For NHANES 2003–2004, physical activity monitoring was administered to participants aged ≥6 years who were not reliant on wheelchairs or walking devices for mobility (n=7176).[18] Participants aged 20–60 years (n=2791) with data for all covariates (see below; n=2757) were selected. Participants who reported being in school or retired were excluded (n=100), as were those who reported being "with a job or business but not at work" (n=113), because of uncertainty in their employment status during the activity monitoring week. Each day of monitoring was considered valid if the accelerometer was worn for ≥10 hours, and participants with ≥4 valid days were included (n=1838). Participants with accelerometer data indicating device malfunction were excluded (n=12), leaving a sample of 1826 participants (892 men, 934 women).

Accelerometry

Participants were given an ActiGraph model 7164, a hip-worn uniaxial accelerometer that measures motion in the vertical axis in arbitrary acceleration units of "counts." The accelerometers were programmed to record count values at 1-minute intervals for the entire 7-day period, and participants were instructed to remove the devices for swimming, bathing, and sleeping.

For a measure of total physical activity, mean wear-time counts/minute was calculated for each day by dividing total counts by minutes of wear time. Non–wear time was defined as 60 consecutive minutes with accelerometer counts of 0, allowing for 1–2 minutes with 1–100 counts, in accordance with previous studies.[4]

Each minute of wear time during the monitoring period was classified into sedentary (0–99 counts); light (100–759 counts); lifestyle (760–2019 counts); or moderate-to-vigorous (MVPA) (≥2020 counts) activity according to cut points reported in previous validation studies.[4,19] Proportion of wear time spent in each intensity level was calculated by dividing minutes in each intensity level by minutes of wear time. Activity variables are reported as averages of daily values, using all valid days. Accelerometer data were processed using customized software written in MATLAB R2006a.

Employment Classifications

Data from the NHANES 2003–2004 occupational questionnaire were used to categorize participants into employment groups. Participants who said they were "working at a job or business" in the week prior to the interview were considered employed full-time (EFT) if they reported working ≥35 hours (n=1180; 679 men, 501 women) or employed part-time (EPT) if they reported working 1–34 hours (n=253; 82 men, 171 women). These classifications are based on the current definitions used by the U.S. Bureau of Labor Statistics (BLS).[9] Participants who said they were "looking for work" or "not working at a job or business" were considered not employed and divided into two groups: not employed healthy (NEH) if they did not report being "unable to work for health reasons" or "disabled" as the main reason for not working (n=256; 63 men, 193 women); or not employed unhealthy (NEU) if they reported either of these choices (n=137; 68 men, 69 women).

For part of the analysis, EFT and EPT were classified into job types using occupational codes and a previously established classification system.[20] Briefly, King et al.[20] identified seven of 42 occupations as involving high levels of physical activity (active jobs [e.g., farm and nursery workers, construction laborers]); ten as involving low levels of activity (sedentary jobs [e.g., secretaries, motor vehicle operators]); and the remaining 25 as involving moderate or uncertain activity demands (unclassified jobs).

Covariates

Covariates included age (years) and BMI as continuous variables and race/ethnicity (non-Hispanic white; non-Hispanic black; Mexican-American; other); marital status (married/living with partner; single/not living with partner); educational level (less than high school; high school graduate; more than high school); and smoking status (never smoked; former smoker; current smoker) as categoric variables. Race/ethnicity was reported by survey participants in a series of multiple-choice questions and recoded into the

categories listed above, and was included in the analysis because of a known association between race/ethnicity and physical activity.[4]

Statistical Analysis

Data were analyzed using SAS software, version 9.1, and SUDAAN, version 10.0, to incorporate sample weights and account for the complex survey design. Analyses were stratified by gender because of observed interaction effects between gender and employment group on activity variables in preliminary analyses. Adjusted means and SEs were calculated for employment groups, and ANOVA was used to compare activity levels across groups. Statistical comparisons were done using $\alpha=0.05/6$ for employment status pairs and $\alpha=0.05/3$ for job type pairs to account for multiple comparisons. Paired *t*-tests with $\alpha=0.05$ were used to compare weekday and weekend activity within employment groups for participants with at least 1 valid weekday and 1 valid weekend day.

