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# Retirement and Physical Activity

## Analyses by Occupation and Wealth

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**Background:** Older adults close to retirement age show the lowest level of physical activity. Changes in lifestyle with retirement may alter physical activity levels. This study investigated whether retirement changes physical activity and how the effect differs by occupation type and wealth level.

**Methods:** This longitudinal study used the Health and Retirement Study (1996–2002), U.S. population-based data. Analyses were conducted in 2007 and 2008. Physical activity was measured by a composite indicator of participation in either work-related or leisure-time physical activity. Fixed-effects regression models were used to account for confounders and unobserved heterogeneity. The dependent variable was a composite indicator of participation in regular physical activity either at work or during nonworking hours.

**Results:** Physical activity decreased with retirement from a physically demanding job but increased with retirement from a sedentary job. Occupation type interacted with wealth level, with the negative impact on physical activity of retirement exacerbated by lack of wealth and the positive effect of retirement on physical activity enhanced by wealth.

**Conclusions:** Substantial differences in the effect of retirement on physical activity occurred across subgroups. As the number of people approaching retirement age rapidly increases, findings suggest that a growing segment of the nation's population may not sustain an adequate level of physical activity.

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### Introduction

Physical activity has a large number of important effects on adult health, yet 60% of older American adults are physically inactive.<sup>1–10</sup> Because a large percentage of adults live 20 years or more after retirement, it is important to understand how retirement affects physical activity.

Retirement may provide both opportunities and barriers for maintaining recommended levels of physical activity. Retired people may have more time to allocate to leisure activities such as walking and sports participation. However, reduced disposable income and the loss of social contact may prohibit retirees from participating in some leisure and social activities that are largely physical in nature.<sup>11</sup> The overall direction of change in physical activity level with retirement is ambiguous a priori.

Another complicating issue in predicting the effect of retirement on physical activity relates to the varying levels of physical demand across pre-retirement occupations. The potential positive effect of retirement due to increased leisure time may be reduced or reversed for retirees from physically demanding occupations. For these people, work-related activities may have required higher levels of physical demand than leisure-time physical activities, and thus retirement potentially reduces the overall physical activity level.

Wealth level may also interact with the effect of retirement on physical activity in multiple ways. People who have higher wage rates and are likely to be wealthier may experience a substantial decline in opportunity cost of time with retirement, and thus may be more motivated to engage in physical activity after retirement. Wealthier people also have more financial resources to support leisure activities after retirement.<sup>12</sup> Conversely, a lack of wealth could limit participation in physical activities that were deemed unaffordable.

To date, surprisingly few studies have investigated the effect of retirement on physical activity, and none have examined how the effect differs by occupation type and wealth level. Findings of three previous studies<sup>13–15</sup> are inconclusive. One analysis<sup>13</sup> that used cross-sectional data from a United Kingdom study of white-collar

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workers found that leisure-time physical activity decreased as working hours increased. Another study,<sup>14</sup> conducted longitudinally in four communities in the U.S. with a 6-year follow-up, showed an increase in exercise participation among people who were not continuously employed during the follow-up compared to those who were continuously employed. A study<sup>15</sup> conducted in the Netherlands used longitudinal data with a 13-year follow-up and reported mixed findings, concluding that retirement reduced physical activity from work-related active transportation but increased leisure-time physical activity. It is not clear, however, whether the inconsistent findings arise from the different sample representations or from varying definitions of physical activity and retirement.

To further explore the effect of retirement on participation in physical activity, this study addressed the gap in the literature in several ways. First, physical activity in this study encompassed both work-related and leisure-time physical activities. Moderate activities, including occupation activity and housework, make up the largest part of daily activities<sup>16</sup> and produce health benefits such as improved functional ability, particularly among older adults.<sup>17–19</sup> Second, the definition of retirement in this study was based on current working hours and did not rely on self-defined retirement status. Third, a longitudinal survey was used that tracked individuals every 2 years and collected comprehensive health and economic information. The data allowed adjustment for confounding factors and individual heterogeneity that are potentially associated with retirement and physical activity. Fourth, the study sample was nationally representative and consisted of people near retirement age during the last decade. Thus, the findings of this study can be generalized to the national level and can inform policy affecting Baby Boomers reaching retirement age. Finally, the effect of retirement was allowed to vary across groups—rather than treating as homogeneous diverse groups with varying occupation types and wealth level—to identify the highest-priority population for public health interventions.

