Differences in Leisure-time, Household, and Work-related Physical Activity by Race, Ethnicity, and Education

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BACKGROUND: Racial and ethnic minority groups have lower levels of leisure-time physical activity (LTPA) than whites, but it is unclear how much of this is explained by differences in socioeconomic status and health.

OBJECTIVE: To examine differences in LTPA, work-related physical activity (WRPA; heavy household chores and strenuous job activities), and total physical activity (TPA) by race, ethnicity, and education.

DESIGN, SETTING, AND PARTICIPANTS: Cross-sectional analyses of data from the 1992 Health and Retirement Study for a nationally representative cohort of 9,621 community-dwelling adults aged 51–61 years.

MEASUREMENTS: Physical activity scores for LTPA, WRPA, and TPA based upon self-reported frequency of light or vigorous recreational activities, heavy household chores, and strenuous job-related physical activities.

MAIN RESULTS: LTPA was lower for blacks and Hispanics compared to whites, and LTPA steadily declined with lower levels of education. WRPA showed the reverse pattern, being lowest for whites and persons with greater education. Education was far more important than race/ethnicity as a determinant of LTPA and WRPA in multivariate analyses. After adjusting for differences in overall health and physical functioning, mean TPA scores were similar across racial/ethnic and education categories; blacks ($\beta = 1.0$; 95% confidence interval [CI], 0.5 to 1.5) and Spanish-speaking Hispanics ($\beta = 1.1$; 95% CI, 0.3 to 1.9) had slightly higher levels of TPA than whites ($P < .01$ and $P = .01$, respectively).

CONCLUSIONS: Differences in educational attainment and health status accounted for virtually all of the racial and ethnic differences in LTPA. After accounting for WRPA, TPA was similar across race, ethnicity, and education subgroups.

KEY WORDS: physical activity; race; ethnicity; education.

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Data have shown that leisure-time physical activity (LTPA) is associated with a lower risk for coronary heart disease and cancer^{1–3} and better cardiorespiratory fitness.^{4,5} Several studies have found that racial/ethnic minorities and individuals with lower socioeconomic status (SES) perform less LTPA,^{6–8} and these differences could contribute to disparities in health outcomes. The relationship between work-related

physical activity (WRPA) and health outcomes is less clear.^{9,10} WRPA is not associated with plasma viscosity or inflammatory markers of cardiovascular disease.¹¹ In addition, we previously reported that WRPA was not associated with the risk of declines in health status and physical functioning.¹²

Few studies have examined the relationships between race, ethnicity, SES, health, and physical activity in all areas of living. Brownson et al. surveyed U.S. women age 40 and older. When they accounted for WRPA, the percent of people being active increased.¹³ The study focused on various categories of physical activity, but did not calculate total physical activity (TPA), and did not adjust for differences in health status. The 1990 National Health Interview Survey (NHIS) suggested that blacks and Hispanics participated in less LTPA, but persons with very low LTPA reported more occupational activity.¹⁴ The study did not measure household chores, and the data were not adjusted for individual's health status. Thus, the true independent relationship between total levels of physical activity and race, ethnicity, and SES is not clear. The purpose of this study was to examine differences in LTPA, WRPA (vigorous household chores and strenuous job-related physical activities), and TPA by race, ethnicity, and education, using national survey data from the 1992 Health and Retirement Study (HRS).

METHODS

Study Population

The HRS data collection is sponsored by the National Institute on Aging and conducted by the Institute for Social Research at University of Michigan.¹⁵ Designed to investigate health outcomes, retirement decisions, and economic security during retirement, the HRS targeted U.S. adults who were born between 1931 and 1941.¹⁶ The HRS sample is selected under a multi-stage area probability sample design, including random selection of respondents from households. Blacks and Hispanics were oversampled. In 1992, in-home interviews were conducted in English or Spanish in 7,702 households (82.0% response rate), yielding 12,652 participants. Vital status was determined through the National Death Index and household contacts. This analysis was limited to 9,824 participants aged 51–61 years. The “other races” group was heterogeneous, and participants in this category (97 men and 106 women) were dropped, leaving a total of 9,621 participants for analyses. The study received approval from the Institutional Review Board of Northwestern University.

Physical Activity Measurement

LTPA was assessed with 2 questions: “How often do you participate in light physical activity, such as walking, dancing, gardening, golfing, or bowling, etc.,” and “How often do you participate in vigorous exercise or sports, such as aerobics,

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running, swimming, or bicycling?" Heavy housework was determined by asking: "How often do you do heavy housework like scrubbing floors or washing windows?" There were 5 response options for the frequency: "never," "less than once per month," "1–3 times per month," "1–2 times per week," or "≥ 3 times per week."

Self-reported job-related activity was determined based on participants' response to the question: "My job requires lots of physical effort, such as lifting heavy loads, stooping, kneeling, or crouching." The response options were "all or almost all of the time," "most of the time," "some of the time," and "none or almost none of the time." Participants who responded "non-employed" were assigned to the "none or almost none of the time" category.