Results

Average age was 41.4 years for men and 41.9 years for women (Table 1). Men were more active overall, averaging 379.8 counts/minute whereas women averaged 306.0 counts/minute. Adjusted means and SEs for the activity variables are shown for employment status groups in Table 2.

Table 1. Demographics of the study population, % unless otherwise indicated

Characteristic	Men ($n=892$)	Women ($n=934$)	*p*-value
Age (years), M (SE)	41.4 (0.62)	41.9 (0.80)	0.63
Height (cm), M (SE)	176.8 (0.29)	163.2 (0.40)	<0.001
Weight (kg), M (SE)	87.8 (1.11)	74.7 (1.03)	<0.001
BMI, M (SE)	28.0 (0.31)	28.0 (0.36)	0.97
Race/ethnicity			
Non-Hispanic white	71.4	69.0	0.19
Non-Hispanic black	10.7	12.8	—
Mexican-American	9.2	7.7	—
Other	8.7	10.5	—
Marital status			
Married/living with partner	71.4	63.0	<0.001
Single/not living with partner	28.6	37.0	—
Educational level			
Less than high school	15.1	13.0	0.44
High school graduate	27.0	23.9	—
More than high school	57.8	63.2	—
Smoking status			
Never smoked	43.6	57.5	0.001
Former smoker	25.8	19.7	—
Current smoker	30.5	22.8	—
Employment status			
EFT	77.3	56.1	<0.001
EPT	9.4	20.9	—
NEH	5.7	16.6	—
NEU	7.6	6.4	—
Job type (within EFT)			<0.001
Active	14.8	3.1	—
Unclassified	48.5	47.4	—
Sedentary	36.7	49.5	—
Accelerometry			
Valid days of ≥10 hours wear time, M (SE)	5.95 (0.05)	5.94 (0.05)	0.91
Minutes of wear time per valid day, M (SE)	886.9 (5.15)	856.6 (4.25)	0.001
Wear-time counts per minute, M (SE)	379.8 (8.84)	306.0 (4.35)	<0.001

EFT, employed full-time; EPT, employed part-time; NEH, not employed (not due to health problems); NEU, not employed (due to health problems)

In men, EFT had the highest mean wear-time counts/minute (395.9), followed by EPT (356.8); NEH (324.6); and NEU (285.2), with the difference between EFT and NEH significant ($p=0.004$). EFT had less sedentary time and spent more time engaged in light and lifestyle intensity activity than NEH. As expected, NEU were less active

Table 2. Accelerometer-derived physical activity comparison across employment status groups, using various inclusion criteria for workers[a,b,c]

