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TITLE
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YEAR
2024

DOI
10.1123/jpah.2023-0558

CITATION
Fröberg, A., Sacco, L., Suorsa, K., Leskinen, T., Hettiarachchi, P., Svartengren, M., Stenholm, S., & Westerlund, H. (2024). Changes in Accelerometer-Measured Physical Activity and Sedentary Time Across Retirement Transition as a Predictor of Self-Rated Health. *Journal of Physical Activity and Health, 21*(8), 778–786. https://doi.org/10.1123/jpah.2023-0558

VERSION
Accepted Manuscript

Changes in accelerometer measured physical activity and sedentary time across retirement transition as a predictor of self-rated health

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Manuscript type: Original Research

Keywords: Accelerometers; aging; health; older adults; physical activity.

Manuscript word count: 5556

Abstract word count: 249

Date of manuscript submission: 2023-09-29

Brief running head: Physical activity and self-rated health

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Abstract

Background: Retirement transition has shown to associate with changes in physical activity (PA) and self-rated health (SRH), but their interrelationship is less studied. The aim was to investigate changes in accelerometer measured total PA, moderate-to-vigorous PA (MVPA) and sedentary time across retirement transition as a predictor of self-rated health.

Methods: Data from the Swedish Retirement Study and the Finnish Retirement and Aging study was harmonized and pooled. Data from three waves (about 12 months apart) was included: one pre-retirement (wave 1) and two post-retirement follow-ups (wave 2-3). Totally 245 participants (27% men) were included. Thigh-worn accelerometers were used to collect data for PA variables (wave 1-2), and SRH was obtained from the questionnaire (wave 1-3).

Results: Between wave 1 and 2, total PA decreased with 11 (CI:-22;-1) minutes per day, MVPA was stable (0 [CI:-3;3] min), and sedentary time decreased non-significantly with 9 (CI:-20;1) minutes. SRH changed between all three waves (all, $p<0.001$). At pre-retirement, 10 more minutes of MVPA was associated with greater odds of better SRH when adjusting for accelerometer wear-time, cohort, sex and age, and occupational status (OR:1.11 (95%CI:1.02-1.22)). This association was no longer statistically significant when additionally adjusting for marital status, BMI, and smoking. No significant associations were observed between changes in the PA variables during retirement transition, and SRH at post-retirement follow-ups.

Conclusion: This study showed a cross-sectional association between MVPA and greater odds of reporting better SRH before retirement. No longitudinal associations were observed between changes in the PA variables from before to after retirement and later change in SRH.

Background

Physical activity (PA) is a critical determinant of health and well-being among people from all age groups, and many of the health benefits are achieved when performing moderate-to-vigorous PA (MVPA). [1] In particular, PA among older adults promotes healthy ageing by reducing the risk of chronic diseases, functional limitations, falls and fractures and cardiovascular and all-cause mortality, as well as by improving quality of life and cognitive functioning. [2] The deleterious health effects of sedentary time have also been increasingly recognised during the past decades [1,3] and therefore also included in the World Health Organization's PA recommendations. [1]

Across the life course, extent of time spent in PA and sedentary time may change due to life events and transitions, and one such major late mid-life transition is retirement. [4,5] Retirement removes work exposures and increases flexibility in time use and may therefore enable substantial changes in daytime routines. Studies based on both self-reported and accelerometer data show that retirement generally is associated with a decrease in total PA, but that PA may change differently across domains. [6,7] For example, occupational PA and active transportation generally decrease, while recreational, leisure-time and domestic PA increase. [6] Regarding sedentary time, daily total and prolonged accelerometer-based sedentary time increases after retirement, especially among manual workers. [8,9] Based on self-reported data, time spent sitting while watching TV and using computer at home increases, whereas sitting in a vehicle decreases after retirement. [10-12]

Furthermore, retirement transition may associate with several health and well-being indicators. For example, longitudinal studies suggest that mental health and sleep may improve across the retirement transition. [13-16] Among other outcomes, self-rated health is a widely used global measure of general health often used in population health surveys. [17] Among older adults, several factors are associated with self-rated health, such as the number of chronic conditions and the presence of depressive symptoms, [18] but there are currently mixed longitudinal findings for changes in self-rated health across the retirement transition. [19,20]

To date, there is lack of longitudinal studies that have investigated changes in PA and sedentary time, and self-rated health across the retirement transition. [18] However, there are some cross-sectional studies that have investigated associations between accelerometer measured PA and self-rated health among older adults. [21] One study that involved older adults aged 65-85 years, of which 82 percent were retired, found that those who reported having very good health had approximately 50 percent more PA compared to those who reported poor or very poor health. [21] However, longitudinal studies would improve our knowledge on how changes in PA influence self-rated health over time.