The responses for light and vigorous LTPA were used to create an LTPA scale. Based on the average times/month that a person performed vigorous exercise, the activity points were assigned as, 0: "never or less than once/month," 2: "1–3 times/month," 6: "1–2 times/week," and 12: "≥ 3 times/week." For light activities, we assigned values one half those for vigorous exercise (i.e., 0, 1, 3, and 6, respectively). The LTPA scale was calculated as the sum of the points for light and vigorous activities.

For heavy housework, the same point system as that of vigorous LTPA was used (0, 2, 6, and 12, respectively). For job-related activities, the points were assigned as, 0: "none or almost none of the time," 2: "some of the time," 6: "most of the time," and 12: "all or almost all of the time." This point scale equates performing strenuous job-related activities "all or almost all of the time" with performing vigorous LTPA "≥ 3 times/week." The WRPA scale was calculated as the sum of the points for housework and job-related activities. The TPA scale was calculated as the sum of exercise points for light, vigorous, household, and job-related activities.

Race, Ethnicity, and Socioeconomic Measures

Race and ethnicity were classified based on participants' responses to the questions 1) "Do you consider yourself Hispanic or Latino?" 2) "Do you consider yourself primarily white or Caucasian, Black or African American, American Indian, or Asian?" and 3) interviewer's records of whether the interview was conducted in English or Spanish. Because the "other races" category was dropped, the final categories were white (non-Hispanic), black (non-Hispanic), Hispanic (English as preferred language), and Hispanic (Spanish as preferred language).

Socioeconomic measures included education and income. Education was determined by the years of school completed, grouped as 0–8 years, 9–11 years, high school graduates (12 years), and some college or higher (greater than 12 years). Income was defined with the use of 1991 income-to-needs ratio. The 1991 income-to-needs ratio was total household income divided by the 1991 Federal Poverty Guideline for the participant's household size.¹⁷ This income variable was categorized as less than 149%, 150%–299%, 300%–499%, and equal or greater than 500% of the federal poverty level.

Health Indicators

Health indicators included body mass index (BMI), overall health, and physical functioning. The BMI was calculated as

the weight in kilograms divided by the square of height in meters. Overall health was measured with a single question that asked respondents to rate their health status on a Likert scale (poor, fair, good, very good, and excellent). Physical difficulties were assessed with 4 mobility questions,¹⁸ which assessed whether a participant reported any degree of difficulty (yes/no) walking several blocks, walking one block, climbing one flight of stairs without resting, and climbing several flights of stairs without resting. The mobility scale ranged from 0 to 4, with higher scores indicating more difficulties walking and climbing stairs.

Statistical Analysis

All analyses were conducted separately for men and women with the use of Stata version 8 (Stata Corporation, College Station, TX) and were adjusted for the complex survey design and for person-level analytic weights. Levels of LTPA, WRPA, and TPA were compared by race/ethnicity and education using the Wald test for continuous variables and the Pearson χ^2 statistic for categorical variables. To determine the independent relationships between race, ethnicity, SES, and physical activity, multivariate analyses were conducted with LTPA, WRPA, and TPA scores as the dependent variables. In addition to race/ethnicity and education, other covariates included age, BMI, overall health, and mobility difficulties. Because some HRS participants were employed part-time, we also recalculated the WRPA and TPA with adjustment for hours worked per week (i.e., multiplied WRPA by participants' self-reported hours of work per week divided by 40). To determine whether part of the effect of education was mediated by differences in income, we also repeated the multivariate models of LTPA with income included as a covariate. All *P* values were calculated using two-sided tests, and a *P* value of .05 or less was used to determine statistical significance.

RESULTS

Table 1 presents characteristics of the study population. Among men, the mean age was 56 years, 84.7% were white, and over three fourths had high school education or above. Over half were in very good or excellent health, 21.0% were obese (BMI ≥ 30 kg/m²), and the mean number of mobility difficulties was 0.8. Most men participated in light LTPA at least once a week, and over half reported doing light LTPA 3 or more times per week. However, only 26.8% reported performing vigorous LTPA at least once a week. Most men (68.1%) reported doing heavy household chores less than once a month or never, while 31.7% said they did strenuously physical work at their job most or all of the time. The demographics and health status of women were similar to men, although women were less likely than men to have greater than 12 years of education (34.1% vs 42.6% for men; *P* < .01), and they reported more mobility difficulties (1.2 ± 0.03 vs 0.8 ± 0.02 for men; *P* < .01). Patterns of light LTPA were similar for women compared to men, but women were more likely to say they never did "vigorous" LTPA (52.3% vs 43.1%; *P* < .01). Most women reported doing heavy household chores at least several times per month, which was far more than men (*P* < .01). Conversely, women reported doing vigorous job-related physical activities less often than men (Table 1; *P* < .01), although 22.8% women said they did vigorous job-related activities most or all of the