	n	Wear-time counts/minute (M [SE])	Sedentary percentage (M [SE])	Light percentage (M [SE])	Lifestyle percentage (M [SE])	MVPA percentage (M [SE])
MEN						
All jobs						
EFT (A)	679	395.9 (6.97)	53.61 (0.60)	29.51 (0.41)	12.77 (0.31)	4.11 (0.15)
EPT (B)	82	356.8 (22.1)	55.35 (1.35)	30.29 (0.78)	10.90 (0.77)	3.46 (0.40)
NEH (C)	63	324.6 (20.7)	60.12 (0.99)	27.21 (0.57)	9.20 (0.53)	3.47 (0.51)
NEU (D)	68	285.2 (14.9)	60.52 (0.93)	28.02 (0.92)	9.10 (0.47)	2.36 (0.29)
p-value		<0.001	<0.001	0.03	<0.001	<0.001
		AC, AD	AC, AD, BD	AC	AC, AD	AD
Active jobs removed[d]						
EFT (A)	567	380.3 (7.99)	54.85 (0.61)	29.16 (0.44)	12.11 (0.32)	3.88 (0.17)
EPT (B)	65	346.7 (23.8)	56.42 (1.29)	29.96 (0.91)	10.21 (0.64)	3.41 (0.48)
NEH (C)	63	328.3 (19.8)	59.95 (0.98)	27.15 (0.63)	9.36 (0.50)	3.54 (0.50)
NEU (D)	68	278.5 (15.7)	61.14 (0.86)	27.74 (0.93)	8.86 (0.46)	2.27 (0.32)
p-value		<0.001	<0.001	0.08	<0.001	<0.001
		AD	AC, AD, BD		AC, AD	AD
Sedentary jobs only[e]						
EFT (A)	230	371.9 (12.9)	57.15 (0.78)	27.66 (0.61)	11.27 (0.48)	3.92 (0.24)
EPT (B)	26	331.8 (33.5)	57.78 (1.79)	29.44 (1.39)	9.56 (0.86)	3.22 (0.66)
NEH (C)	63	319.2 (25.4)	60.44 (1.35)	27.12 (0.71)	9.05 (0.56)	3.39 (0.58)
NEU (D)	68	275.4 (17.5)	61.85 (0.83)	27.37 (0.78)	8.56 (0.45)	2.21 (0.33)
p-value		0.001	0.002	0.58	0.003	0.002
		AD	AD		AC, AD	AD
WOMEN						
All jobs						
EFT (A)	501	307.7 (6.36)	55.63 (0.65)	32.05 (0.47)	10.02 (0.25)	2.30 (0.12)
EPT (B)	171	330.6 (7.90)	53.84 (1.13)	32.53 (0.94)	11.07 (0.44)	2.57 (0.21)
NEH (C)	193	298.0 (5.67)	55.63 (0.83)	32.20 (0.75)	10.07 (0.32)	2.10 (0.15)
NEU (D)	69	231.9 (7.57)	60.66 (1.37)	30.85 (1.26)	7.32 (0.36)	1.17 (0.18)
p-value		<0.001	0.01	0.73	<0.001	<0.001
		AD, BC, BD, CD	AD, BD, CD		AD, BD, CD	AD, BD, CD
Active jobs removed[d]						
EFT (A)	481	302.8 (6.03)	56.12 (0.64)	31.84 (0.45)	9.78 (0.24)	2.26 (0.11)
EPT (B)	146	321.0 (10.4)	55.24 (1.13)	31.55 (0.66)	10.72 (0.54)	2.48 (0.19)
NEH (C)	193	299.2 (6.02)	55.53 (0.88)	32.22 (0.74)	10.15 (0.33)	2.10 (0.15)
NEU (D)	69	233.3 (7.94)	60.40 (1.38)	31.10 (1.24)	7.32 (0.36)	1.18 (0.17)
p-value		<0.001	0.04	0.87	<0.001	<0.001
		AD, BD, CD	AD, CD		AD, BD, CD	AD, BD, CD

(continued on next page)

Table 2. Accelerometer-derived physical activity comparison across employment status groups, using various inclusion criteria for workers[a,b,c] *(continued)*

	n	Wear-time counts/minute (M [SE])	Sedentary percentage (M [SE])	Light percentage (M [SE])	Lifestyle percentage (M [SE])	MVPA percentage (M [SE])
Sedentary jobs only[e]						
EFT (A)	241	287.7 (6.82)	58.19 (0.57)	30.62 (0.44)	9.02 (0.22)	2.17 (0.12)
EPT (B)	56	318.4 (22.1)	58.11 (1.93)	29.22 (0.88)	9.87 (1.00)	2.80 (0.33)
NEH (C)	193	299.7 (6.12)	55.44 (0.92)	32.25 (0.77)	10.20 (0.31)	2.11 (0.15)
NEU (D)	69	230.3 (8.31)	60.48 (1.49)	31.15 (1.33)	7.25 (0.41)	1.12 (0.17)
p-value		<0.001	0.04	0.13	<0.001	<0.001
		AD, BD, CD			AC, AD, CD	AD, BD, CD