## Methods

### Data

Data came from the Health and Retirement Study (HRS), a nationally representative panel survey of older adults that was launched in 1992. The HRS sample used in the present study represents birth cohorts from 1931 to 1947. The baseline interview was conducted in the home; follow-up interviews were conducted every 2 years, mostly by phone. Baseline response rates were approximately 80%, and re-interview participation rates were 92%–95%. The data are publicly available through the HRS website ([hrsonline.isr.umich.edu](http://hrsonline.isr.umich.edu)).

This study used observations from Waves 3–6 (1996–2002) in which the wording of the question eliciting information on

physical activity was exactly the same ( $n=42,140$  interview observations from 12,582 individuals). The analysis was conducted in 2007 and 2008. Because the physical activity question was substantially changed beginning in 2004, later waves were not used.

Exclusions consisted of people who defined themselves as homemakers or who had not worked for more than 1 year at baseline ( $n=6869$  interview observations; 815 individuals) and people who were currently not working but were looking for a job ( $n=1252$  interview observations; 298 individuals), leaving 34,019 observations from 11,469 individuals for analysis. These exclusions were necessary because the objective was to identify the effect of retirement from work rather than the effect of not working for any reason. The potential misclassification problem of some retirees reporting themselves as homemakers was explored by also combining *homemakers* into the *retired* category. To examine the potential impact of classification error, another model that combined the *homemakers* and *retired* categories was examined; this model produced a result similar to the sample without homemakers. The HRS used rigorous cross-wave validations and imputation methods for income and wealth information, so no further exclusions were needed because of incomplete data on covariates.

Among the 11,469 people in the analysis sample, 13% ( $n=1534$ ) were lost to follow-up. Although these people were less likely to be retired at baseline, they did not differ in the likelihood of physical activity compared to those who participated in all follow-up interviews, after adjusting for demographic factors and health conditions. Thus, bias is unlikely in the estimates from attrition.

### Variables

Physical activity was measured by a dichotomous variable based on this question: *On average over the last 12 months, have you participated in vigorous physical activity or exercise 3 times a week or more? By vigorous physical activity, we mean things like sports, heavy housework, or a job that involves physical labor.*

Working status was dichotomized as either retired or working for each wave-specific observation. *Retired* included those who were currently not working for pay and defined themselves as retired. Because the analysis sample excluded observations for which working status could not be categorized as either retired or working (e.g., homemakers, people looking for a job), the referent was a homogenous group of current workers. This definition allowed for a reversible retirement status. In the study sample, a subsequent interview determined that 710 (7%) participants had returned to the workforce after retirement during the study period (1996–2002). A significant shift occurred from working status into retired status during the study period: At baseline, 30% of the sample was retired, compared to 43% at the latest interview.

Individuals in the HRS reported separately their job title and type of work for both the current occupation and the previous longest occupation. Based on this information, a representative occupation type was assigned, based on the Standard Occupational Classification System.<sup>20</sup> Occupation types were classified as either sedentary or physically demanding. The classification was based primarily on the physical demands of either the current or the latest occupation type before retirement. If the respondent was not working, or if current occupation information was missing for the entire

study period, the previous longest occupation type was used for the classification. Occupations were classified according to the associated strength factor as defined in the Dictionary of Occupational Titles.<sup>21</sup> Using this system, the term *sedentary job* pertains to occupations with strength factors of sedentary or light, and the term *physically demanding job* pertains to occupations with strength factors of medium, heavy, or very heavy. Examples of occupation types classified as sedentary include *managerial specialty operation* and *clerical, administrative support*; examples of physically demanding occupations include *food preparation service* and *mechanics and repair*. An alternative approach based on the self-reported physical demands of the occupation was not used in classifying occupation types because the self-reported physical demands of jobs could be highly subjective and might reflect individuals' preferences for physical activity rather than providing an objective measure of occupation-specific physical demands.

Two categories of wealth level were created using the median of household wealth at baseline as a cutoff. Household wealth included equity in primary housing, other non-financial assets, and financial wealth. Survey weights were used in calculating the median.