Table 1. Characteristics of the Participants in the Study Cohort of 9,621 Men and Women*

Characteristics	Men (N=4,505)	Women (N=5,116)
Mean age, y (SE)	56.0 (0.05)	56.0 (0.04)
Race/ethnicity, %		
White/other	84.7	83.1
Black	9.2	10.7
Hispanic (English-speaking)	3.6	3.5
Hispanic (Spanish-speaking)	2.5	2.8
Education, y (%) [†]		
0–8	11.4	8.7
9–11	12.9	16.6
12	33.1	40.6
> 12	42.6	34.1
Self-reported overall health, % [‡]		
Excellent	24.5	22.9
Very good	28.9	30.2
Good	27.6	25.8
Fair	11.7	13.9
Poor	7.3	7.3
Mean body mass index, kg/m ² (SE) [†]	27.2 (0.07)	26.8 (0.10)
Mean no. of mobility difficulties (SE) [†]	0.8 (0.02)	1.2 (0.03)
Physical activities		
Light leisure-time activity, % [‡]		
Never	9.4	9.5
< 1/month	6.3	8.0
1–3/month	7.9	9.5
1–2/week	20.6	22.4
≥ 3/week	55.8	50.6
Vigorous leisure-time exercise, % [‡]		
Never	43.1	52.3
< 1/month	20.5	19.4
1–3/month	9.6	7.7
1–2/week	10.7	9.7
≥ 3/week	16.1	10.9
Heavy household chores, % [‡]		
Never	39.0	13.2
< 1/month	29.1	23.1
1–3/month	15.5	26.2
1–2/week	11.6	27.9
≥ 3/week	4.8	9.6
Strenuous job-related activities, % [‡]		
Nonemployed	21.2	39.5
None or almost none of the time	24.3	20.6
Some of the time	22.9	17.3
Most of the time	14.6	10.7
All or almost all of the time	17.1	12.1
Physical activity scales [‡]		
Mean leisure-time physical activity (SE) [†]	6.8 (0.1)	5.8 (0.1)
Mean work-related physical activity (SE) [†]	5.0 (0.1)	5.8 (0.1)
Mean total physical activity (SE)	11.8 (0.2)	11.6 (0.2)

*Data were adjusted for the complex design of the survey and for the person-level analytic weights. Numbers may not add up to 100% due to rounding.

[†] $P < .05$ for the comparisons between men and women.

[‡]Physical activity scales ranged from 0 to 18 for leisure-time, 0 to 24 for work-related, and 0 to 42 for total physical activities, with higher scores indicating higher levels of physical activity.

SE, standard error.

time. Despite these differences between men and women, mean scores for TPA were similar (11.8 ± 0.2 for men and 11.6 ± 0.2 for women).

Among men, blacks and Hispanics were more likely than whites to report never doing light or vigorous LTPA (Table 2). The rates of never performing heavy housework ranged from 38.2% in whites to 51.6% in Spanish-speaking Hispanics, although Spanish-speaking Hispanic men had the highest rate of reporting doing heavy household chores 1 to 2 times per

week or more. Hispanics and blacks were more likely than whites to report performing strenuous job-related physical activities all of the time, with the highest rates among Spanish-speaking Hispanics. The mean LTPA scale was highest in whites, and lowest in Spanish-speaking Hispanics. The means for WRPA showed the opposite trends, being lowest in whites and highest in Spanish-speaking Hispanics. As a result of these countervailing trends, TPA scores were very similar across the 4 groups, although English-speaking Hispanic men had a slightly higher mean TPA score.

Among women, Spanish-speaking Hispanics and blacks had lower levels of light or vigorous LTPA compared to whites (Table 2). In addition, Spanish-speaking Hispanics were far more likely than whites to say they never performed vigorous LTPA (87.3% vs 48.6%, respectively; $P < .01$). The proportion of women who said they did heavy housework ≥ 3 times per week was lowest for whites (8.6%) and highest for Spanish-speaking Hispanics (27.7%; $P < .01$ for trend across groups). Black women were the most likely to report job-related physical activity, and Spanish-speaking Hispanic women were the least likely. Blacks were also most likely to report doing strenuous job-related physical activities all of the time (17.0%), followed by Spanish-speaking Hispanics (15.1%); however, the differences were small compared to English-speaking Hispanics (12.4%) and whites (11.3%). The mean for the LTPA scale was lowest for Spanish-speaking Hispanics and second lowest for blacks. Conversely, the mean for the WRPA scale was highest in Spanish-speaking Hispanics and second highest for blacks. As was the case for men, the means for the TPA scale were similar across the racial/ethnic groups.

