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Influence of Retirement on Leisure-time Physical Activity

The Atherosclerosis Risk in Communities Study

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Cross-sectional data suggest that leisure-time physical activity may increase during retirement. Prospective population-based studies are necessary to characterize leisure activity patterns through retirement among the same persons to verify this observation. Therefore, the purpose of this study was to describe the influence of retirement on leisure activity using data from Atherosclerosis Risk in Communities Study cohort participants aged 45–64 years at baseline. Physical activity was measured by the Baecke questionnaire in 1,825 African-American and 5,957 White participants who were working at the initial visit (1986–1989) and either retired or working 6 years later (1993–1995). Participants who retired during follow-up were more likely to increase their sport participation and television watching than those who continued to work over the 6-year period. Among those reporting sport or exercise at baseline, those retiring over follow-up were more likely to maintain their sport and exercise participation than those who continued to work across race-gender groups. Among those not reporting sport or exercise at baseline, those who retired were more likely to adopt activity than those who continued to work except for African-American women. In this study, retirement was associated with gains in sport and exercise participation as well as television watching. *Am J Epidemiol* 2002;155:692–9.

exercise; exertion; health promotion; leisure activities; life style; retirement

Physical activity is a complex behavior, which varies over the life span. Factors associated with the continuity of physical activity throughout life are poorly understood (1). Prospective cohort studies can provide information to help determine when habits of physical activity change and what personal or social factors may be associated with that change through the life course. According to life stage or developmental behavior theory, transitions into life stages may be effective points to intervene and promote preventive health behaviors (2). Understanding how these transitions and milestones affect physical activity patterns across the life span could influence how interventions are delivered and accepted in population groups.

One such life event is retirement, which may be a period when physical activity patterns could change due to a decline in occupational demands (3, 4). Empirical evidence supporting a change in leisure-time physical activity at retirement arises from cross-sectional surveillance studies, where light and moderate intensity activities increase around retirement age but overall activity continues to decline (5–7). To confirm this finding, prospective population-based studies are needed to characterize leisure activity patterns through retirement among the same persons. Therefore, we sought to prospectively examine the patterns of leisure activity associated with retirement over a 6-year period among African-American and White persons initially aged 45–64 years.

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Abbreviations: ARIC, Atherosclerosis Risk in Communities; CI, confidence interval.

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MATERIALS AND METHODS

Study population

The Atherosclerosis Risk in Communities (ARIC) Study was designed to investigate the etiology and natural history of atherosclerosis (8). The cohort comprised persons aged 45–64 years at recruitment in 1986–1989. Population samples were selected from four communities (Washington County, Maryland; northwest suburbs of Minneapolis, Minnesota; Jackson, Mississippi; and Forsyth County, North Carolina). Only African Americans were enrolled from the Jackson site, while the remaining three samples approximately reflected the demographics of the communities from which they were chosen. Participation rates for the clinical examination were 46 percent at Jackson and 65–67 percent at the three remaining sites (9). ARIC Study participants visited a clinic triennially and received a follow-up phone call yearly.

Physical activity assessment

Physical activity was assessed at the baseline examination using the Baecke questionnaire (10). The questionnaire was administered by an interviewer and yielded three semicontinuous scores from 1 (low) to 5 (high) for sport, leisure, and work. A few modifications to the original version of the Baecke questionnaire were made and are detailed elsewhere (11). The sport score was derived from three questions regarding the frequency of overall sport and exercise participation, the frequency of sweating, and a subjective comparison of physical activity with that of others one's own age. A fourth component on the frequency, intensity, and duration of up to four activities also contributed to the sport score. The leisure score was designed to capture leisure activity and consisted of four questions on television viewing, bicycling, walking, and time spent walking and bicycling to and from work or shopping. The work score was calculated from eight items. Participants were asked how often while at work they sit, stand, walk, lift heavy loads, sweat, and leave work physically tired. They were also asked to compare their work activity with that of others their own age. The last component of the work score consisted of a ranking (low, medium, or high) of activity based upon occupational job title (12). Participants not reporting any occupational activity were assigned a work score of 1. Each component of the sport, leisure, or work score contributed equally to the final scores.

