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Physical Activity, Sedentary Behavior, and Retirement: The Multi-Ethnic Study of Atherosclerosis

Sydney A. Jones, MSPH[1], **Quefeng Li, PhD**[2], **Allison E. Aiello, PhD**[2,3], **Angela M. O'Rand, PhD**[4], and **Kelly R. Evenson, PhD, MS**[1]

[1]Department of Epidemiology, Gillings School of Global Public Health, University of North Carolina, Chapel Hill, North Carolina

[2]Department of Biostatistics, Gillings School of Global Public Health, University of North Carolina, Chapel Hill, North Carolina

[3]Carolina Population Center, University of North Carolina, Chapel Hill, North Carolina

[4]Department of Sociology, Duke University, Durham, North Carolina

Abstract

Introduction—Physical activity and sedentary behavior are major risk factors for chronic disease. These behaviors may change at retirement with implications for health in later life. The study objective was to describe longitudinal patterns of moderate to vigorous and domain-specific physical activity and TV watching by retirement status.

Methods—Participants in the Multi-Ethnic Study of Atherosclerosis (N=6,814) were recruited from six U.S. communities and were aged 45–84 years at baseline. Retirement status and frequency and duration of domain-specific physical activity (recreational walking, transport walking, non-walking leisure activity, caregiving, household, occupational/volunteer) and TV watching were self-reported at four study exams (2000 to 2012). Fixed effect linear regression models were used to describe longitudinal patterns in physical activity and TV watching by retirement status overall and stratified by socioeconomic position. Analyses were conducted in 2017.

Results—Of 4,091 Multi-Ethnic Study of Atherosclerosis participants not retired at baseline, 1,012 (25%) retired during a median of 9 years follow-up. Retirement was associated with a 10% decrease (95% CI= −15%, −5%) in moderate to vigorous physical activity and increases of 13% to 29% in recreational walking, household activity, and TV watching. Among people of low socioeconomic position, the magnitude of association was larger for moderate to vigorous physical activity. Among people of high socioeconomic position, the magnitude of association was larger for non-walking leisure and household activity.

Address correspondence to: Sydney A. Jones, MSPH, 137 East Franklin Street, Suite 303, University of North Carolina, Gillings School of Global Public Health, Department of Epidemiology, Chapel Hill NC 27514. sydneyjones@unc.edu.

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Conclusions—The retirement transition was associated with changes in physical activity and TV watching. To inform intervention development, future research is needed on the determinants of behavior change after retirement, particularly among individuals of low socioeconomic position.

INTRODUCTION

Retirement is a major life transition involving disruption in daily activities, time constraints, social support, and priorities.[1,2] Maintenance of a healthy lifestyle after retirement can improve quality of life, delay impairment, and lower healthcare costs.[3–5] Regular physical activity is an important component of a healthy lifestyle.[3,5] However, the prevalence of physical activity among retirees is low, with 45% of American retirees reporting no physical activity.[6] Understanding behavior change at retirement could inform interventions to support physical activity after retirement.[7,8]

Retirement has been associated with positive and negative changes in physical activity and sedentary behavior.[9,10] Leisure-time physical activity and TV watching increased after retirement with inconsistent changes in overall physical activity.[10–13] Without measures of occupational physical activity, many prior studies could not determine whether increased leisure-time physical activity was sufficient to replace lost occupational activity.[10] Utilitarian domains of physical activity, such as transportation activity, have not been well studied.[10] Describing domain-specific changes in physical activity is important to guide intervention development. Interventions are more likely to be effective if targeted to specific physical activity domains.[14]

Patterns of behavior change at retirement may vary by socioeconomic position (SEP).[12,15,16] Socioeconomically disadvantaged adults are more likely to retire because of ill health or job loss rather than voluntarily,[17,18] and to live alone and with disabilities,[19,20] making prevention of chronic disease a priority among disadvantaged elders. This study aims to describe longitudinal patterns in overall moderate to vigorous physical activity (MVPA) and domain-specific physical activity and TV watching among participants in the Multi-Ethnic Study of Atherosclerosis (MESA) by retirement status, overall and within strata of SEP.

METHODS

Study Population

The MESA is a prospective, longitudinal cohort study of subclinical cardiovascular disease (CVD).[21] Briefly, 6,814 adults aged 45 to 84 years and free of clinical CVD were recruited at six sites: Forsyth County, North Carolina; Northern Manhattan and the Bronx, New York; Baltimore City and Baltimore County, Maryland; St. Paul, Minnesota; Chicago, Illinois; and Los Angeles County, California. Participants who were retired at baseline (n=2,584) were excluded.[12] Pre-retirement physical activity and TV watching measures were not available for these participants and their date of retirement was unknown. Participants with missing data on employment status, physical activity, or covariates at all timepoints also were excluded (n=139). For the remaining 4,091 participants, data were analyzed from five study

exams (2000–2002, 2002–2004, 2004–2005, 2005–2007, 2010–2012), and five follow-up phone calls (2007–2012).

Measures

MESA participants self-reported employment status at exams and follow-up calls. Participants who reported being retired and not working, retired and working, or retired and volunteering were classified as retired. All other participants were classified as not retired (Appendix Table 1). Retirement date was estimated as the midpoint between the last non-retired and first retired exam. Participants were classified as retired for all exams after the first exam at which they reported being retired.[22]

Physical activity and sedentary behavior were self-reported at Exams 1, 2, 3, and 5. The MESA physical activity questionnaire (www.mesa-nhlbi.org/PublicDocs/010101-011231/MESABaselineExamForms/physactivity.pdf) was adapted from the Cross-Cultural Activity Participation Study,[23] which had acceptable test–retest reliability (Intra-Class Correlation coefficients 0.55 to 0.75) and validity (r= 0.45 to 0.51) among women.[24] Participants reported whether they participated in multiple domains of physical activity and sedentary behavior in a typical week of the last month. Participants reported frequency (days/week) and duration (minutes/day) of activity by domain and by perceived intensity for household/yard, caregiving, conditioning, and occupational/volunteer activities.