Educational attainment showed a very strong relationship to both light and vigorous LTPA for men (Table 3). The relationship between education and heavy household chores was weaker. The proportion of men who said they “never” did heavy household chores declined with increasing education, although the proportion that averaged doing heavy chores more than once a week was similar across the education categories. The proportion of men who reported doing no strenuous job-related physical activity was higher among those with 12 or more years of school; the proportion of men who reported doing strenuous job-related activities most or all of the time declined from 49.2% among those with 0–8 years of school to 16.3% among those with 12 or more years of school ($P < .01$ for trend). These opposite relationships between education and LTPA compared to education and WRPA were seen even more clearly for the physical activity scales. As a result, the total physical activity was similar across educational subgroups.

Educational attainment also showed a very strong relationship to both light and vigorous LTPA for women (Table 3; P for trend $< .01$ for both). Among women, the proportion that averagely doing heavy chores more than once a week declined dramatically with education from 49.7% among those with 0–8 years of school down to 29.4% among those with more than 12 years of school (P for trend $< .01$). The relationship between education and strenuous job-related activities was more complicated. Women with 0–8 years of school were the least likely to have some strenuous job-related activities, mostly due to their higher rate of being unemployed ($P < .01$ compared to the other groups). Women with 9–11 years of school were the most likely to be employed in a job requiring strenuous job-related activities most or all of the time (33.1%; $P < .01$ compared to the other groups). As a result of the opposite trends for LTPA and

Table 2. Levels of Physical Activity by Race/Ethnicity*

Levels of Physical Activity	Race/Ethnicity: Men				Race/Ethnicity: Women			
	White	Black	Hispanic (English)	Hispanic (Spanish)	White	Black	Hispanic (English)	Hispanic (Spanish)
N	3,390	705	231	179	3,640	974	266	236
Leisure-time physical activity, %								
Light activity [†]	Ref	<i>P</i> < .01	<i>P</i> = .01	<i>P</i> < .01	Ref	<i>P</i> < .01	<i>P</i> = .28	<i>P</i> < .01
Never	8.3	14.6	13.3	22.7	8.0	17.7	9.9	22.2
< 1/month	6.4	6.0	5.1	6.3	7.9	9.0	8.7	6.4
1–3/month	7.8	7.6	9.3	10.5	9.5	8.8	10.9	8.1
1–2/week	21.0	18.4	20.8	14.2	22.8	20.0	24.5	17.0
≥ 3/week	56.6	53.4	51.5	46.4	51.7	44.5	46.1	46.3
Vigorous exercise [†]	Ref	<i>P</i> < .01	<i>P</i> < .01	<i>P</i> < .01	Ref	<i>P</i> < .01	<i>P</i> < .01	<i>P</i> < .01
Never	40.5	54.1	53.6	74.2	48.6	68.9	61.2	87.3
< 1/month	21.7	15.8	13.9	7.6	20.9	13.5	15.2	3.0
1–3/month	10.3	7.4	5.9	2.4	8.3	4.4	8.0	1.1
1–2/week	11.2	9.3	6.4	6.7	10.4	6.9	7.4	5.4
≥ 3/week	16.5	13.5	20.3	9.1	11.9	6.3	8.1	3.4
Work-related physical activity, %								
Heavy household chores [‡]	Ref	<i>P</i> < .01	<i>P</i> = .02	<i>P</i> = .02	Ref	<i>P</i> < .01	<i>P</i> = .17	<i>P</i> < .01
Never	38.2	39.9	47.1	51.6	12.0	20.0	16.7	18.1
< 1/month	31.6	18.0	16.0	8.1	24.5	19.3	15.2	5.7
1–3/month	15.4	17.1	15.4	11.9	27.5	19.4	24.9	14.9
1–2/week	10.8	16.2	13.0	19.3	27.4	28.8	31.6	33.6
≥ 3/week	4.1	8.8	8.5	9.2	8.6	12.5	11.6	27.7
Strenuous job-related activities [‡]	Ref	<i>P</i> = .13	<i>P</i> = .01	<i>P</i> < .01	Ref	<i>P</i> < .01	<i>P</i> = .59	<i>P</i> = .81
Nonemployed	19.2	34.2	28.9	30.9	38.2	39.7	45.4	69.1
None or almost none of the time	26.2	14.1	14.8	11.0	22.1	13.9	15.9	5.8
Some of the time	24.0	17.3	16.6	15.3	17.9	15.4	18.3	4.0
Most of the time	14.8	13.0	16.9	11.5	10.5	14.1	7.9	6.0
All or almost all of the time	15.9	21.3	22.7	31.3	11.3	17.0	12.4	15.1
Physical activity scale [‡]								
Mean leisure-time physical activity (SE)	6.9 (0.1) [§]	6.2 (0.2)	6.7 (0.6)	4.9 (0.5) [¶]	6.1 (0.1)	4.6 (0.1)	5.2 (0.3) [#]	4.1 (0.2)
Mean work-related physical activity (SE)	4.7 (0.1)	6.1 (0.2)	6.2 (0.4)	7.3 (0.7)	5.6 (0.1) [§]	6.8 (0.2)	6.1 (0.4)	7.9 (0.4) [†]
Mean total physical activity (SE)	11.7 (0.2)	12.2 (0.4)	12.9 (0.8)	12.1 (1.0)	11.7 (0.2)	11.4 (0.3)	11.3 (0.5)	12.0 (0.4)

*Data were adjusted for the complex design of the survey and for the person-level analytic weights.