The reliability and validity of the Baecke questionnaire have been evaluated in several populations. The Baecke questionnaire more accurately assesses heavy intensity activity, which tends to be well-defined activities performed repetitively by participants (e.g., bicycling, jogging, swimming), as compared with low intensity activity (13). Moderate correlations have been observed between sport and leisure indices and activity diaries (13–15). However, lower correlations were observed between the work index and occupational activity diaries (16) or maximal oxygen consumption (15). Short-term reliability, assessed by a 1-month test-retest Pearson correlation coefficient adjusted for age and gender, was 0.90 for sport, 0.86 for leisure, and 0.78 for work (15). Longer term reliability (3–5 months) has also been demonstrated for men and women, ranging from 0.71 to 0.88 for sport, from 0.74 to 0.83 for leisure, and from 0.80 to 0.89 for work (10, 14, 17).

Changes in sport and leisure scores over 6 years were computed by subtracting the baseline value from the 6-year value (range, from –4 to 4). Hypothetically, sport and leisure indices could increase by one point if a person moved from the lowest (score = 1) to the highest (score = 5) category for any one of the questions, holding all other responses to component questions constant. For example, if a participant reported never sweating during leisure at baseline and reported sweating very often at the follow-up visit, the sport score would increase by one point if all the other responses to sport component questions remained identical. Similarly, if a participant reported never walking at baseline and reported walking very often at the follow-up visit, the leisure score would increase by one point given that all other responses to leisure component questions remained identical.

In addition to the scores described above, physical activity was also characterized in several other ways. Participants were defined as engaging in vigorous activity if they reported at least one sport that was classified as vigorous (>6 metabolic equivalents). Participants were also defined as engaging in regular activity if they reported participation in at least one activity at least 1 hour per week for 10 or more months per year. Participants were asked whether they had participated in any sport or exercise (yes or no) at baseline and year 6, referred to as "sport or exercise participation." Based on self-report, participants were classified into four mutually exclusive categories: 1) maintainers, if they reported participating in at least one sport or exercise at baseline and year 6; 2) sedentary, if they reported not participating in any sport or exercise at baseline and year 6; 3) adopters, if they did not report any sport or exercise at baseline but did at year 6; and 4) stoppers, if they did report any sport or exercise at baseline but not at year 6.

Measurement of other study variables

Participants were asked to define occupational status at baseline and at year 6 of the study. Only participants who identified themselves as "employed" at baseline and as "employed," "retired and working," or "retired and not working" at the year 6 follow-up visit were included in these analyses. Education was self-reported at the home interview and defined for these analyses categorically by years of education (less than high school, high school, or greater than high school). Baseline distributions of education and occupation in the ARIC Study have been previously reported (18). Perceived health status was assessed by telephone just prior to the year 6 visit with the question, "Compared with other people your age, would you say that your health has been excellent, good, fair, or poor?"

Exclusion criteria

The original ARIC Study cohort comprised 15,792 persons. Participants not identifying themselves as African American or White ($n = 49$) and African Americans living in Minneapolis ($n = 22$) or Washington County ($n = 33$) were excluded. Participants not providing complete information on physical activity ($n = 73$) or education ($n = 24$) and not between 45 and 64 years of age ($n = 158$) were also excluded. Those not working at baseline ($n = 4{,}987$), those not returning or having incomplete physical activity or health status information at the year 6 visit ($n = 1{,}726$), those retiring for health reasons ($n = 250$), and those having incomplete or inconsistent information on work status at the follow-up visits ($n = 688$) were excluded, leaving 7,782 for these analyses.

Statistical methods

All analyses were calculated by race-gender group. Multivariable linear regression models were used to examine the adjusted sport, leisure, and sport + leisure scores, as well as individual change scores, comparing retirees with work-

ers. These models were recalculated, excluding persons who reported "retired and working" at year 6. Unconditional multivariable logistic regression models were used to examine the maintenance of any exercise compared with stopping and adoption of any exercise compared with remaining sedentary by retirement status. All race- and gender-specific models were adjusted for age (55 years), center, education, and perceived health status. We did not adjust for the season of the year, because the questionnaire queried physical activity during the past year and clinic visits occurred throughout the year. For the study population, the distribution of perceived health status was as follows: 35.4 percent, excellent; 51.2 percent, good; 11.8 percent, fair; and 1.5 percent, poor. To control for perceived health status in statistical modeling, we created two indicator variables that compared excellent health or good health with the referent (those who reported either fair or poor health). Tracking was defined as the ability to maintain over time one's relative physical activity ranking among cohort members (19). Adjusted Spearman's rank correlation coefficients were used to assess 6-year physical activity tracking, with confidence intervals calculated using a bootstrap procedure (20).