This study analyzed one overall and six domain-specific physical activity measures. To calculate overall MVPA, MET tasks were assigned (Appendix Table 2), and MET-minutes/week were summed for moderate and vigorous walking, household/yard, caregiving, non-walking leisure activity, and occupational/volunteer activities. Domain-specific measures were: minutes/week of recreational walking, transport walking, household/yard activity, caregiving activity, non-walking leisure activity (sports, conditioning, and individual activities), and MET-minutes/week occupational/volunteer MVPA. TV watching (minutes/week) was the only sedentary behavior assessed consistently across exams.

SEP was calculated as previously in MESA[25] based on self-reported education (high school or less, some college but no degree, associate/bachelor's degree, graduate/professional degree), household income (<$25,000, $25,000–39,999, $40,000–74,999, ≥$75,000), and four indicators of wealth (ownership of a home, car, land/property, or investments). The SEP score (range, 0–10) was the sum of scores for education (0–3 from lowest to highest), income (0–3 from lowest to highest), and one point for each wealth indicator.

Self-rated health relative to others of the same age (worse, same, better) and partnership status (married/living with partner versus not) were self-reported at study exams. Partnership status was not assessed at Exam 2, so it was imputed from the closer of Exams 1 or 3. At each exam, nine chronic conditions were assessed: self-reported asthma, emphysema, or arthritis flare up in the previous 2 weeks; measured high cholesterol or hypertension; self-reported or measured diabetes; and kidney disease, cancer, and CVD ascertained from medical records and hospital billing claims.[21,26]

Statistical Analysis

Participant characteristics were described for the overall study population and by retirement status during follow-up. Participant characteristics were compared by retirement status using chi-square and Kruskal–Wallis tests.

Longitudinal patterns in physical activity and TV watching were described using fixed effect regression.[27] Fixed effect models focus on within-person variation to control for confounding by measured and unmeasured time-fixed characteristics and account for dependence between repeated measures. The timescale for analyses was age, which is meaningful for people who did and did not retire and accommodated repeated measures taken at unequal intervals. Longitudinal models in this study had the form:

$$Y_{ij} = \beta_1 age_{ij} + \beta_2 R_{ij} + \beta_3 t_{ij} + \sum_k \beta_k Z_{ijk} + \alpha_i + \varepsilon_{ij}$$

Age was centered at age 63 years. R_{ij} was a time-varying indicator of retirement, and t_{ij} represented time since retirement (t_{ij}=0 if R_{ij}=0, t_{ij}=age_{ij}-retirement age if R_{ij}=1). The vector Z_{ijk} was a dummy indicator variable for time-varying covariates (partnership status, self-rated health, chronic conditions). α_i was an individual-specific intercept and ε_{ij} was an error term. Y_{ij} represented the log-transformed outcome measure for individual i at time j. Prior to log-transformation, a small value was added to account for zeros in the data. Exponentiated model coefficients represented the percentage change in the outcome associated with retirement (β_2), and percentage change in the outcome per 5-year increase in age among not retired (β_1) and retired ($\beta_1 + \beta_3$) participants, conditional on fixed values of the adjustment variables. Each physical activity measure and TV watching were modeled separately for the entire sample and stratified by SEP (dichotomized at the median). There was no evidence for variation by gender or non-linear changes in outcomes over time. Crude and adjusted estimates were nearly identical so only adjusted estimates are presented. Analyses were conducted in 2017 using SAS, version 9.3.

To address potential residual confounding by health problems that could force retirement and reduce physical activity, sensitivity analyses were conducted among participants (1) in good health throughout follow-up and (2) with chronic diseases (CVD, depression, cognitive impairment, cancer, or chronic obstructive pulmonary disease; Appendix Table 3).[28]

To explore the robustness of findings, retirement was redefined in four sensitivity analyses (Appendix Table 1). First, retirement status was defined in three-levels: not retired (referent), retired and working for pay (n=184 people), and retired and volunteering or not working (n=828 people). Second, retirement status was reassigned at each exam to accommodate retirees who returned to work (n=141, 14% of retirees). Third, retirement was strictly defined as self-identifying as retired, reporting zero work hours, and no occupational physical activity (n=717, 71% of retirees). Fourth, individuals who ever identified as homemakers (n=866), on leave from work, or unemployed (n=855 observations) were excluded.

Additional sensitivity analyses were conducted to assess self-reported physical activity measures and attrition. People reporting ≥18 hours/day of physical activity were excluded and models were additionally adjusted for method of physical activity questionnaire administration (self versus interviewer) and season of exam. To explore potential selection bias, models were weighted by inverse probability of attrition.[29]

RESULTS

These analyses included 4,091 MESA participants who were not retired at baseline of the total MESA sample size of 6,814. Participants in this study were younger, more likely female and of higher SEP, and at baseline had fewer chronic conditions, watched less TV, and engaged in more MVPA compared with excluded participants. At baseline, participants had an average age of 57 years, 56% were female, 40% were non-Hispanic white, 51% had a college degree or higher, 65% lived with a partner, and 62% were employed full-time (Table 1). Participants reported a median of 10 minutes/week non-walking leisure activity, 90 minutes/week recreational walking, 180 minutes/week transport walking, 13.5 hours/week household activity, and 12 hours/week TV watching.

During a median of 9 years of follow-up, 1,012 participants (25%) retired. Median retirement age was 63 years. Compared with participants who did not retire, retirees were more likely male, non-Hispanic white or black, of higher SEP, older, in better health, employed full-time, and reported more MVPA and transport walking at baseline (Table 1). There were 435 retirees with low SEP and 577 with high SEP.

Domain-specific patterns of physical activity and TV watching by retirement status, overall (Table 2) and by SEP (Table 3), are described next. Findings are presented graphically in Appendix Figures 1 and 2.