To adjust for health problems that may affect the decision to retire<sup>22,23</sup> as well as the level of physical activity, eight indicators of the most common health problems were included: hypertension; diabetes; cancer (excluding skin cancer); lung disease; arthritis; stroke; heart disease (heart attack, angina, or congestive heart disease); and limitation in an activity of daily living (ADL; bathing, eating, dressing, walking across a room, and getting in or out of bed). All health problems were self-reported and defined for each 2-year wave.

Variables indicating socioeconomic factors were defined as follows: Age in years was measured as a continuous variable. Four mutually exclusive categories of race/ethnicity (non-Hispanic white, black, Hispanic, and other race) were used. Two dummy variables were used for educational attainment, indicating either less than high school or some college, with the referent of high school graduation. Indicators of marital status included divorced or separated, widowed, and never married, with a referent of married. Total household income was included as a continuous variable.

## Analytic Methods

Multivariate regression analyses were conducted with the primary covariate of interest—retired—and other covariates representing health problems and relevant socioeconomic factors. To model participation in physical activity as an outcome, logistic and linear regressions were conducted. The two methods produced virtually the same results, so results from the linear regressions are reported for easier interpretation. Huber–White SEs with an adjustment for clustering on individuals were used for all regressions.

To select consistent estimates as well as the most efficient ones, ordinary least square (OLS) estimates and fixed-effects estimates were compared. Fixed-effects models used within-person variation over multiple periods of time for the estimation. Specifically, participation in physical activity at the current interview (*t*) was compared to the average physical activity of the person over multiple waves (1–*T*) to identify the effect of independent variables on changes in physical activity. The Hausman specification test<sup>24</sup> showed that fixed-effects models that account for unobserved individual heter-

ogeneity were preferred to OLS that uses only cross-sectional relationships ( $p < 0.001$ ). The fixed-effects regression results are reported hereafter.

The effect of retirement on physical activity by occupation type and wealth level was explored with subgroup analyses. To examine this, the sets of coefficients for the overall sample and for the subgroups were compared, using F-tests.<sup>25</sup> According to the F statistics, the equivalence of overall coefficients between the two occupation groups in the combined sample was rejected ( $p < 0.001$ ). Therefore, the subgroup analysis was preferred to a single regression using an interaction term of *retirement\*occupation type* in a combined sample. Similarly, subgroup analysis by wealth level was preferred to a combined sample analysis with an interaction term ( $p < 0.001$ ).

Because the regressions controlled for many factors, estimates with survey weights (not reported) were very similar to those reported here. All the analyses were conducted using the Stata statistical program, version 10.

## Results

### Sample Characteristics

The majority of the study participants were women (53%); non-Hispanic whites (74%); with high school or some college education (76%); and married (75%). The average age was 60 years, and the average household income was \$64,921 during the study period (Table 1). About one third (34%) of the observations were classified as retired. Among the observations with valid information on either current or previous longest occupation type ( $n = 33,099$ ; 97% of analysis sample), 54% of participants had jobs classified as sedentary, and 46% had jobs classified as physically demanding. Among the health conditions examined, almost half (49%) of the participants reported having arthritis. Hypertension (44%), heart disease (16%), and diabetes (14%) were also common health problems.

### Physical Activity by Working Status

On average, 50% of people participated in regular physical activity (Table 2). People who had worked or were working at physically demanding jobs were more likely to report participating in physical activity (54%) than those in sedentary jobs (48%). People with higher wealth were more likely to participate in physical activity (55%) than those with lower wealth (45%). All differences were significant ( $p < 0.01$ ).

There was also an interaction effect between occupation type and wealth level. Among those who had physically demanding jobs, people with higher wealth were more likely to participate in physical activity than people with lower wealth (62% vs 49%;  $p < 0.01$ ). Among those who had sedentary jobs, a similar difference was observed (52%: higher wealth vs 41%: lower wealth;  $p < 0.01$ ).