RESULTS

Among workers at baseline, the percentage that had retired by year 6 was 26.0 percent among African-American women, 23.8 percent among African-American men, 26.1 percent among White women, and 34.8 percent among White men. Activity prevalence from selected Baecke component questions at baseline and year 6 is displayed in table 1 by race-gender and year 6 retirement status. Reported participation in any exercise or sport increased significantly for retirees over the 6-year period across race-gender groups, while increasing less among African Americans who continued to work and declining significantly among Whites who continued to work. The prevalence of vigorous activity did not change by more than 3 percent except among White men, where declines in prevalence were reported for both retirees and workers. Regular activity increased significantly for retirees across race-gender groups. Over the 6-year period, walking during leisure and self-reported television watching often or very often increased across all groups, with larger increases occurring among retirees as compared with those continuing to work. The prevalence of biking during leisure was low and did not significantly change across the 6 years for any group.

Sport and leisure scores by retirement status

The overall mean adjusted sport, leisure, and sport + leisure scores are presented in table 2 by race-gender and retirement status for the baseline and year 6 visits. Baseline sport and leisure scores were generally similar in the comparison of workers with retirees within race-gender groups.

TABLE 1. Physical activity prevalence at year 0 (1986–1989) and year 6 (1993–1995) among workers at baseline stratified by working status at year 6 by race-gender, Atherosclerosis Risk in Communities Study

Physical activity prevalence	African-American women by work status at year 6		African-American men by work status at year 6		White women by work status at year 6		White men by work status at year 6	
	Retired (*n* = 295)	Working (*n* = 841)	Retired (*n* = 164)	Working (*n* = 525)	Retired (*n* = 714)	Working (*n* = 2,025)	Retired (*n* = 1,120)	Working (*n* = 2,098)
Any exercise or sport participation (%)								
Year 0	43.0	39.5	47.6	51.8	70.5	67.7	68.8	72.6
Year 6	58.6	47.9	65.9	53.0	74.9	64.7	74.4	67.5
Any vigorous activity (%)								
Year 0	4.1	3.7	5.5	11.2	10.8	13.8	17.1	20.5
Year 6	4.8	6.3	3.1	9.1	13.3	14.1	13.8	16.9
Any regular activity (%)								
Year 0	19.3	15.5	22.6	28.0	32.9	31.5	35.8	37.0
Year 6	31.5	24.3	37.2	30.3	44.4	34.1	46.3	37.5
Walk during leisure often or very often (%)								
Year 0	17.0	13.1	15.9	13.1	22.7	22.7	24.4	20.7
Year 6	20.3	14.6	24.4	15.4	29.0	24.0	32.5	21.9
Bike during leisure often or very often (%)								
Year 0	2.4	1.6	1.2	2.3	4.6	4.0	4.0	3.9
Year 6	2.7	2.0	2.4	2.1	4.5	3.4	4.8	4.4
Watch television often or very often (%)								
Year 0	35.6	34.6	43.3	43.0	26.9	23.8	34.0	33.1
Year 6	45.4	39.1	57.3	47.6	32.6	24.1	39.3	34.8

TABLE 2. Sport, leisure, and sport + leisure scores at baseline (1986–1989) and year 6 (1993–1995) and mean changes with 95% confidence intervals, adjusted for age, center, education, and perceived health status, Atherosclerosis Risk in Communities Study