Retirement was associated with a 10% decrease in MVPA (95% CI= −15%, −5%; Table 2). MVPA declined over time regardless of retirement status at a rate of −4% to −6% per 5 years. Stratified by SEP, retirement was associated with a 24% decrease in MVPA among individuals of low but not high SEP (Table 3).

Retirement was associated with a 9% increase (95% CI=3%, 14%) in non-walking leisure activity in the overall sample (Table 2) and 16% increase (95% CI=8%, 24%) among people of high SEP (Table 3). The average change in non-walking leisure activity per 5 years was small, except for an increase among low SEP retirees.

Retirement was associated with a 13% (95% CI=7%, 20%) increase in recreational walking in the overall sample (Table 2), and among individuals of low and high SEP (17% and 11% increase, respectively; Table 3). Recreational walking increased at a rate of 8% per 5 years in the overall sample with small differences between SEP strata. Retirement was not associated with changes in transport walking (Tables 2 and 3).

At retirement, household/yard activity increased by an average of 29% (95% CI=22%, 36%) in the overall sample (Table 2) and increased in both SEP strata (Table 3). Household/yard activity changed little over time. In the overall sample, retirement was not associated with

changes in caregiving (Table 2). Caregiving activity declined with age among individuals of low but not high SEP (Table 3).

Retirement was associated with a 48% decrease in occupational/volunteer MVPA (95% CI= −52%, −44%) in the overall sample (Table 2) and decreases in both SEP strata (Table 3). Among non-retired participants, occupational/volunteer MVPA declined with age in all SEP strata.

Retirement was associated with a 15% increase in TV watching (95% CI=8%, 21%) in the overall sample (Table 2) and increases in both SEP strata (Table 3). TV watching increased by 11%–17% per 5 years in all retirement and SEP groups.

Among 2,085 participants who were healthy throughout follow-up, 611 retired (226 low SEP and 385 high SEP). In this healthy subset, retirement was associated with a smaller decrease in MVPA among people of low SEP and larger increase in household/yard activity in both SEP strata (Table 4). Among participants with chronic diseases (n=1,435), retirement was associated with a larger decrease in MVPA among individuals of low SEP, and smaller increase in household/yard activity in both SEP strata (Appendix Table 4).

Employing alternative retirement definitions made little impact on the results (data not shown). Among people retired and working (n=184), retirement was not associated with change in MVPA, recreational walking, or non-walking leisure activity. Other findings were similar among retirees who were and were not working. Adjustment for mode of physical activity questionnaire administration and season of exam, exclusion of people reporting excessive activity, and weighting by inverse probability of attrition did not alter the pattern of results (data not shown).

DISCUSSION

In this U.S. cohort, retirement was associated with increased recreational walking, household/yard activities, and TV watching. Among individuals of low SEP, retirement was associated with declines in overall MVPA. Overall MVPA was stable during the retirement transition among participants of high SEP who reported more non-walking leisure activity after retirement. These findings are consistent with increased leisure-time physical activity after retirement observed among people of high SEP but not low SEP,[10,12,15,16] and suggest that the retirement transition may be an important period for physical activity promotion, particularly among individuals of low SEP.[30]

Among retirees of low SEP, declines in occupational activity at retirement were not recouped by increases in other physical activity domains, resulting in decreased overall MVPA. Poor heath is one explanation for this finding. Illness and disability are more common reasons for retirement among people of low SEP[17] and associated with limited physical activity.[31] Retirement was associated with larger decreases in MVPA among individuals of low SEP with chronic diseases. However, persistence of a negative association of retirement with MVPA among healthy retirees of low SEP suggests that poor health does not entirely account for MVPA declines associated with retirement. Future studies could be

strengthened by exploring the role of physical function, which was not consistently measured in MESA.

SEP is a multidimensional construct that can be measured at different points in the lifespan.[32] In this study, adult SEP was measured prior to retirement as a composite of education, income, and wealth.[25] Stratification by education instead of SEP yielded consistent results (data not shown).

Cumulative disadvantage was not measured in this study; however, earlier life opportunities are key determinants of retirement and physical activity.[33–36] Individuals with more debt or lower income are less likely to be able to retire and more likely to return to work after retirement.[34,37] Low SEP can constrain earlier life physical activity through limited leisure-time, disposable income, and the demands of physical labor.[36,38] After retirement, low SEP may be associated with less access to physical activity equipment and residence in a neighborhood lacking physical activity supports (e.g., few parks),[39] whereas age discrimination may discourage activity in public.[40] In addition to SEP, the relationship between retirement and physical activity may vary by race/ethnicity[32]; however, estimates stratified by race/ethnicity and SEP were imprecise due to small numbers of retirees in some subgroups (data not shown). Future research should consider race/ethnicity in addition to SEP to inform intervention development.

The feasibility of intervening to promote physical activity during the retirement transition is not well established.[41] Ninety percent of large worksites offer health promotion programs; however, retirees often are excluded.[42] In addition, although employers assist with financial planning, few resources are available to help workers prepare for post-retirement physical activity.[34] Existing retirement planning resources could be expanded to include health promotion materials.[35] However, racial/ethnic minorities and women have less access to retirement planning and are more likely to retire without the opportunity to plan (e.g., because of job loss).[34] Thus, multiple strategies, including community-based interventions, are needed to avoid exacerbation of health inequities. Experience Corps was a successful intervention among low-income retirees that improved physical activity and strength after retirement.[43] In addition to programming, environmental supports may enable retirees to be physically active.[44] However, despite a strong theoretic rationale, it is not clear how environmental changes affect retirees' physical activity.[45,46]

Retirement was associated with increased TV watching in this sample, which is consistent with findings in other studies.[12,47–50] There was little difference by SEP, contrary to some studies.[12,50] TV watching is the most commonly reported sedentary behavior among older adults.[49,51] It is unclear how retirement affects other domains of sedentary behavior not measured in MESA. For example, Internet and social media could promote sedentary behavior and be a source of information for physical activity. Also, factors that determine whether sedentary work time is replaced by active or sedentary pursuits after retirement have not been identified.[13] Overall sedentary behavior increased at retirement among French[48] but decreased among Australian retirees.[52,53] Future work should explore correlates of sedentary behavior change at retirement.