Retired people were less likely to participate in regular physical activity (44%) than working people

**Table 1.** Characteristics of Health and Retirement Study sample, 1996–2002<sup>a</sup>

Characteristics	Frequency <sup>b</sup> / M (SD)
<b>DEMOGRAPHIC CHARACTERISTICS</b>	
Age (years)	60.3 (4.78)
Female	52.9
Race/ethnicity	
Non-Hispanic white	73.6
Black	16.1
Hispanic	7.9
Other race	2.2
Education	
<High school	24.0
High school	41.8
Some college	34.2
Marital status	
Married	75.2
Divorced or separated	12.8
Widowed	8.9
Never married	3.0
Household income/\$100K	0.65 (1.14)
<b>MAIN INDEPENDENT VARIABLES</b>	
Retired	33.9
Health problems	
Hypertension	44.3
Diabetes	13.5
Heart disease (angina, heart attack, heart failure)	15.8
Stroke	3.3
Lung disease	7.8
Cancer (except skin cancer)	8.6
Arthritis	49.3
Limitation in activity of daily living	9.1
<b>SUBGROUPS</b>	
Occupation type of current or previous longest job <sup>c</sup>	
Sedentary	54.3
Physically demanding	45.7
Household wealth status (population median (\$125K) as a cutoff) <sup>c</sup>	
Higher wealth	51.3
Lower wealth	48.7

<sup>a</sup>Statistics are based on total wave-specific number of observations ( $n=34,019$ ) for time-varying characteristics. For time-constant person characteristics (including gender, race/ethnicity, and education category), statistics are based on the number of individuals ( $n=11,469$ ).

<sup>b</sup>Percent unless otherwise noted

<sup>c</sup>These two person-specific identifiers were used for subgroup analysis. Statistics are based on the number of individuals ( $n=10,978$  for occupation type;  $n=11,469$  for wealth status).

K, \$1000

(53%) in the overall sample ( $p<0.01$ ). The pattern was consistent across all the subgroups defined by job type and wealth level ( $p<0.01$ ) except for the sedentary-job group ( $p=0.07$ ). The magnitude of the difference between retirees and workers was much larger among people who had or were working at physically demanding jobs (19%) and among people with lower wealth (18%) than among people with higher wealth (3%).

In the analyses of subgroups defined by both occupation type and wealth status, retirees were less likely than current workers to participate in physical activity,

with the exception of those with sedentary jobs and higher wealth ( $p=0.07$ ). The difference in physical activity between retirees and current workers was largest (33% vs 57%) for those with physically demanding jobs and lower wealth.

### The Effect of Retirement on Physical Activity

After controlling for confounding factors and taking account of unobserved heterogeneity using fixed effects, retirement did not have a significant effect on physical activity in the overall sample (Table 3). Two health conditions that may be disabling (stroke and ADL limitation) were negative predictors of physical activity. However, other health conditions that could be associated with a lack of physical activity were not significant predictors of physical activity. Physical activity declined significantly with increasing age.

Retirement did have an effect on physical activity in certain subgroups, and this effect varied widely (Table 4). Physical activity decreased with retirement from physically demanding jobs (a decrease of 7.5 percentage points in the probability of participation;  $p<0.01$ ) but increased with retirement from sedentary jobs (an increase of 4.4 percentage points;  $p<0.01$ ). Physical activity decreased with retirement among people with lower levels of wealth (a decrease of 5.6 percentage points;  $p<0.01$ ), but did not change with retirement among people with higher levels of wealth ( $p=0.09$ ).

Analyses of four subgroups defined by both occupation type and wealth status indicated an interaction between occupation and wealth in how retirement affected physical activity. For people in physically demanding jobs, physical activity decreased with retirement only among those with a lower level of wealth (a decrease of 10.4 percentage points;  $p<0.01$ ). For people in sedentary jobs, physical activity increased with retirement only among those with higher wealth (an increase of 6.1 percentage points;  $p<0.01$ ).

### Discussion

Substantial heterogeneity in the effect of retirement on physical activity was found in groups defined by occupation type. For retirees from physically demanding occupations, retirement led to a decline in overall physical activity level, suggesting that the loss of work-related physical activity was not compensated by an equivalent increase in leisure-time physical activity.