	African-American women (*n* = 1,136)		African-American men (*n* = 689)		White women (*n* = 2,739)		White men (*n* = 3,218)	
	Score	95% confidence interval	Score	95% confidence interval	Score	95% confidence interval	Score	95% confidence interval
Sport scores								
Retired at year 6								
Year 0	2.07	2.00, 2.14	2.26	2.14, 2.37	2.41	2.35, 2.47	2.68	2.64, 2.73
Year 6	2.38	2.30, 2.46	2.63	2.51, 2.75	2.62	2.57, 2.68	2.87	2.82, 2.92
Year 6 − year 0	0.31	0.22, 0.40	0.37	0.25, 0.49	0.22	0.16, 0.27	0.19	0.14, 0.23
Working at year 6								
Year 0	2.07	2.01, 2.13	2.26	2.18, 2.34	2.38	2.34, 2.43	2.66	2.62, 2.70
Year 6	2.22	2.16, 2.28	2.35	2.27, 2.43	2.38	2.34, 2.42	2.66	2.62, 2.70
Year 6 − year 0	0.15	0.08, 0.22	0.10	0.01, 0.18	−0.00	−0.04, 0.04	−0.01	−0.05, 0.03
Leisure scores								
Retired at year 6								
Year 0	2.14	2.08, 2.21	2.07	1.98, 2.16	2.54	2.50, 2.58	2.45	2.42, 2.48
Year 6	2.13	2.06, 2.19	2.13	2.04, 2.22	2.47	2.43, 2.51	2.46	2.42, 2.49
Year 6 − year 0	−0.02	−0.10, 0.06	0.06	−0.05, 0.17	−0.06	−0.11, −0.02	0.01	−0.02, 0.04
Working at year 6								
Year 0	2.11	2.06, 2.16	2.10	2.04, 2.16	2.51	2.48, 2.54	2.41	2.38, 2.44
Year 6	2.11	2.06, 2.16	2.04	1.97, 2.10	2.46	2.43, 2.49	2.42	2.39, 2.45
Year 6 − year 0	−0.00	−0.06, 0.06	−0.06	−0.14, 0.01	−0.05	−0.08, −0.02	0.01	−0.02, 0.04
Sport + leisure scores								
Retired at year 6								
Year 0	4.21	4.10, 4.33	4.33	4.16, 4.49	4.95	4.86, 5.03	5.13	5.06, 5.19
Year 6	4.51	4.39, 4.63	4.76	4.59, 4.93	5.10	5.01, 5.18	5.32	5.26, 5.39
Year 6 − year 0	0.29	0.17, 0.42	0.43	0.26, 0.60	0.15	0.07, 0.23	0.20	0.14, 0.26
Working at year 6								
Year 0	4.18	4.09, 4.27	4.36	4.24, 4.47	4.89	4.83, 4.95	5.07	5.02, 5.13
Year 6	4.33	4.23, 4.42	4.39	4.27, 4.51	4.84	4.78, 4.90	5.08	5.02, 5.13
Year 6 − year 0	0.15	0.05, 0.25	0.03	−0.09, 0.15	−0.05	−0.11, 0.01	0.00	−0.05, 0.05

Sport scores were lowest among African-American women and highest among White men. Leisure scores were lowest among African-American men and highest among White women. Individual changes in scores were calculated by subtracting the baseline value (year 0) from the year 6 value and then modeled using linear regression. The adjusted race-gender-specific and retirement-specific scores for change are reported in table 2. Over the 6-year period, sport scores significantly increased for retirees and for African Americans who continued to work. Among African Americans, the increase in sport scores over the follow-up period was greater for retirees than for those who continued to work. The only significant change identified for leisure scores was a decline for both working and retired White women. For those that retired at year 6, changes in sport + leisure scores increased significantly across all race-gender groups. For those continuing to work at year 6, the only significant changes in sport + leisure scores were an increase for African-American women.

The unadjusted distribution of changes in sport and leisure scores by retirement status is shown in figure 1. For sport scores, a shift in the distribution to the right occurred among retirees as compared with workers, indicating a gain in activity. However, for leisure scores the distribution remained stable across retirement and working groups largely because of the disproportionate increase in television watching among retirees as compared with workers, which counted against the leisure score.