[†]*P* values in pairwise comparisons to whites for never performing light leisure-time activity, never performing vigorous leisure-time activity, performing heavy household chores 3 or more times per week, and performing strenuous job-related physical activities most or all of the time.

[‡]Physical activity scales ranged from 0 to 18 for leisure-time, 0 to 24 for work-related, and 0 to 42 for total physical activities, with higher scores indicating higher levels of physical activity.

[§]*P* < .01 for the comparisons between whites and blacks.

^{||}*P* < .05 for the comparisons between whites and all others.

[¶]*P* < .05 for the comparisons between Hispanic (Spanish) and all others.

[#]*P* < .01 for the comparisons between Hispanic (English) and Hispanic (Spanish).

SE, standard error; Ref, reference group.

WRPA with respect to education, the mean scores on the TPA scale were similar across the education categories. Nevertheless, the mean scores on the TPA scale were lower for women with 0 to 8 years of school, and the test for this trend was borderline significant.

In multivariate analyses for men, the adjusted mean LTPA score for Spanish-speaking Hispanic men was only 0.7 (95% confidence interval [CI], –1.7 to 0.3) points lower than for white men, and scores for blacks and English-speaking Hispanics were almost identical to whites (Table 4). Thus, the large unadjusted differences in LTPA across the racial/ethnic groups (Table 2) were almost completely explained by differences in health status and education. Adjusted mean LTPA scores were markedly lower among individuals with less education. When income was added to the multivariate models, income less than 500% of the federal poverty level was independently associated with slightly lower levels of LTPA (beta coefficients ranging from –0.6 to –0.8 for the 3 income categories below 500%), and the beta coefficients for education were somewhat attenuated (data not shown). For WRPA, ad-

justed mean scores were slightly higher for blacks (1.0; 95% CI, 0.5 to 1.6), English-speaking Hispanics (1.2; 95% CI, 0.5 to 1.9), and Spanish-speaking Hispanics (1.1; 95% CI, –0.1 to 2.3). Adjusted mean WRPA scores were markedly higher among individuals with less education. For TPA, adjusted mean scores were higher for blacks (1.1; 95% CI, 0.4 to 1.8) and English-speaking Hispanics (1.5; 95% CI, –0.1 to 3.0). The adjusted mean TPA score was lower for those with more than 12 years of education compared to all other groups.

In the multivariate models for women (Table 5), blacks and Spanish-speaking Hispanics had lower mean scores for LTPA compared to whites, but they also had higher adjusted mean scores for WRPA. As a result, TPA was higher in blacks and Spanish-speaking Hispanics compared with whites. English-speaking Hispanics had lower mean LTPA scores, but similar WRPA and TPA scores as compared with whites. Lower educational attainment was strongly associated with lower mean LTPA scores and higher mean scores for WRPA. TPA was higher among the group of women with 9 to 11 years of edu-