Limitations

Limitations to this work include reliance on self-reported retirement, physical activity, and TV watching. Perceptions of what it means to be retired may vary among participants. Some retirees continued to work. Sensitivity analyses restricted to retirees reporting zero hours of work did not appreciably change results. However, physical activity differences at retirement were attenuated among retired and working participants, perhaps because retirement influences behavior partly through changes in discretionary time.[16,18] Self-report typically overestimates physical activity and underestimates sedentary behavior relative to accelerometer measures.[54,55] It is not clear whether measurement error in self-reported physical activity or sedentary behavior varied by retirement status. Combined use of self-report and accelerometer measures would strengthen future studies.

The generalizability of findings may be limited because at baseline MESA participants were free of clinical CVD and willing to participate in a longitudinal study, and about 25% of the sample died or was lost to follow-up.[21] However, median retirement age of 63 years and 14% rate of return to work after retirement are consistent with U.S. averages.[34,56] Findings were robust after statistical adjustment for attrition.

Strengths of this study include prospective follow-up of a diverse U.S. cohort with repeated measures of multiple physical activity domains and TV watching. Domain-specific changes in physical activity were explored, which may improve targeting of interventions. Also, fixed effect models controlled for confounding by time-invariant characteristics by design and were adjusted for time-varying confounders. Further, multiple sensitivity analyses explored the robustness of the findings.

CONCLUSIONS

The health of retirement age adults is of increasing public health importance given demographic trends. Almost one quarter of the American workforce is aged 55 years or older[57] and 72 million Americans will be aged 65 years or older by 2030.[58] Although retirement is increasingly viewed as an active phase of life,[36] the prevalence of physical activity among retirees remains low.[6] Interventions during the retirement transition may help support active lifestyles in later life. To inform intervention development, future research is needed on the determinants of behavior change after retirement, particularly among individuals of low SEP.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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References

1. Felner, RD., Farber, SS., Primavera, J. Preventive Psychology: Theory, research and practice. 1. Pergamon Press; 1983. Transitions and stressful life events: A model for primary prevention; p. 199-215.
2. Beck F, Gillison F, Standage M. A theoretical investigation of the development of physical activity habits in retirement. Br J Health Psychol. 2010; 15:663–679. https://doi.org/10.1348/135910709X479096. [PubMed: 19922724]
3. Chodzko-Zajko WJ. American College of Sports Medicine position stand. Exercise and physical activity for older adults. Med Sci Sports Exerc. 2009; 41(7):1510–1530. https://doi.org/10.1249/MSS.0b013e3181a0c95c. [PubMed: 19516148]
4. Wang F, McDonald T, Reffitt B, Edington DW. BMI, physical activity, and health care utilization/costs among Medicare retirees. Obes Res. 2005; 13(8):1450–1457. https://doi.org/10.1038/oby.2005.175. [PubMed: 16129728]
5. U.S. DHHS. Physical Activity Guidelines for Americans. Washington, DC: DHHS; 2008. https://health.gov/paguidelines/pdf/paguide.pdf. Published 2008. Accessed March 31, 2017.
6. King DE, Xiang J. Retirement and Healthy Lifestyle: A National Health and Nutrition Examination Survey (NHANES) Data Report. J Am Board Fam Med. 2017; 30(2):213–219. https://doi.org/10.3122/jabfm.2017.02.160244. [PubMed: 28379828]
7. Kenter EJ, Gebhardt WA, Lottman I, et al. The influence of life events on physical activity patterns of Dutch older adults: A life history method. Psychol Health. 2015; 30(6):627–651. https://doi.org/10.1080/08870446.2014.934687. [PubMed: 24942133]
8. Barnett I, Guell C, Ogilvie D. The experience of physical activity and the transition to retirement: a systematic review and integrative synthesis of qualitative and quantitative evidence. Int J Behav Nutr Phys Act. 2012; 9:97. https://doi.org/10.1186/1479-5868-9-97. [PubMed: 22897911]
9. Baxter S, Johnson M, Payne N, et al. Promoting and maintaining physical activity in the transition to retirement: a systematic review of interventions for adults around retirement age. Int J Behav Nutr Phys Act. 2016; 13(1):12. https://doi.org/10.1186/s12966-016-0336-3. [PubMed: 26830026]
10. Barnett I, van Sluijs EM, Ogilvie D. Physical activity and transitioning to retirement: a systematic review. Am J Prev Med. 2012; 43(3):329–336. https://doi.org/10.1016/j.amepre.2012.05.026. [PubMed: 22898127]
11. Engberg E, Alen M, Kukkonen-Harjula K, et al. Life events and change in leisure time physical activity: a systematic review. Sports Med. 2012; 42(5):433–447. https://doi.org/10.2165/11597610-000000000-00000. [PubMed: 22512413]
12. Barnett I, van Sluijs E, Ogilvie D, Wareham NJ. Changes in household, transport and recreational physical activity and television viewing time across the transition to retirement: longitudinal evidence from the EPIC-Norfolk cohort. J Epidemiol Community Health. 2014; 68(8):747–753. https://doi.org/10.1136/jech-2013-203225. [PubMed: 24302753]
13. Sprod J, Ferrar K, Olds T, Maher C. Changes in sedentary behaviours across the retirement transition: a systematic review. Age Ageing. 2015; 44(6):918–925. https://doi.org/10.1093/ageing/afv140. [PubMed: 26504115]
14. Van Holle V, Deforche B, Van Cauwenberg J, et al. Relationship between the physical environment and different domains of physical activity in European adults: a systematic review. BMC Public Health. 2012; 12:807. https://doi.org/10.1186/1471-2458-12-807. [PubMed: 22992438]
15. Chung S, Domino ME, Stearns SC, Popkin BM. Retirement and physical activity: analyses by occupation and wealth. Am J Prev Med. 2009; 36(5):422–428. https://doi.org/10.1016/j.amepre.2009.01.026. [PubMed: 19269129]