Retirees could report working or not working at the year 6 visit. Among retirees, the following are the percentages who reported working (total sample size for retirees in parentheses): 25.8 percent African-American women (n = 295), 25.0 percent African-American men (n = 164), 21.4 percent White women (n = 714), and 31.8 percent White men (n = 1,120). The models shown in table 2 were recalculated, excluding participants who reported "retired and working" at year 6, in order to compare "workers" with "retired and not working." The results for sport scores and sport + leisure scores remained consistent except those for White men. The increase in scores associated with retirement was greater when analyses were restricted to those reporting "retired and not working" among White men (sport: 0.29, 95 percent confidence interval (CI): 0.23, 0.34; sport + leisure: 0.31, 95 percent CI: 0.24, 0.38). The leisure scores remained consistent across race-gender groups when comparing the two groups of retirees.

For retirees, we explored whether work activity was replaced with sport and leisure activity. To do this, we deter-

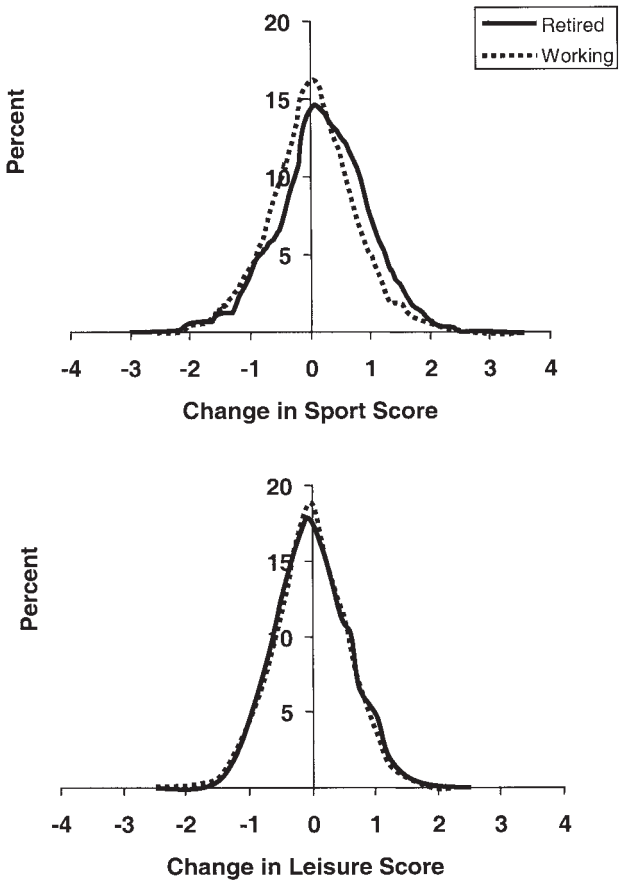

FIGURE 1. Distribution of unadjusted changes in sport and leisure scores, expressed as percentage, by working status at year 6, Atherosclerosis Risk in Communities Study, 1993–1995.

mined individual change in sport and leisure scores after grouping retirees according to three baseline work activity groups (work scores 1–1.9, 2–2.9, 3–5) (data not shown). For sport scores, there were no significant differences for sport scores when comparing different baseline work values for African-American and White women. However, for African-American men, sport scores declined significantly across baseline work categories: work score 1–1.9 (n = 19): 0.84 (95 percent CI: 0.54, 1.13); work score 2–2.9 (n = 88): 0.42 (95 percent CI: 0.28, 0.56); and work score 3–5 (n = 57): 0.16 (95 percent CI: –0.02, 0.33). For White men, the differences in sport scores were not as pronounced: work score 1–1.9 (n = 160): 0.26 (95 percent CI: 0.15, 0.36); work score 2–2.9 (n = 639): 0.17 (95 percent CI: 0.12, 0.23); and work score 3–5 (n = 321): 0.19 (95 percent CI: 0.11, 0.27). There were no significant differences for leisure scores at follow-up when comparing across different baseline work values for each race-gender group.

Adjusted Spearman's rank correlation coefficients for sport, leisure, and sport + leisure scores at baseline and year 6 were calculated by retirement status across race-gender groups (table 3). The sport score generally tracked more consistently than the leisure score (except for African-American men), as indicated by higher Spearman's rank correlation coefficients. Retirees were more likely to change their sport score ranking than were those who continued to work.

Predicting maintenance or adoption of activity

Persons who participated in any sport or exercise at baseline and the follow-up visit were compared with persons who stopped leisure activity at the follow-up visit by race-gender group (table 4). Retirement significantly increased the likelihood that a participant maintained his or her exercise as compared with stopping across race-gender groups.