Table 3. Levels of Physical Activity by Educational Attainment*

Levels of Physical Activity	Men				Women			
Years in school	0-8	9-11	12	>12	0-8	9-11	12	>12
N	643	629	1,467	1,766	603	943	2,009	1,561
Leisure-time physical activity, %								
Light activity [†]	<i>P</i> < .01	<i>P</i> < .01	<i>P</i> = .05	Ref	<i>P</i> < .01	<i>P</i> < .01	<i>P</i> = .05	Ref
Never	21.1	13.8	8.0	6.0	22.0	14.2	8.4	5.4
<1/month	5.7	9.4	7.2	4.9	7.9	9.7	8.8	6.4
1-3/month	9.1	7.5	8.0	7.7	6.2	9.7	11.0	8.4
1-2/week	16.0	16.9	22.2	21.6	21.5	20.0	23.6	22.5
≥3/week	48.2	52.4	54.6	59.8	42.4	46.5	48.3	57.4
Vigorous exercise [‡]	<i>P</i> < .01	<i>P</i> < .01	<i>P</i> < .01	Ref	<i>P</i> < .01	<i>P</i> < .01	<i>P</i> < .01	Ref
Never	72.4	57.8	44.8	29.3	84.7	64.5	52.8	37.5
<1/month	9.0	18.5	22.0	23.0	5.7	15.9	20.2	23.6
1-3/month	3.9	5.2	10.2	12.1	1.6	5.5	8.0	9.9
1-2/week	6.7	7.5	9.4	13.8	3.6	7.6	9.2	13.0
≥3/week	8.1	11.0	13.6	21.8	4.5	6.5	9.8	16.0
Work-related physical activity, %								
Heavy household chores [‡]	<i>P</i> < .01	<i>P</i> = .02	<i>P</i> = .03	Ref	<i>P</i> < .01	<i>P</i> = .02	<i>P</i> = .03	Ref
Never	55.2	45.7	39.0	32.7	18.8	13.9	10.1	15.0
<1/month	19.5	22.5	29.8	33.2	14.7	19.4	22.8	27.5
1-3/month	7.2	13.6	14.8	18.8	16.7	20.2	29.2	28.0
1-2/week	11.5	12.2	11.2	11.7	30.6	30.4	29.2	24.4
≥3/week	6.7	6.0	5.2	3.6	19.1	16.1	8.8	5.0
Strenuous job-related activities [‡]	<i>P</i> < .01	<i>P</i> < .01	<i>P</i> < .01	Ref	<i>P</i> < .01	<i>P</i> < .01	<i>P</i> < .01	Ref
Nonemployed	35.0	26.6	21.2	15.9	65.3	47.6	39.7	28.6
None or almost none of the time	7.4	8.9	14.0	41.5	5.3	7.4	22.2	28.9
Some of the time	10.4	18.4	24.3	26.4	5.9	11.9	16.6	23.6
Most of the time	19.2	21.7	19.2	7.7	8.4	13.0	11.2	9.5
All or almost all of the time	30.0	24.5	21.3	8.6	15.1	20.1	10.3	9.5
Physical activity scale [‡]								
Mean leisure-time physical activity (SE)	4.9 (0.2) [§]	5.6 (0.2) [¶]	6.4 (0.2)	8.0 (0.2)	4.0 (0.2) [§]	4.8 (0.2) [¶]	5.6 (0.2)	7.1 (0.2)
Mean work-related physical activity (SE)	6.3 (0.4)	6.3 (0.2)	5.8 (0.1)	3.5 (0.1)	6.9 (0.3)	7.6 (0.3)	5.6 (0.2) [#]	4.8 (0.2)
Mean total physical activity (SE)	11.3 (0.5)	11.9 (0.3)	12.2 (0.2) ^{**}	11.5 (0.2)	10.9 (0.4)	12.4 (0.3) [¶]	11.2 (0.3)	11.9 (0.3)

*Data were adjusted for the complex design of the survey and for the person-level analytic weights.

[†]*P* values in pairwise comparisons to persons with more than 12 years of school for never performing light or vigorous leisure-time physical activity, performing heavy household chores 3 or more times per week, and strenuous job-related physical activities most or all of the time.

[‡]Physical activity scales ranged from 0 to 18 for leisure-time, 0 to 24 for work-related, and 0 to 42 for total physical activities, with higher scores indicating higher levels of physical activity.

[§]*P* < .05 for the comparisons between 0 and 8 years of school and all other groups.

^{||}*P* < .01 for the comparisons between more than 12 years of school and all other groups.

[¶]*P* < .01 for the comparisons between 9-11 years of school and 0-8 or 12 years of school.

[#]*P* < .01 for the comparisons between 12 years of school and 0-8 or 9-11 years of school.

^{**}*P* < .05 for the comparisons between 12 years of school and more than 12 years of school.

SE, standard error; Ref, reference group.

cation compared to women with more than 12 years of school. Income was not associated with LTPA for women. Additional adjusting the WRPA for the average number of hours worked per week did not change our conclusions.

DISCUSSION

Among this cohort of U.S. adults, most of the racial and ethnic differences in leisure activities were explained by the worse health and lower educational attainment of blacks and Hispanics compared to whites. Black women and Spanish-speaking Hispanic men and women had moderately lower adjusted rates of LTPA in multivariate analyses. In contrast, a strong inverse relationship between education and LTPA remained even after adjusting for differences in health. Thus, education and health status are the dominant determinants of LTPA, not race and ethnicity.

In contrast, WRPA (including strenuous job-related activities and household chores) showed the opposite relationship to race/ethnicity and education compared to LTPA. Nonwhites had higher adjusted rates of WRPA compared to whites. Nev-

ertheless, education was the most important determinant of WRPA, surpassing race/ethnicity, self-reported overall health, and mobility difficulties. As a result of the high rates of WRPA among individuals with less education, mean TPA scores were similar across racial, ethnic, and educational categories. The slightly lower mean TPA scores for women with 0 to 8 years of school is due to this group's lower rate of employment, which is a potential bias. While unemployed women might voluntarily work for their churches or children's schools, this may not be perceived as physical activity because of its spiritual or educational nature. Future studies of total physical activity may need to expand the scope of questions, or they may need to rely upon direct measurements.