16. Kampfen F, Maurer J. Time to burn (calories)? The impact of retirement on physical activity among mature Americans. J Health Econ. 2015; 45:91–102. https://doi.org/10.1016/j.jhealeco.2015.12.001. [PubMed: 26773282]
17. Henretta JC, Chan CG, O'Rand AM. Retirement reason versus retirement process: examining the reasons for retirement typology. J Gerontol. 1992; 47(1):S1–7. https://doi.org/10.1093/geronj/47.1.S1. [PubMed: 1730861]
18. Feng X, Croteau K, Kolt GS, Astell-Burt T. Does retirement mean more physical activity? A longitudinal study. BMC Public Health. 2016; 16(1):605. https://doi.org/10.1186/s12889-016-3253-0. [PubMed: 27439914]
19. Minority Aging. Administration on Aging website; www.acl.gov/aging-and-disability-in-america/data-and-research/minority-aging. Accessed January 22, 2016.
20. Gassoumis, Z., Linkcoln, K., Vega, W. How low-income minorities get by in retirement: poverty levels and income sources. Los Angeles, CA: USC Edward R. Roybal Institute on Aging; 2011.
21. Bild DE, Bluemke DA, Burke GL, et al. Multi-Ethnic Study of Atherosclerosis: objectives and design. Am J Epidemiol. 2002; 156(9):871–881. https://doi.org/10.1093/aje/kwf113. [PubMed: 12397006]
22. Celidoni M, Rebba V. Healthier lifestyles after retirement in Europe? Evidence from SHARE. Eur J Health Econ. 2017; 18(7):805–830. https://doi.org/10.1007/s10198-016-0828-8. [PubMed: 27670655]
23. Ainsworth BE, Irwin ML, Addy CL, Whitt MC, Stolarczyk LM. Moderate physical activity patterns of minority women: the Cross-Cultural Activity Participation Study. J Womens Health Gend Based Med. 1999; 8(6):805–813. https://doi.org/10.1089/152460999319129. [PubMed: 10495261]
24. Ainsworth, BE., Drowatzky, K. Proceedings of the Community Prevention Research in Women's Health Conference; 2000 October 26-27. Bethesda, MD: NIH; 2000. Evaluation of the CAPS typical week physical activity survey (TWPAS) among minority women.
25. Lemelin ET, Diez Roux AV, Franklin TG, et al. Life-course socioeconomic positions and subclinical atherosclerosis in the Multi-Ethnic Study of Atherosclerosis. Soc Sci Med. 2009; 68(3):444–451. https://doi.org/10.1016/j.socscimed.2008.10.038. [PubMed: 19081660]
26. Hirsch JA, Diez Roux AV, Moore KA, Evenson KR, Rodriguez DA. Change in walking and body mass index following residential relocation: the Multi-Ethnic Study of Atherosclerosis. Am J Public Health. 2014; 104(3):e49–56. https://doi.org/10.2105/AJPH.2013.301773.
27. Allison, PD. Fixed effects regression methods for longitudinal data: using SAS. Cary, NC: SAS Institute; 2005.
28. Shea S, Lima J, Diez-Roux A, Jorgensen NW, McClelland RL. Socioeconomic status and poor health outcome at 10 years of follow-up in the Multi-Ethnic Study of Atherosclerosis. PLoS One. 2016; 11(11):e0165651. https://doi.org/10.1371/journal.pone.0165651. [PubMed: 27875557]
29. Howe CJ, Cole SR, Lau B, Napravnik S, Eron JJ Jr. Selection bias due to loss to follow up in cohort studies. Epidemiology. 2016; 27(1):91–97. https://doi.org/10.1097/EDE.0000000000000409. [PubMed: 26484424]
30. Kelly S, Martin S, Kuhn I, et al. Barriers and facilitators to the uptake and maintenance of healthy behaviours by people at mid-life: A rapid systematic review. PLoS One. 2016; 11(1):e0145074. https://doi.org/10.1371/journal.pone.0145074. [PubMed: 26815199]
31. Jones SA, Wen F, Herring AH, Evenson KR. Correlates of U.S. adult physical activity and sedentary behavior patterns. J Sci Med Sport. 2016; 19(12):1020–1027. https://doi.org/10.1016/j.jsams.2016.03.009. [PubMed: 27053434]
32. Krieger N, Williams DR, Moss NE. Measuring social class in U.S. public health research: concepts, methodologies, and guidelines. Annu Rev Public Health. 1997; 18:341–378. https://doi.org/10.1146/annurev.publhealth.18.1.341. [PubMed: 9143723]
33. O'Rand AM. 2010 SSS Presidential Address: The devolution of risk and the changing life course in the United States. Soc Forces. 2011; 90(1):1–16. https://doi.org/10.1093/sf/90.1.1.
34. Lytle MC, Clancy ME, Foley PF, Cotter EW. Current trends in retirement: Implications for career counseling and vocational psychology. J Career Dev. 2015; 42(3):170–184. https://doi.org/10.1177/0894845314545785. [PubMed: 26034345]