Table 4 also displays the comparison of persons who adopted any sport or exercise at the follow-up visit compared with persons who remained sedentary during leisure by race-gender group. Retirement also significantly increased the likelihood that a participant adopted exercise as compared with remaining sedentary during leisure for all race-gender groups except African-American women.

TABLE 3. Spearman's rank correlation coefficients for sport, leisure, and sport + leisure scores at baseline (1986–1989) and year 6 (1993–1995), by retirement status at year 6 and race-gender, adjusted for age, center, education, and perceived health, with 95% confidence intervals, Atherosclerosis Risk in Communities Study

	African-American women (n = 1,136)		African-American men (n = 689)		White women (n = 2,739)		White men (n = 3,218)	
	Spearman's r	95% confidence interval	Spearman's r	95% confidence interval	Spearman's r	95% confidence interval	Spearman's r	95% confidence interval
Sport scores								
Retired at year 6	0.30	0.18, 0.42	0.29	0.15, 0.43	0.47	0.41, 0.52	0.47	0.42, 0.51
Working at year 6	0.32	0.25, 0.39	0.43	0.34, 0.52	0.49	0.46, 0.53	0.55	0.52, 0.58
Leisure scores								
Retired at year 6	0.22	0.11, 0.32	0.35	0.21, 0.50	0.39	0.32, 0.47	0.39	0.35, 0.44
Working at year 6	0.22	0.16, 0.28	0.27	0.19, 0.34	0.43	0.39, 0.47	0.44	0.40, 0.48
Sport + leisure scores								
Retired at year 6	0.36	0.25, 0.46	0.35	0.20, 0.49	0.48	0.42, 0.54	0.52	0.48, 0.57
Working at year 6	0.33	0.27, 0.40	0.44	0.36, 0.52	0.53	0.49, 0.56	0.56	0.53, 0.59

TABLE 4. Odds ratios of maintaining versus stopping or adopting versus remaining sedentary in participants who retire compared with those who continue to work at year 6 (1993–1995), adjusted for age, center, education, and perceived health status, with 95% confidence intervals, Atherosclerosis Risk in Communities Study

	Among those reporting sport or exercise at baseline							
	African-American women (*n* = 459)		African-American men (*n* = 350)		White women (*n* = 1,874)		White men (*n* = 2,294)	
	Odds ratio*	95% confidence interval	Odds ratio*	95% confidence interval	Odds ratio*	95% confidence interval	Odds ratio*	95% confidence interval
Retired at year 6	2.95	1.63, 5.34	2.30	1.13, 4.68	1.62	1.19, 2.19	1.61	1.22, 2.11
Working at year 6	1.0		1.0		1.0		1.0	
	Among those not reporting sport or exercise at baseline							
	African-American women (*n* = 677)		African-American men (*n* = 339)		White women (*n* = 865)		White men (*n* = 924)	
	Odds ratio†	95% confidence interval	Odds ratio†	95% confidence interval	Odds ratio†	95% confidence interval	Odds ratio†	95% confidence interval
Retired at year 6	1.08	0.71, 1.64	2.03	1.12, 3.68	1.66	1.14, 2.41	1.66	1.20, 2.31
Working at year 6	1.0		1.0		1.0		1.0	

* Odds ratio of maintaining sport or exercise versus stopping.
† Odds ratio of adopting sport or exercise versus remaining sedentary.

Among retirees who were considered adopters (e.g., did not report any sport or leisure activity at year 0 but reported activities at year 6), we examined what activities these participants adopted. Among African-American women, the most common activities adopted in order were walking briskly, walking for pleasure, gardening/yard work, and floor exercise (bending, stretching, etc., of low intensity). Among African-American men, the activities adopted in order were walking briskly, gardening/yard work, fishing from the bank or boat, and mowing the lawn with a riding mower/walking behind a power mower. Among White women, the activities adopted in order were walking briskly, walking for pleasure, gardening/yard work, and riding an exercise bike. Among White men, the activities adopted in order were gardening/yard work, walking briskly, walking for pleasure, and mowing the lawn with a riding mower/walking behind a power mower.