Our findings are consistent with the few previous studies that have simultaneously examined leisure and nonleisure activities. Surveys of 30- to 59-year-olds in eastern Finland (1972-1997, every 5 years) showed that the percentage of people who were sedentary during leisure time decreased, while those with low occupational activity and low commuting activity increased.¹⁹ The main reason for these trends was the change in the profile of work in Finland.^{19,20} A study of men

Table 4. Multivariate Models of Leisure-time, Work-related, and Total Physical Activity in Men*

Regression Coefficients (95% CI)	Leisure-time Physical Activity	Work-related Physical Activity	Total Physical Activity
Age, per 10-year increment	0.1 (−0.4 to 0.6)	−0.8 (−1.3 to −0.3) [‡]	−0.7 (−1.5 to 0.1)
Race/ethnicity			
White	Ref	Ref	Ref
Black	0.1 (−0.4 to 0.5)	1.0 (0.5 to 1.6) [‡]	1.1 (0.4 to 1.8) [‡]
Hispanic (English)	0.3 (−0.8 to 1.4)	1.2 (0.5 to 1.9) [‡]	1.5 (−0.1 to 3.0) [‡]
Hispanic (Spanish)	−0.7 (−1.7 to 0.3)	1.1 (−0.1 to 2.3)	0.4 (−1.3 to 2.0)
Education, y			
> 12	Ref	Ref	Ref
12	−1.1 (−1.5 to −0.7) [‡]	2.5 (2.2 to 2.8) [‡]	1.4 (0.9 to 2.0) [‡]
9–11	−1.4 (−1.9 to −1.0) [‡]	3.4 (2.8 to 3.9) [‡]	1.9 (1.3 to 2.5) [‡]
0–8	−1.7 (−2.3 to −1.2) [‡]	3.6 (2.9 to 4.3) [‡]	1.9 (1.0 to 2.8) [‡]
Self-reported health			
Excellent	Ref	Ref	Ref
Very good	−1.5 (−1.9 to −1.1) [‡]	−0.3 (−0.7 to 0.2)	−1.8 (−2.5 to −1.1) [‡]
Good	−1.7 (−2.1 to −1.2) [‡]	−0.1 (−0.6 to 0.4)	−1.7 (−2.4 to −0.9) [‡]
Fair	−1.4 (−2.1 to −0.8) [‡]	−0.7 (−1.6 to 0.1)	−2.2 (−3.1 to −1.2) [‡]
Poor	−1.5 (−2.2 to −0.7) [‡]	−2.6 (−3.3 to −1.9) [‡]	−4.1 (−5.2 to −3.0) [‡]
BMI, per 10 kg/m ² increment	−0.9 (−1.3 to −0.6) [‡]	−0.2 (−0.6 to 0.2)	−1.1 (−1.8 to −0.5) [‡]
Mobility difficulties			
0	Ref	Ref	Ref
1	−2.0 (−2.4 to −1.6) [‡]	−0.6 (−1.0 to −0.2) [‡]	−2.6 (−3.2 to −2.0) [‡]
2	−2.9 (−3.6 to −2.3) [‡]	−0.4 (−1.2 to 0.4)	−3.3 (−4.3 to −2.4) [‡]
3	−3.5 (−4.2 to −2.7) [‡]	−2.4 (−3.1 to −1.6) [‡]	−5.8 (−6.9 to −4.7) [‡]
4	−4.8 (−5.3 to −4.3) [‡]	−3.1 (−3.8 to −2.4) [‡]	−7.9 (−8.9 to −6.9) [‡]

*Data were adjusted for the complex design of the survey and for the person-level analytic weights. All models included age, race/ethnicity, education, BMI, health status, and number of mobility difficulties.

[‡]P < .05.

[‡]P < .01.

CI, confidence interval; BMI, body mass index; Ref, reference group.

in Sweden found that those with higher education tended to have more sedentary jobs.²¹ Another study conducted by the National Heart Foundation of Australia found that differences in LTPA between occupational groups were diminished in men

after including job and home activities, although the differences for women did not change.²² Thus, the findings from analyses of TPA yield markedly different conclusions than studies that examine LTPA. The perception that racial/ethnic

Table 5. Multivariate Models of Leisure-time, Work-related, and Total Physical Activity in Women*