The role of wealth on the effect of retirement was also striking. The likelihood of physical activity participation declined with retirement only in the lower-wealth group, suggesting that heightened economic constraints may have a greater impact on physical activity than the increased availability of time during retirement. Further, the wealth effect interacted with occupation type, so that the negative effect of retire-

**Table 2.** Participation in regular physical activity among retirees and workers, by occupation type and wealth level

	By working status <sup>b</sup>					
	Overall <sup>a</sup>		Retired		Working	
	%	Total no. of observations	%	Total no. of observations	%	Total no. of observations
<b>Overall sample</b>	50	34,019	44*	11,542	53	22,477
<b>By occupation type</b>						
Physically demanding job	54*	14,616	41*	5,114	60	9,502
Sedentary job	48	18,483	47	5,598	49	12,885
<b>By wealth level</b>						
Lower wealth	45*	16,675	33*	5,542	51	11,133
Higher wealth	55	17,344	53*	6,000	56	11,344
<b>By occupation type and wealth level</b>						
Physically demanding job with lower wealth	49*	9,134	33*	3,146	57	5,988
Physically demanding job with higher wealth	62	5,482	54*	1,968	66	3,514
Sedentary job with lower wealth	41*	6,966	35*	1,874	43	5,092
Sedentary job with higher wealth	52	11,517	53	3,724	52	7,793

<sup>a</sup>Significance presented is the difference between subgroups: physically demanding job versus sedentary job, higher wealth versus lower wealth, physically demanding job with lower wealth versus physically demanding job with higher wealth, and sedentary job with lower wealth versus sedentary job with higher wealth.

<sup>b</sup>Significance presented is the difference between retired and working groups, for each subgroup.

\* $p < 0.01$  (based on Fisher's exact test)

no., number

ment from physically demanding jobs was exacerbated by lower wealth, and the positive effect of retirement from sedentary jobs was enhanced by greater wealth. These findings suggest that existing disparities in physical activity by SES<sup>26</sup> will widen as people retire.

**Table 3.** Effects of retirement on physical activity (fixed-effects estimates)

Dependent variable: participation in regular physical activity (0/1)	
Independent variables	Coefficient (robust SE)
Retired (ref: working)	-0.01 (0.01)
<b>Demographic characteristics<sup>a</sup></b>	
Age	-0.01** (0.002)
Household income/\$100K	0.002 (0.004)
Marital status (ref: married)	
Divorced or separated	-0.02 (0.03)
Widowed	-0.02 (0.02)
Never married	-0.10 (0.09)
<b>Health problems</b>	
Hypertension	0.004 (0.01)
Diabetes	0.03 (0.02)
Heart disease	0.002 (0.02)
Stroke	-0.08* (0.04)
Lung disease	-0.04 (0.03)
Cancer	-0.04 (0.03)
Arthritis	-0.02 (0.01)
ADL limitation	-0.04** (0.02)
Constant	1.11** (0.09)
$R^2$	0.59
Number of observations	34,019
Number of people	11,469

<sup>a</sup>Time-constant demographic characteristics, including gender, race/ethnicity, and education, were not estimated in the fixed-effects model.

\* $p < 0.05$ ; \*\* $p < 0.01$

ADL, activity of daily living; K, \$1000

Given the well-known health benefit of regular physical activity for older adults, the reduced physical activity in retirement for this group may result in disproportionately adverse health outcomes, which could have important public health implications. Similarly, a previous study<sup>27</sup> showed that retirees from physically demanding occupations were likely to gain weight, while retirees from sedentary occupations did not show a weight gain due to retirement. The data used in that study also showed that the prevalence of health problems associated with lack of physical activity (e.g., diabetes, heart disease) was significantly higher among retirees from physically demanding jobs than among those from sedentary jobs (Table 5).

The role of wealth might be influenced by multiple environmental factors favoring physical activity. Studies on populations of varying ages show that SES is associated with environmental factors affecting an individual's physical activity, such as access to exercise facilities, the availability of walking trails, and neighborhood safety.<sup>28-30</sup> Pathways through which wealth affects the physical activity of retirees merit further investigation to better inform effective strategies to reduce the disparity in their physical activity levels. Based on accumulated evidence, public health policies may consider increasing access to allow low-cost physical activity options, such as walkable communities or public parks, particularly in areas with a high concentration of lower-income older adults.