[a]Adjusted for age, BMI, race/ethnicity, marital status, educational level, and smoking status. Used $\alpha=0.05/6$ for pairwise comparisons; significant differences are indicated by ABCD pairs.
[b]Intensity levels are based on minute-to-minute accelerometer counts and are classified as follows: sedentary (0–99); light (100–759); lifestyle (760–2019); and MVPA (≥2020).
[c]NEH and NEU have different means for All Jobs, Active Jobs Removed, and Sedentary Jobs Only because means are adjusted for covariates based on all data in each subanalysis, from EFT, EPT, NEH, and NEU. The total number of participants in each of the three subanalyses is different.
[d]Excluded workers with highly active jobs (waiters and waitresses; cleaning and building service occupations; farm and nursery workers; construction trades; construction laborers; laborers, except construction; and freight, stock, and material movers, hand).
[e]Included only workers with sedentary jobs (executives, administrators, and managers; management-related occupations; engineers, architects, and scientists; teachers; secretaries, stenographers, and typists; information clerks; records-processing occupations; material-recording, scheduling, and distributing clerks; miscellaneous administrative support occupations; and motor vehicle operators).
EFT, employed full-time; EPT, employed part-time; MVPA, moderate-to-vigorous physical activity; NEH, not employed (not due to health problems); NEU, not employed (due to health problems)

than those in the other groups. To test whether activity differences between EFT and NEH were only due to a subset of EFT with active jobs, participants with active jobs were excluded for a follow-up analysis and differences still were observed between EFT and NEH in sedentary ($p<0.001$) and lifestyle ($p<0.001$) percentages. When participants with unclassified jobs also were excluded, the difference in lifestyle percentage between EFT with sedentary jobs and NEH remained significant ($p=0.007$).

In women, EFT, EPT, and NEH were generally similar, whereas NEU were less active than the other groups. Within EFT, activity levels varied across job type groups (Table 3). On weekdays, men and women with active jobs had greater mean wear-time counts/minute than those with unclassified or sedentary jobs, whereas on weekends all three groups were similar. In men, EFT with active jobs and EFT with unclassified jobs were significantly more active on weekdays than they were on weekend days ($p<0.001$ for active jobs; $p=0.008$ for unclassified jobs), whereas EFT with sedentary jobs were equally active on weekdays and weekend days. In women, EFT with active jobs were less sedentary and had more light activity on weekdays, EFT with unclassified jobs were equally active on weekdays and weekend days, and EFT with sedentary jobs were more sedentary and had less lifestyle activity on weekdays.

Weekday and weekend activity comparisons for EFT with sedentary jobs versus NEH are shown in Figure 1. On weekdays, EFT men with sedentary jobs had greater mean wear-time counts/minute ($p=0.03$); less sedentary time ($p<0.001$); and more light ($p=0.04$) and lifestyle ($p=0.004$) activity than NEH. Graphs of activity patterns by time of day (Figure 2) showed that EFT men with sedentary jobs averaged substantial activity starting at 6AM, whereas NEH men were inactive in the morning hours; these differences diminished in the afternoon. On weekend days, there were no differences in mean wear-time counts/minute or any other activity measure among job classifications. EFT women with sedentary jobs had more sedentary time ($p=0.008$) and spent less time engaged in light ($p=0.02$) and lifestyle ($p=0.001$) activity than NEH women on weekdays; there were no differences on weekend days.

Additional analyses were performed to identify causes for the gender differences observed in activity levels for EFT with sedentary jobs compared to NEH. First, prevalence of active commuting (walking or biking to and from work) and activity differences between active commuters

Table 3. Physical activity on weekdays and weekends for full-time workers with active, unclassified, and sedentary jobs[a]