35. McDonald S, O'Brien N, White M, Sniehotta FF. Changes in physical activity during the retirement transition: a theory-based, qualitative interview study. Int J Behav Nutr Phys Act. 2015; 12:25. https://doi.org/10.1186/s12966-015-0186-4. [PubMed: 25889481]
36. Hirvensalo M, Lintunen T. Life-course perspective for physical activity and sports participation. Eur Rev Aging Phys Act. 2011; 8(1):13–22. https://doi.org/10.1007/s11556-010-0076-3.
37. Szinovacz ME, Martin L, Davey A. Recession and expected retirement age: another look at the evidence. Gerontologist. 2014; 54(2):245–257. https://doi.org/10.1093/geront/gnt010. [PubMed: 23448961]
38. Witcher CS, Holt NL, Spence JC, Cousins SO. A case study of physical activity among older adults in rural Newfoundland, Canada. J Aging Phys Act. 2007; 15(2):166–183. https://doi.org/10.1123/japa.15.2.166. [PubMed: 17556783]
39. Jones SA, Moore LV, Moore K, et al. Disparities in physical activity resource availability in six U.S. regions. Prev Med. 2015; 78:17–22. https://doi.org/10.1016/j.ypmed.2015.05.028. [PubMed: 26067479]
40. Ory M, Kinney Hoffman M, Hawkins M, Sanner B, Mockenhaupt R. Challenging aging stereotypes: strategies for creating a more active society. Am J Prev Med. 2003; 25(3 suppl 2): 164–171. https://doi.org/10.1016/S0749-3797(03)00181-8. [PubMed: 14552941]
41. Baxter S, Blank L, Johnson M, et al. Interventions to promote or maintain physical activity during and after the transition to retirement: an evidence synthesis. Public Health Research. 2016; 4(4)
42. Yen L, Schultz AB, McDonald T, Champagne L, Edington DW. Participation in employer-sponsored wellness programs before and after retirement. Am J Health Behav. 2006; 30(1):27–38. https://doi.org/10.5993/AJHB.30.1.3. [PubMed: 16430318]
43. Varma VR, Tan EJ, Gross AL, et al. Effect of Community volunteering on physical activity A randomized controlled trial. Am J Prev Med. 2016; 50(1):106–110. https://doi.org/10.1016/j.amepre.2015.06.015. [PubMed: 26340864]
44. Wilson DM, Palha P. A systematic review of published research articles on health promotion at retirement. J Nursing Scholarship. 2007; 39(4):330–337. https://doi.org/10.1111/j.1547-5069.2007.00189.x.
45. Lieberman L, Golden SD, Earp JA. Structural approaches to health promotion: what do we need to know about policy and environmental change? Health Educ Behav. 2013; 40(5):520–525. https://doi.org/10.1177/1090198113503342. [PubMed: 24048612]
46. Van Cauwenberg J, De Bourdeaudhuij I, De Meester F, et al. Relationship between the physical environment and physical activity in older adults: a systematic review. Health Place. 2011; 17(2): 458–469. https://doi.org/10.1016/j.healthplace.2010.11.010. [PubMed: 21257333]
47. Evenson KR, Rosamond WD, Cai J, Diez-Roux AV, Brancati FL. Influence of retirement on leisure-time physical activity: the Atherosclerosis Risk in Communities Study. Am J Epidemiol. 2002; 155(8):692–699. https://doi.org/10.1093/aje/155.8.692. [PubMed: 11943686]
48. Menai M, Fezeu L, Charreire H, et al. Changes in sedentary behaviours and associations with physical activity through retirement: A 6-year longitudinal study. PLoS One. 2014; 9(9):e106850. https://doi.org/10.1371/journal.pone.0106850. [PubMed: 25259801]
49. Rosenkoetter MM, Gams JM, Engdahl RA. Postretirement use of time: Implications for preretirement planning and postretirement management. Activities Adaptation Aging. 2001; 25(3–4):1–18. https://doi.org/10.1300/J016v25n03_01.
50. Touvier M, Bertrais S, Charreire H, et al. Changes in leisure-time physical activity and sedentary behaviour at retirement: a prospective study in middle-aged French subjects. Int J Behav Nutr Phys Act. 2010; 7:14. https://doi.org/10.1186/1479-5868-7-14. [PubMed: 20181088]
51. Rhodes RE, Mark RS, Temmel CP. Adult sedentary behavior: a systematic review. Am J Prev Med. 2012; 42(3):e3–28. https://doi.org/10.1016/j.amepre.2011.10.020. [PubMed: 22341176]
52. Clark B, Peeters G, Gomersall S, Pavey T, Brown W. Nine year changes in sitting time in young and mid-aged Australian women: Findings from the Australian Longitudinal Study for Women's Health. Prev Med. 2014; 64:1–7. https://doi.org/10.1016/j.ypmed.2014.03.017. [PubMed: 24657548]

53. Ding D, Grunseit AC, Chau JY, et al. Retirement-A transition to a healthier lifestyle?: Evidence from a large Australian study. Am J Prev Med. 2016; 51(2):170–178. https://doi.org/10.1016/j.amepre.2016.01.019. [PubMed: 26972491]

54. Prince SA, Adamo KB, Hamel ME, et al. A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. Int J Behav Nutr Phys Act. 2008; 5:56. https://doi.org/10.1186/1479-5868-5-56. [PubMed: 18990237]

55. Aguilar-Farias N, Brown WJ, Olds TS, Peeters GM. Validity of self-report methods for measuring sedentary behaviour in older adults. J Sci Med Sport. 2015; 18(6):662–666. https://doi.org/10.1016/j.jsams.2014.08.004. [PubMed: 25172367]

56. O'Rand, AM., Hamil-Luker, J. Late employment careers, transitions to retirement and retirement income in the U.S. In: Kurz, K.Buchholz, S., Blossfeld, H-P., editors. Aging Populations, Globalization and the Labor Market: Comparing Late Working Life and Retirement in Modern Societies. Cheltenham: Edward Elgar Publishing; 2011. p. 283-307.https://doi.org/10.4337/9781849805858.00019

57. Toossi, M. Monthly Labor Review. Washington, DC: US Bureau of Labor Statistics; Labor force projections to 2022 the labor force participation rate continues to fall. https://doi.org/10.21916/mlr.2013.40

58. National Center for Chronic Disease Prevention and Health Promotion. The state of aging and health in America. Atlanta, GA: CDC; 2013. www.cdc.gov/aging/pdf/State-Aging-Health-in-America-2013.pdf. Published 2013. Accessed March 17, 2017.