Little is also known regarding whether changes in PA and sedentary time have any impact on self-rated health across the retirement transition depending on the occupational status. Of interest in relation to PA during retirement transition is the so-called “physical activity paradox” which suggest that the health benefits generally observed for leisure-time PA are not found for occupational PA. [22,23] There is also some evidence to suggest that PA and sedentary time change differently upon retirement depending on occupational status. For example, some studies show that those with higher occupational status and non-manual workers have more favourable changes in PA compared to those with lower occupational status, [6-8,16,24] and that increases in sedentary time are most pronounced among manual workers. [8,9] However, those who retire from physically more demanding work may reduce some of their low intensity, long duration activity that may characterise many manual works, in favour of relatively higher intensity, recreational PA, perhaps positively affecting self-rated health.

The aim of the current study was to investigate changes in accelerometer measured total PA, MVPA and sedentary time across retirement transition as a predictor of self-rated health. In addition, we examined whether the associations are different for non-manual and manual workers. This was done by harmonizing and pooling data from two longitudinal studies that used similar methods.

Materials and Methods

For this study, data from the Swedish Retirement Study (SRS) and the Finnish Retirement and Aging (FIREA) study was harmonized and pooled to increase the sample size and allow for more robust analyses and conclusions.

The SRS cohort included 119 participants aged between 60 and 72 years and still in paid work at baseline that was prospectively followed across the retirement transition. [25,26] Of these, 99 participants were recruited from two waves (2016 and 2018) of the large Swedish Longitudinal Occupational Survey of Health (SLOSH), and another 20 participants from Aging at work study that aimed to validate the SLOSH questionnaire items among older adult workers. [25-27] In SRS, 111 participants were considered for inclusion as they planned to retire within two years of the study timeframe which meant that they had to decrease their working hours by at least 50% of full-time, resulting in no more than 25 percent of full-time. To be included in the present study, participants were required to have not been on sick leave or unemployed for more than three months over the past year and were not working night shifts (between 22:00 and 06:00 h). The SRS study was approved by the Regional Ethical Review Board in Stockholm and the Swedish Ethical Review (#2022-01930-02; and #2014/486-31/5), and all participants provided written informed consent. [25,26]

The FIREA study is an ongoing cohort study established in 2013 and includes working aged adults who are followed up from the final working years into retirement. [28] The FIREA cohort included all adults who in 2012 worked in the public sector in one of the 27 municipalities in southwest Finland, or in one of the nine selected cities or five hospital districts around Finland, and whose estimated full-time retirement date (information from pension register) was between 2014 and 2019. Participants were first contacted 18 months prior to their estimated retirement date by sending them a questionnaire. After responding to the questionnaire, Finnish-speaking participants with estimated retirement date between 2017 and 2019, who lived in Southwest Finland and were still working, were invited to participate in the clinical sub-study (n=773). Of them, 290 agreed to participate and were followed up with annual questionnaires and accelerometer measurements across the transition to retirement. The FIREA study was approved by the Ethics Committee of Hospital District of Southwest Finland (#84-1801-2014). Informed consent was obtained from all the participants.

In this paper, we used data from three waves of data collection: the pre-retirement (wave 1), and 2 post-retirement follow-ups (wave 2 and wave 3). In both the SRS and FIREA cohort, wave 1 was conducted approximately six months pre-retirement, whereas wave 2 and wave 3 were conducted approximately six- and 18-months post-retirement, respectively. In total, pre- and post-retirement data was available from 119 participants from SRS, and 243 participants from FIREA.