Regression Coefficients (95% CI)	Leisure-time Physical Activity	Work-related Physical Activity	Total Physical Activity
Age, per 10-year increment	−0.5 (−1.0 to 0.1)	−0.8 (−1.4 to −0.3) [‡]	−1.3 (−0.2 to −0.6) [‡]
Race/ethnicity			
White	Ref	Ref	Ref
Black	−0.5 (−0.9 to −0.2) [‡]	1.3 (0.9 to 1.7) [‡]	0.7 (0.2 to 1.3) [‡]
Hispanic (English)	−0.2 (−1.0 to 0.5)	0.1 (−0.7 to 0.9)	−0.1 (−1.2 to 0.9)
Hispanic (Spanish)	−0.3 (−1.0 to 0.3)	1.9 (1.0 to 2.7) [‡]	1.5 (0.6 to 2.5) [‡]
Education, y			
> 12	Ref	Ref	Ref
12	−1.0 (−1.4 to −0.6) [‡]	1.2 (0.8 to 1.6) [‡]	0.2 (−0.5 to 0.9)
9–11	−1.2 (−1.7 to −0.7) [‡]	3.5 (2.9 to 4.1) [‡]	2.3 (1.5 to 3.1) [‡]
0–8	−1.5 (−2.2 to −0.8) [‡]	2.9 (2.2 to 3.6) [‡]	1.4 (0.3 to 2.5) [‡]
Self-reported health			
Excellent	Ref	Ref	Ref
Very good	−0.9 (−1.5 to −0.4) [‡]	−0.3 (−0.8 to 0.3)	−1.2 (−2.0 to −0.3) [‡]
Good	−1.0 (−1.5 to −0.6) [‡]	0.5 (−0.2 to 1.1)	−0.6 (−1.0 to 0.2)
Fair	−1.1 (−1.6 to −0.6) [‡]	−0.3 (−1.1 to 0.4)	−1.4 (−2.2 to −0.6) [‡]
Poor	−0.9 (−1.5 to −0.3) [‡]	−2.2 (−3.0 to −1.4) [‡]	−3.1 (−4.3 to −2.0) [‡]
BMI, per 10 kg/m ² increment	−0.5 (−0.7 to −0.2) [‡]	−0.1 (−0.5 to 0.2)	−0.6 (−1.0 to −0.2) [‡]
Mobility difficulties			
0	Ref	Ref	Ref
1	−1.7 (−2.1 to −1.4) [‡]	−0.8 (−1.3 to −0.3) [‡]	−2.5 (−3.1 to −1.8) [‡]
2	−2.4 (−2.9 to −1.9) [‡]	−2.0 (−2.6 to −1.4) [‡]	−4.4 (−5.2 to −3.6) [‡]
3	−2.8 (−3.4 to −2.2) [‡]	−2.0 (−2.9 to −1.2) [‡]	−4.8 (−6.0 to −3.7) [‡]
4	−4.1 (−4.5 to −3.6) [‡]	−3.6 (−4.3 to −2.8) [‡]	−7.7 (−8.5 to −6.8) [‡]

*Data were adjusted for the complex design of the survey and for the person-level analytic weights. All models included age, race/ethnicity, education, BMI, health status, and number of mobility difficulties.

[‡]P < .05.

[‡]P < .01.

CI, confidence interval; BMI, body mass index; Ref, reference group.

minorities and the less educated are more sedentary may be spurious merely because the studies have focused predominantly on LTPA. Education appears to be a more important predictor of the *type* of physical activities someone performs than the *total amount* of physical activity performed. It may be difficult to motivate individuals who are physically active in their job to increase their LTPA for reducing their future risk of adverse health outcomes.

There are several limitations of this study. First, although our models assumed that health status affected physical activity, it is also possible that physical activity affected self-reported overall health. For example, someone who does not exercise regularly may rate his or her health lower because of awareness that a sedentary lifestyle increases the risk for many diseases. If this occurs, it is likely to be far less important than the negative effect of pain or physical limitations on the ability to exercise comfortably. Second, physical activity was self-reported in the HRS. Previous studies of the validity of self-report suggest that reliability depends on factors such as the questionnaire used, participants' age, and the type, duration, and intensity of activities measured.²³⁻²⁵ In addition, the validity of self-report could vary according to race/ethnicity, language, education, and health status.²⁶⁻²⁸

The validity of the HRS physical activity questions has not been assessed by comparison to direct measurement of physical activity. However, the LTPA questions are similar to questions used in other validated measures. In addition, the construct validity and the predictive validity of the LTPA questions appear good: we have previously reported that people who are overweight and obese performed less LTPA, and individuals who performed more LTPA were less likely to have a decline in overall health and physical functioning.¹² The validity of self-reported WRPA is less clear, and this is an important area for future research. The lack of an association between WRPA and health outcomes may be due to imprecise measurement of WRPA or from some physiologic difference between WRPA and LTPA. Finally, the point system we used to calculate TPA from LTPA and WRPA is best viewed as an estimate. For example, we equated performing vigorous job-related activities "all or almost all of the time" with performing vigorous LTPA "three or more times per week." We conducted sensitivity analyses to assess the influence of this and found that our conclusions did not change when we accounted for the number of hours worked per week.

These findings have important implications for understanding health disparities. The salutary effects of exercise appear to vary depending upon the type of physical activity. Population studies have shown that LTPA is a predictor of coronary heart disease,²⁹⁻³⁶ overall health, and physical functioning.¹² However, it has not been clearly shown that higher levels of WRPA lead to better health.^{10,37,38} Thus, lower levels of LTPA among the less educated help explain socioeconomic disparities in health, as well as health disparities for blacks and Latinos as a result of the lower educational attainment among these groups. Because of their higher rates of WRPA, we should reexamine the prevailing notion that the less educated are more sedentary. It may be more that the type of exercise that they do is problematic rather than their total amount of exercise. Public health efforts to promote greater physical activity may need to overcome individuals' perceptions that the activities they do at their job and around the house are adequate to maintain their health. Additional studies are also

needed to understand whether WRPA truly does not lead to better health outcomes and the reasons for any differences.

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