Table 1

Participant Characteristics Overall by Employment Status at Follow-up, MESA (N=4,091)

Baseline characteristics	Overall[a] (N=4,091)	Retirement status at follow-up	
		Not retired[a] (N=3,079)	Retired[a] (N=1,012)
Age (years), mean ± SD	57.3 ± 8.9	56.9 ± 9.4	58.4 ± 6.9
Female	2,309 (56)	1,768 (57)	541 (53)
Race/ethnicity, n (%)			
Non-Hispanic white	1,628 (40)	1,193 (39)	435 (43)
Chinese American	522 (13)	416 (14)	106 (10)
Non-Hispanic black	975 (24)	680 (22)	295 (29)
Hispanic	966 (24)	790 (26)	176 (17)
Education, n (%)			
<High school	684 (17)	581 (19)	103 (10)
Some college, no degree	1,303 (32)	950 (31)	353 (35)
≥Bachelor's degree	2,102 (51)	1,547 (50)	555 (55)
Low SEP, n (%)	2,003 (49)	1,568 (51)	435 (43)
Married / with partner, n (%)	2,636 (65)	1,994 (65)	642 (64)
Baseline job, n (%)			
Homemaker	749 (18)	694 (23)	55 (5)
Employed full time	2,549 (62)	1,799 (58)	750 (74)
Employed part time	570 (14)	411 (13)	159 (16)
On leave or unemployed	221 (5)	174 (6)	47 (5)
Self-rated health, n (%)			
Better	2,131 (53)	1,554 (51)	577 (57)
Same	1,612 (40)	1,261 (41)	351 (35)
Worse	316 (8)	239 (8)	77 (8)
MESA site, n (%)			
Forsyth, NC	594 (15)	383 (12)	211 (21)
New York City, NY	653 (16)	488 (16)	165 (16)
Baltimore, MD	584 (14)	442 (14)	142 (14)
St. Paul, MN	713 (17)	527 (17)	186 (18)
Chicago, IL	743 (18)	543 (18)	200 (20)
Los Angeles, CA	804 (20)	696 (23)	108 (11)
Physical activity, median (IQR)			
MVPA (MET-minutes/week)	4,590 (2,190, 8,475)	4,425 (2,098, 8,370)	5,220 (2,513, 9,025)
Non-walking leisure (minutes/week)	10 (0, 180)	3 (0, 180)	15 (0, 180.0)
Recreation walking (minutes/week)	90 (0, 225)	90 (0, 225)	90 (0, 240.0)
Transport walking (minutes/week)	180 (45, 420)	150 (35, 375)	180 (60, 420.0)
Household/yard (minutes/week)	810 (420, 1,370)	815 (420, 1,380)	765 (390, 1,290)
Caregiving (minutes/week)	0 (0, 180)	0 (0, 180.0)	0 (0, 165)
Occupational/volunteer	0 (0, 2,880)	0 (0, 2,700)	450 (0, 3,600)
MVPA (MET-minutes/week)			

Baseline characteristics	Overall[a] (N=4,091)	Retirement status at follow-up	
		Not retired[a] (N=3,079)	Retired[a] (N=1,012)
TV watching (hours/week), median (IQR)	12 (5, 18)	12 (5, 19)	12 (6, 18)

MVPA, moderate to vigorous physical activity; SEP, socioeconomic position; IQR, interquartile range; MESA, Multi-Ethnic Study of Atherosclerosis

Table 2

Change[a] in Physical Activity and TV Watching by Retirement Status (N=4,091)

Behavior	Mean change associated with retirement[b] (95% CI)	Mean 5-year change[c] (95% CI)	
		Not retired	Retired
MVPA	0.90 (0.85, 0.95)	0.94 (0.92, 0.96)	0.96 (0.90, 1.02)
Non-walking leisure	1.09 (1.03, 1.14)	1.01 (1.00, 1.03)	1.02 (0.97, 1.08)
Recreation walking	1.13 (1.07, 1.20)	1.08 (1.06, 1.10)	1.08 (1.01, 1.14)
Transport walking	0.99 (0.93, 1.06)	1.02 (0.99, 1.04)	1.01 (0.94, 1.08)
Household/yard activity	1.29 (1.22, 1.36)	1.02 (1.00, 1.04)	0.97 (0.91, 1.02)
Caregiving activity	1.00 (0.93, 1.07)	0.98 (0.96, 1.00)	0.97 (0.90, 1.05)
Occupational/volunteer	0.52 (0.48, 0.56)	0.84 (0.82, 0.87)	1.03 (0.95, 1.11)
MVPA			
TV watching	1.15 (1.08, 1.21)	1.14 (1.12, 1.16)	1.14 (1.08, 1.21)

[a]Values are exponentiated coefficients from linear models of log-transformed outcomes. Values can be interpreted as percentage differences, for example 1.07 represents a 7% increase in the outcome associated with retirement, conditional on adjustment variables (self-reported health, partnership status, and 9 chronic conditions: asthma, emphysema, arthritis flare up, high cholesterol, hypertension, diabetes, kidney disease, cancer, cardiovascular disease). Data presented graphically in Appendix Figure 1.

[b]Exponentiated mean difference in log-transformed outcome associated with retirement, conditional on adjustment variables.

[c]Exponentiated mean difference in log-transformed outcome associated with 5-year increase in age among retired and not retired participants, conditional on adjustment variables.