	n	Wear-time counts/minute (SE)	Sedentary percentage (SE)	Light percentage (SE)	Lifestyle percentage (SE)	MVPA percentage (SE)
MEN						
Weekdays						
Active jobs (A)	93	468.7 (14.4)	47.46 (0.97)	31.55 (0.55)	15.74 (0.59)	5.25 (0.30)
Unclassified jobs (B)	293	391.7 (10.0)	52.87 (0.89)	30.32 (0.61)	12.88 (0.46)	3.92 (0.23)
Sedentary jobs (C)	206	376.5 (9.13)	57.22 (0.95)	27.60 (0.81)	11.09 (0.39)	4.09 (0.20)
p-value		<0.001	<0.001	0.003	<0.001	0.006
		AB, AC	AB, AC, BC	AC, BC	AB, AC, BC	AB, AC
Weekend days						
Active jobs (A)	93	399.1 (16.7)	51.65 (1.60)	30.57 (0.97)	13.84 (0.79)	3.94 (0.26)
Unclassified jobs (B)	293	367.9 (12.4)	55.18 (1.07)	29.18 (0.68)	12.01 (0.42)	3.63 (0.20)
Sedentary jobs (C)	206	381.9 (19.6)	55.38 (1.34)	28.69 (0.60)	11.98 (0.70)	3.95 (0.33)
p-value		0.41	0.27	0.38	0.24	0.49
Difference between weekday and weekend[b]						
Active jobs (A)	93	87.40 (9.10)***	−5.42 (1.03)***	1.43 (0.96)	2.45 (0.34)***	1.54 (0.33)***
Unclassified jobs (B)	293	27.62 (8.98)**	−2.74 (0.63)***	1.42 (0.56)*	0.98 (0.27)**	0.33 (0.19)
Sedentary jobs (C)	206	−17.73 (21.2)	2.90 (1.43)	−1.63 (0.81)	−1.26 (0.66)	−0.01 (0.33)
WOMEN						
Weekdays						
Active jobs (A)	17	390.5 (31.6)	45.54 (2.89)	37.26 (2.27)	14.50 (1.58)	2.69 (0.50)
Unclassified jobs (B)	220	320.0 (7.05)	53.94 (0.85)	33.05 (0.68)	10.65 (0.34)	2.37 (0.17)
Sedentary jobs (C)	211	287.4 (8.26)	58.83 (0.63)	30.16 (0.45)	8.73 (0.21)	2.28 (0.14)
p-value		<0.001	<0.001	<0.001	<0.001	0.63
		AC, BC	AB, AC, BC	AC, BC	AC, BC	
Weekend days						
Active jobs (A)	17	296.0 (66.6)	54.92 (5.51)	33.05 (2.98)	10.35 (2.49)	1.68 (0.74)
Unclassified jobs (B)	220	315.0 (8.38)	53.83 (0.83)	33.30 (0.68)	10.68 (0.35)	2.20 (0.16)
Sedentary jobs (C)	211	291.7 (10.0)	57.12 (1.03)	31.23 (0.86)	9.58 (0.41)	2.07 (0.15)
p-value		0.06	0.03	0.17	0.05	0.53
			BC			
Difference between weekday and weekend[b]						
Active jobs (A)	17	100.4 (55.9)	−10.02 (4.01)*	4.59 (2.08)*	4.37 (2.14)	1.05 (0.65)
Unclassified jobs (B)	220	7.02 (7.32)	−0.09 (0.74)	−0.14 (0.51)	0.03 (0.25)	0.19 (0.12)
Sedentary jobs (C)	211	−6.67 (6.51)	1.94 (0.87)*	−1.19 (0.73)	−0.93 (0.31)**	0.19 (0.14)

[a]Adjusted for age, BMI, race/ethnicity, marital status, educational level, and smoking status. Used $\alpha=0.05/3$ for pairwise comparisons; significant differences are indicated by ABC pairs.

[b]Mean differences are not equal to difference between mean weekday and weekend values listed in table because weekday and weekend averages were adjusted for covariates whereas mean differences were calculated within individual participants and do not take into account covariates.

*$p<0.05$,**$p<0.01$,***$p<0.001$

MVPA, moderate-to-vigorous physical activity

and non-active commuters were compared for men and women. Weekday mean wear-time counts/minute differences between active commuters and non-active commuters increased with increasingly conservative criteria for active commuting status (at least 1, 3, 5, 7, or 10 days of active commuting per month), and in both genders reached significance for the 5-, 7-, and 10-day criteria. For the 5-day criterion, prevalence of active commuting was