DISCUSSION

In this study, retirement was associated with a significant increase in sport and exercise participation, as well as television watching, when compared with continuing to work over a 6-year period. Among those physically active at baseline, those retiring over follow-up were more likely to maintain their sport and exercise participation than those who continued to work. Among those sedentary at baseline, those who retired were more likely to adopt physical activity than were those who continued to work. In general, the activities most commonly adopted were walking (briskly or for pleasure), gardening, yard work, and mowing. King (3) cites multiple reasons why retirement is a time when physical activity increases, including more time availability and flexibility, long-term perspective on health, and concerns about health and independence. Social networks, support systems, and daily routines are probably changing as well during this time (2) as are barriers to activity participation (21).

It is unclear from our data whether the overall net activity increased with retirement. There is a possibility that work activity was replaced with sport and exercise participation for retirees and that no real change in overall activity occurred. However, if work activity did not contribute meaningfully to overall physical activity, then there may be an overall gain. We attempted to examine this in our data by modeling individual changes in sport and leisure scores for retirees by baseline work score, which provides some indication of their activity at work. Across race-gender groups, the largest gains in sport scores occurred among those with the lowest work scores (e.g., least active at work), reaching significance for African-American and White men. No differences were found for leisure scores across work categories. This indicates that retirees' sport and exercise participation was probably adding additional activity and not replacing work activity, for those who worked in the least active occupations. However, we have no precise quantitative estimate of the amount of physical activity needed to cause a one-point increase in scores and whether this amount is consistent for sport, leisure, and work scores. Therefore, estimates of absolute gains or losses in physical activity are not possible.

Tracking data are helpful to determine the consistency of activity over time, as well as to guide how often physical activity should be assessed in prospective study designs. In this study, lower tracking, as measured by correlation coefficients, was noted for sport scores among those retiring from work during the follow-up period. These findings have implications for prospective studies that examine disease outcomes. Many studies assess physical activity at only one time period (baseline), assuming it is a valid estimate of activity over the entire follow-up period. Our findings suggest that this practice may lead to misclassification if the

follow-up period spans over the retirement years, because population levels of sport and exercise participation changed with retirement. These persons may require more frequent measures of physical activity to better represent their activity patterns.

These results should be considered in light of the study's limitations. This study is based on participants from four geographic communities and may not reflect national patterns. African Americans were represented at only two sites, and Whites were represented at only three sites. Therefore, it is difficult to separate racial and geographic effects. Another potential drawback to the generalizability of this study was the response rate at the follow-up visit. Attrition is inherent in prospective closed cohort studies and, in this study, baseline sport, leisure, and work scores were higher for those returning to both examinations when compared with those not returning. Therefore, the group we reported on had higher average baseline activity scores than did the original full cohort. This may have caused selection bias if the changes in the patterns of activity differed by participation status.

In this study we do not know the exact date when retirement occurred, only that it did happen between baseline and the year 6 visit. Future studies should incorporate more frequent ascertainment of both working status and physical activity. Additionally, it is not known if the changes that we observed in physical activity would continue beyond this study period of no longer than 6 years. Finally, the definitions of working and retirement are not mutually exclusive. In our analyses, we classified those who self-reported being "retired and working" as retired. No important differences were observed when analyses were restricted to those "retired and not working" except among White men, for whom an increase in the sport score was greater for "retired and not working" than for "retired and working."

Further research is warranted to examine how other specific milestones, such as having children and changing marital status, affect health behaviors to better understand the population patterns of physical activity and to tailor interventions (22, 23). Patterns should be examined across the life span, because physical activity participation is a lifelong process that is probably influenced by life experiences and stages of development (23, 24). Better characterization of the components of physical activity is also needed to quantify and to compare across domains whether overall physical activity, and therefore energy expenditure, increased with retirement.

Our results highlight the importance of a life course approach to understand the determinants of physical activity and to plan effective interventions that promote healthier lifestyles. Because of the high prevalence of physical inactivity in the United States, interventions to improve these patterns must expand beyond the individual level and also target population groups (25). For example, incorporating physical activity guidance into preretirement planning may further increase participation (26). By better understanding how adults alter physical activity as other important life domains change, researchers can anticipate changes in activity and target interventions appropriately (27).

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