MVPA, moderate to vigorous physical activity

Table 3

Change[a] in Physical Activity and TV Watching by Retirement Status and Socioeconomic Position (N=4,091)

Behavior	Low SEP (N=2,003)			High SEP (N=2088)		
	Mean change associated with retirement[b] (95% CI)	Mean 5-year change[c] (95% CI)		Mean change associated with retirement[b] (95% CI)	Mean 5-year change[c] (95% CI)	
		Not retired	Retired		Not retired	Retired
MVPA	0.76 (0.68, 0.84)	0.89 (0.86, 0.92)	0.96 (0.87, 1.07)	1.01 (0.95, 1.09)	0.98 (0.96, 1.00)	0.95 (0.89, 1.02)
Non-walking leisure	1.00 (0.92, 1.08)	1.01 (0.99, 1.04)	1.09 (1.01, 1.18)	1.16 (1.08, 1.24)	1.02 (1.00, 1.04)	0.98 (0.91, 1.05)
Recreation walking	1.17 (1.06, 1.29)	1.06 (1.03, 1.09)	1.04 (0.94, 1.15)	1.11 (1.03, 1.19)	1.09 (1.07, 1.12)	1.10 (1.02, 1.19)
Transport walking	0.99 (0.89, 1.10)	1.02 (0.99, 1.06)	1.02 (0.91, 1.13)	1.00 (0.92, 1.08)	1.01 (0.98, 1.04)	1.00 (0.92, 1.09)
Household/yard activity	1.20 (1.09, 1.32)	0.99 (0.96, 1.02)	0.97 (0.88, 1.06)	1.36 (1.27, 1.45)	1.05 (1.02, 1.07)	0.97 (0.91, 1.04)
Caregiving activity	1.08 (0.96, 1.22)	0.94 (0.91, 0.98)	0.83 (0.73, 0.95)	0.94 (0.86, 1.03)	1.01 (0.98, 1.04)	1.09 (0.99, 1.19)
Occupational/volunteer MPVA	0.43 (0.38, 0.48)	0.80 (0.77, 0.83)	1.02 (0.90, 1.16)	0.59 (0.54, 0.65)	0.88 (0.85, 0.91)	1.03 (0.94, 1.13)
TV watching	1.13 (1.03, 1.24)	1.15 (1.12, 1.19)	1.11 (1.00, 1.22)	1.16 (1.08, 1.24)	1.13 (1.11, 1.16)	1.17 (1.09, 1.26)

[a] Values are exponentiated coefficients from linear models of log-transformed outcomes. Values can be interpreted as percentage differences, for example 1.07 represents a 7% increase in the outcome associated with retirement, conditional on adjustment variables (self-reported health, partnership status, and 9 chronic conditions: asthma, emphysema, arthritis flare up, high cholesterol, hypertension, diabetes, kidney disease, cancer, cardiovascular disease). Data are presented graphically in Appendix Figure 2.

[b] Exponentiated mean difference in log-transformed outcome associated with retirement, conditional on adjustment variables.

[c] Exponentiated mean difference in log-transformed outcome associated with 5-year increase in age among retired and not retired participants, conditional on adjustment variables.

MVPA, moderate to vigorous physical activity; SEP, socioeconomic position

Table 4

Change[a] in Physical Activity and TV Watching by Retirement and SEP in Healthy Subset[b] (N=2,085)

Behavior	Low SEP (N=828)			High SEP (N=1,257)		
	Mean change associated with retirement[c] (95% CI)	Mean 5-year change[d] (95% CI)		Mean change associated with retirement[c] (95% CI)	Mean 5-year change[d] (95% CI)	
		Not retired	Retired		Not retired	Retired
MVPA	0.81 (0.71, 0.93)	0.88 (0.85, 0.92)	0.93 (0.81, 1.07)	1.06 (0.97, 1.15)	0.98 (0.96, 1.01)	0.93 (0.86, 1.01)
Non-walking leisure	0.97 (0.97, 1.08)	1.00 (0.97, 1.03)	1.09 (0.97, 1.21)	1.14 (1.05, 1.24)	1.03 (1.00, 1.05)	1.00 (0.92, 1.09)
Recreation walking	1.15 (1.02, 1.33)	1.08 (1.04, 1.13)	1.02 (0.89, 1.17)	1.15 (1.05, 1.26)	1.11 (1.08, 1.14)	1.09 (1.00, 1.19)
Transport walking	1.02 (0.88, 1.18)	1.00 (0.96, 1.05)	1.01 (0.87, 1.16)	1.01 (0.91, 1.11)	1.01 (0.98, 1.04)	0.99 (0.90, 1.09)
Household/yard activity	1.33 (1.17, 1.50)	1.00 (0.97, 1.04)	0.90 (0.80, 1.02)	1.44 (1.33, 1.56)	1.06 (1.03, 1.08)	0.96 (0.89, 1.04)
Caregiving activity	1.19 (1.00, 1.42)	0.94 (0.89, 0.99)	0.75 (0.63, 0.89)	1.01 (0.91, 1.13)	1.03 (0.99, 1.06)	1.01 (0.91, 1.12)
Occupational/volunteer MVPA	0.44 (0.37, 0.52)	0.78 (0.74, 0.82)	1.10 (0.92, 1.31)	0.60 (0.54, 0.67)	0.86 (0.83, 0.89)	1.02 (0.91, 1.14)
TV watching	1.11 (0.98, 1.26)	1.16 (1.12, 1.21)	1.11 (0.97, 1.26)	1.19 (1.10, 1.30)	1.12 (1.09, 1.15)	1.11 (1.03, 1.21)

[a]Values are exponentiated coefficients from linear models of log-transformed outcomes. Values can be interpreted as percentage differences, for example 1.07 represents a 7% increase in the outcome associated with retirement, conditional on adjustment variables (self-reported health, partnership status, and 9 chronic conditions: asthma, emphysema, arthritis flare up, high cholesterol, hypertension, diabetes, kidney disease, cancer, cardiovascular disease).

[b]Restricted to participants present at study exam 5 and free of cardiovascular disease, depression, cognitive impairment, cancer, and chronic obstructive pulmonary disease throughout follow-up.

[c]Exponentiated mean difference in log-transformed outcome associated with retirement, conditional on adjustment variables.

[d]Exponentiated mean difference in log-transformed outcome associated with 5-year increase in age among retired and not retired participants, conditional on adjustment variables.

MVPA, moderate to vigorous physical activity; SEP, socioeconomic position