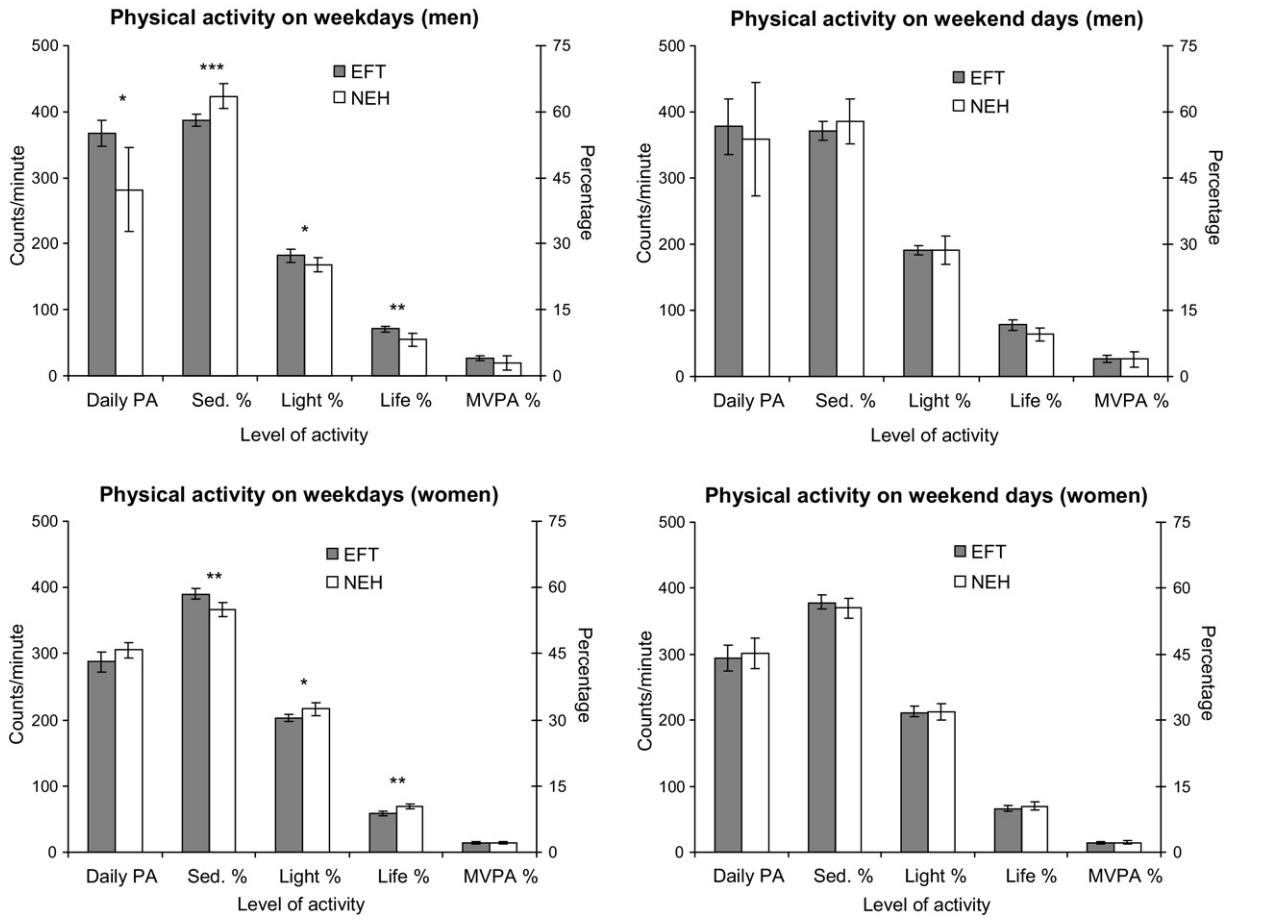

Figure 1. Activity comparisons between full-time workers with sedentary jobs and healthy nonworkers, for data on weekdays and weekend days

Note: Bars represent adjusted means±95% CI. Indicated differences are significant at *$p<0.05$, **$p<0.01$, and ***$p<0.001$. Sedentary=0–99 counts; light=100–759 counts; lifestyle=760–2019 counts; MVPA=≥2020 counts.

EFT, employed full-time (sedentary jobs only); MVPA, moderate-to-vigorous physical activity; NEH, not employed (not due to health problems); PA, physical activity; Sed, sedentary

15.8% in men and 11.9% in women ($p=0.37$), and mean wear-time counts/minute in active commuters vs non-active commuters were 412.4 vs 351.0 ($p=0.01$) in men and 361.1 vs 274.0 ($p=0.01$) in women.