The findings from the subgroup of people with sedentary jobs for whom physical activity increased with retirement are consistent with findings from some previous studies<sup>13-15</sup> using measures of physical activity limited to leisure-time physical activity or exercise par-

**Table 4.** Effect of retirement on physical activity by occupation type and wealth level (fixed-effects estimates)<sup>a</sup>

Dependent variable: participation in regular physical activity (0/1)				
Subgroup	Coefficient on retired	SE	No. of observations	No. of people
Physically demanding job	-0.075*	0.018	14,616	5022
Sedentary job	0.044*	0.016	18,483	5956
Lower wealth	-0.056*	0.019	16,675	5880
Higher wealth	0.026	0.016	17,344	5589
Physically demanding job with lower wealth	-0.104*	0.025	9,134	3249
Physically demanding job with higher wealth	-0.039	0.026	5,482	1773
Sedentary job with lower wealth	0.01	0.028	6,966	2314
Sedentary job with higher wealth	0.061*	0.02	11,517	3642

<sup>a</sup>All the covariates in the main regression, presented in Table 3, were retained. Coefficient estimates for other covariates vary little across subgroups and were similar to those presented in Table 3.

\* $p < 0.01$   
no., number

ticipation. This finding might occur because, for people with sedentary occupations, work-related physical activity constitutes a small fraction of overall physical activity. For people with sedentary jobs, retirement could provide an opportunity for adopting a more-active lifestyle. Using a composite indicator of physical activities during both working and nonworking hours, the present study identified the contrasting effect of retirement by pre-retirement occupation type, which was overlooked in previous literature that examined only leisure-time physical activity.

Limitations of the current study include the possibility of measurement error from the crude measure of occupation-related physical activity. The data did not contain detailed and objective information on the physical demands of each individual's occupation. Physical demands may vary across jobs in one occupation category, and the physical demands of jobs in some occupation categories may change over time. It is particularly likely that physical demands have been reduced in recent years among traditionally physically demanding occupations; in this case, the true difference in the effect of retirement on overall physical activity between physically demanding jobs and sedentary jobs, if measured with more accuracy, might be even larger than the contrast reported here.

A few additional limitations of this study merit discussion and should be addressed in future studies. First, participation in physical activity is self-reported and is subject to reporting errors. However, there is no theoretical reason to believe, or empirical evidence to indicate, that the reporting error is systematic, and thus

potential reporting errors may not have influenced the findings. Second, this study did not provide information on changes in the content or patterns of physical activity with retirement; this next, important step of using various measures of physical activity could help to inform the design of specific interventions. Third, this study used one definition of retirement that was based primarily on current working status in each wave with 2-year intervals and was allowed to be reversed in future waves. Thus, the timing of the effect of retirement in this study is likely to be a short-term effect (that could have happened during the first 2 years of retirement), given the small percentage of people who stayed retired throughout the entire study period. The contrast shown by subgroups defined by occupation type, in particular, may reflect the different re-adjustment pattern from work to retirement. Fourth, occupation type was treated as a given rather than a choice in order to focus on the effect of retirement rather than occupation choice. This distinction might be critical in the study of younger adults' labor transitions and physical activity, because people who tend to be physically active may be more likely to opt for physically demanding occupations.<sup>31</sup> Finally, this study did not explore the effects of reasons for retirement, which may have differential effects on physical activity and other health behavior.<sup>32</sup> Instead, health conditions and individual heterogeneities were controlled in order to estimate the average effect of retirement regardless of health problems. Future studies may explore the differential effects of retirement among individuals retiring for various reasons.

**Table 5.** Prevalence of cardiovascular disease among retirees: comparison of frequencies by pre-retirement occupation type

Pre-retirement occupation type	Currently have following health problem: frequency % <sup>a</sup>			
	Hypertension	Diabetes	Stroke	Heart disease
Sedentary (n=5598)	49.7	15.3	5.0	20.0
Physically demanding (n=5114)	56.9	22.1	7.4	26.7

<sup>a</sup>Difference in frequency between two groups was significant ( $p < 0.001$ , based on Fisher's exact test) for all types of health problems

The number of people approaching retirement age is rapidly increasing. This study suggests that this growing segment of the nation's population may not sustain an adequate level of physical activity and that retirement would widen disparity in physical activity by wealth status.

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