Second, prevalence of not working in order to care for the house or family was compared for men and women. More NEH women than NEH men reported not working in order to take care of the house or family (67.8% vs 1.3%, $p<0.001$). However, NEH women who reported caring for the house or family were no more active than those who reported other reasons for not working (295.1 vs 330.3 counts/minute, $p=0.18$).

Discussion

These data support the importance of work as a determinant of daily activity levels in American adults. In general, EFT men were more active than NEH men, whereas EFT, EPT, and NEH women were similarly active. In both genders, EFT with active jobs had higher weekday physical activity than those with sedentary jobs—mean wear-time counts/minute were 21.8% greater in men and 30.4% greater in women—and similar weekend activity. Compared with healthy nonworkers, full-time employment in sedentary occupations was associated with increased activity in men and decreased activity in women.

There was an opposite association between full-time employment in sedentary jobs and weekday physical activity in men and in women. In men, EFT with sedentary jobs were more active than NEH (four of five accelerometer measures); in women, EFT with sedentary jobs were *less* active than NEH (three of five accelerometer measures). Considering the similar prevalence of active commuting and similar activity differential between active commuters and non-active commuters in both genders, it is unlikely that greater commute-related activity in men is driving the gender difference.

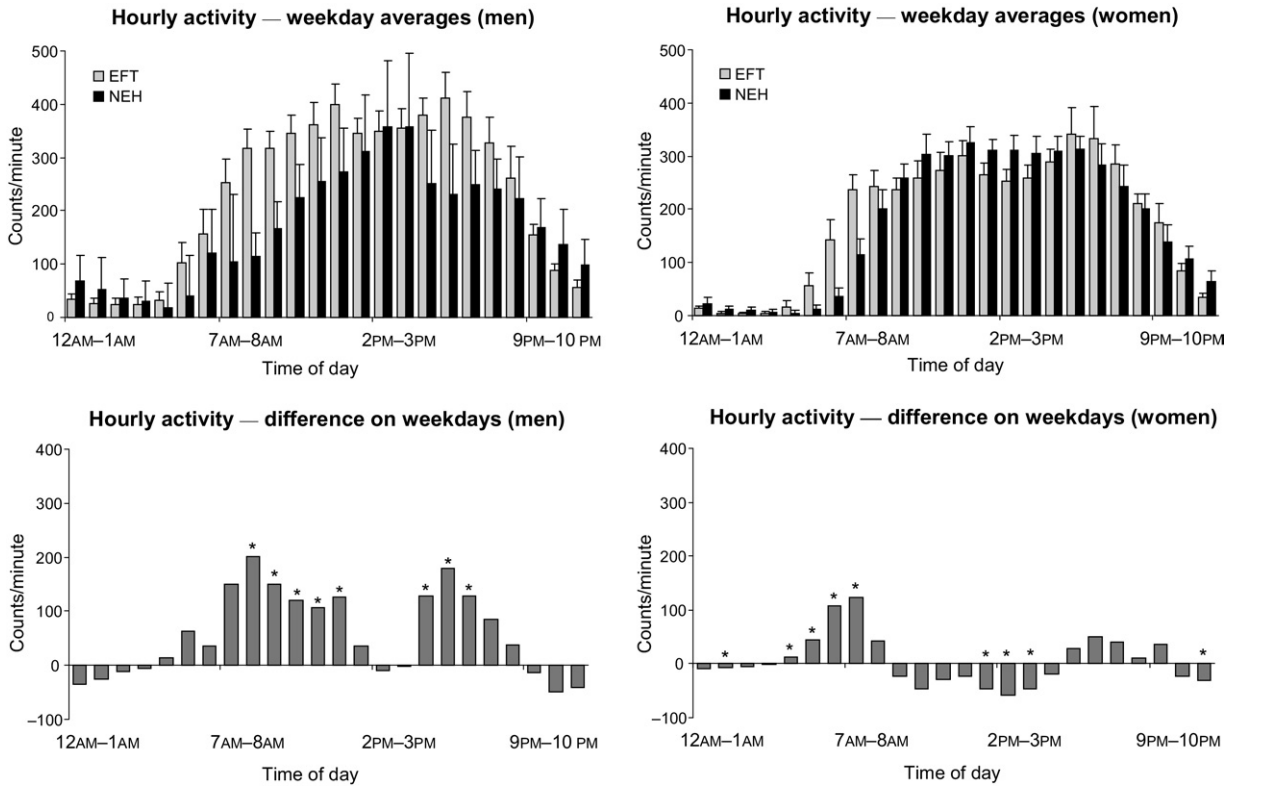

Figure 2. Comparison of hourly activity on weekdays, full-time workers with sedentary jobs versus healthy nonworkers. Bottom plots show differences between groups during each hour of the day.

Note: Bars represent adjusted means±95% CI. Indicated differences are significant at $*p<0.05$.

EFT, employed full-time (sedentary jobs only); NEH, not employed (not due to health problems)

It is possible that NEH women are not less active than EFT women with sedentary jobs because they are participating in domestic activities at home that require physical activity. This explanation is supported by the vastly greater proportion of NEH women that reported caring for the house or family compared to NEH men, but is not supported by the activity levels observed in this group of NEH women, as they were slightly lower than NEH women who reported other reasons for not working. It may be that greater participation in domestic activities for women in general renders employment a weaker determinant of daily activity.[7]

Regardless of the reason for the gender difference, the hourly activity plots showed EFT men with sedentary jobs to be uniquely inactive throughout the morning hours, suggesting that the daily routine that stems from full-time work plays an important role in the accumulation of physical activity for men. On a similar note, it was expected that NEH would be much more active than NEU in both genders, as nonworkers with health problems are presumably limited in their ability to move around and be active. That the activity difference between NEH and NEU was significant only in women supports the notion that NEH women are replacing work with active pursuits, whereas NEH men generally are not.

Significant activity differences between EFT with active jobs and those with sedentary jobs were not surprising, but the magnitudes of differences were striking. Sample size was small in women, but in men, active workers averaged 92.2 greater mean wear-time counts/minute than sedentary workers and 86.7 minutes/day less sedentary time (based on proportions in Table 2 and average wear time in Table 1). For perspective, this counts/minute difference exceeds that reported between normal-weight and obese American men (80.4 counts/minute),[21] and this difference in sedentary time is similar to the difference between American men aged 20–29 years and those aged 60–69 years (91.8 minutes/day).[22] Active workers had 76.3 minutes/day greater combined light and lifestyle activity time, an accelerometer measure associated with 2-hour plasma glucose[23] and other metabolic risk factors.[24] These differences are important considering the increasing prevalence of sedentary occupations in the U.S., which rose from 23% in 1950 to 41% in 2000.[8]

Several studies have examined the relationship between employment and physical activity. Longitudinally,

starting paid work has been shown to be associated with increased odds of being inactive in young Australian women.[25] A representative study in Canada[13] found that the unemployed were equally active as the employed despite having poorer health, and a European study[15] found that inactivity levels were similar in the unemployed. None of these studies used objective measures to assess physical activity.

Strengths of the current study are inclusion of a diverse, nationally representative sample of adults and the use of accelerometers to capture non-exercise activities performed at work. There are also limitations. First, there was no information about what shift or on which days the employed participants in the current sample worked, so not all weekdays were certainly work days and not all weekend days off days. According to the BLS, 34% of employed people work on a typical weekend day, and 84.9% work a regular daytime schedule.[7,26]

Second, because of the cross-sectional design of NHANES, it cannot be concluded that employment causes the physical activity trends that were observed. The differences that were significant on weekdays but not on weekends provide some evidence that employment is the driving factor. Third, participants in the nonworking groups were not necessarily unemployed according to the BLS definition, as not all of these participants were actively seeking work.[27] Finally, accelerometers are poor at detecting cycling; this limitation likely resulted in some underestimation of physical activity throughout the sample and may have confounded the active commuting subanalysis. Prevalence of self-reported cycling in the current study was 12.9% in men and 10.3% in women.

This is the first report on the relationship between employment and objectively measured physical activity within a representative sample of Americans. The results suggest that full-time employment is positively associated with activity levels in men, and that job type is a strong predictor of daily activity levels in both genders. These findings, in conjunction with recent economic trends—increasingly sedentary jobs and rising unemployment—highlight occupational physical activity as an important research target and support the need for special programs that help raise activity levels in the workplace.

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