To be included in the analysis, the participants were required to provide accelerometer data for wave 1 and wave 2, and questionnaire data for self-rated health from wave 1, wave 2, and/or wave 3. Shift workers and those who reported working during wave 2 were excluded from the analyses. Based on these inclusion criteria, 245 participants (27% men) were included in the analyses. Of those excluded, 69 did not provide at least four days of accelerometer-data at wave 1 (n=38) and wave 2 (n=31), and 20 lacked data for at least one workday (n=20) or one day off (n=3) at wave 1. Furthermore, 25 participants were excluded because they were shift workers (n=7) or reported working at wave 2 (n=18). A flow chart depicting the number of participants from SRS and FIREA clinical study during the recruitment process and across waves, and reasons for excluding participants is available in Figure 1.

Accelerometer measurements

In the SRS cohort, participants wore two accelerometers. Data for total PA, MVPA and sedentary time was collected with thigh worn triaxial Axivity (Axivity AX3, Axivity Ltd., Newcastle, UK) accelerometers. In addition, wrist worn ActiGraph (ActiGraph LCC, Pensacola, FL, USA) of model wActiSleep or wGT3X, which are fully comparable in output, was used to estimate sleep. The accelerometers were mailed to the participants, along with instructions (text and photographs) on how to attach the accelerometers into standardized positions. Participants were asked to wear accelerometers for at least four days (≥2 weekdays and ≥2 weekend days) at wave 1, and at least four days at wave 2.

In FIREA, data for total PA, MVPA and sedentary time was collected with triaxial Axivity (Axivity AX3, Axivity Ltd., Newcastle, UK) accelerometers. A study nurse attached the accelerometers to the right thigh into a standardized position [29] at wave 1 and wave 2. The participants were asked to wear the accelerometer for at least four days and nights (≥2 workdays and ≥2 days off) at wave 1, and then at least four days and nights at wave 2.

In both SRS and FIREA, the participants were instructed to wear the accelerometers across the whole 24-h day, including during water-based activities such as showering and bathing. Participants were also asked to record date, waking time, bedtime, reference measurement times and information about workday on a daily log for each day that they wore the devices.

Collected accelerometer data from wave 1 and wave 2 was processed and harmonized for time spent in different PA intensities. Accelerometer data was processed through ActiPASS, [30] which is a more automated version of Acti4 software. [29,31,32] The device specific calibration of raw tri-axial data of each accelerometer measurement was done according to auto-calibration algorithm by Hees et al. [33,34] Any orientation issues in accelerometer placement on the participants' thigh was auto corrected using ActiPASS built-in orientation correction. Non-wear periods were determined automatically by ActiPASS according to Acti4 non-wear detection algorithm [33] and excluded. Additionally in the SRS cohort most participants wore the accelerometer devices for two days in the early part of the measurement week and for two days over the weekend, meaning that accelerometers were not worn for a time of approximately two days in between. In order to assure data quality, an analyst closely inspected each participants activity diagram recording exact times when the accelerometers were removed and put back for participants who had this by-design gap in wear time. This data assurance step was made to prevent that movement of the accelerometers during these periods could not be erroneously classified as movement behaviour from the participant.

For participant-specific calibration, automatic-reference-positions (as determined by ActiPASS) were used in SRS, [33] whereas standing-reference-positions were used for participant-specific calibration in FIREA. Given that the focus was on waking time behaviors, sleep time was excluded from the analyses. In SRS, sleep time was determined through wrist worn ActiGraph (self-reports from night diaries were used for two cases as data from ActiGraph was not available), whereas sleep time in FIREA was determined based on waking and bedtimes reported in the daily log.

Using ActiPASS algorithms, time spent in total PA was estimated by summarizing standing, moving, slow walking with a cadence less than 100 steps/min, fast walking with a cadence 100 steps/min or more, [35] stair walking, running, cycling and other PA. MVPA was estimated by combining fast walking, stair climbing, running, cycling, and other PA. Sedentary time represented time spent in lying and sitting postures.

To be included in the analyses, a minimum of four valid accelerometer measurement days, defined as at least 10 hours of accelerometer wear time during waking hours, at both wave 1 and wave 2 were required. At least one valid workday and one valid non-workday or day off were required for wave 1, and at least two valid days (days off) for wave 2. Mean time spent in total PA, MVPA, and sedentary time was calculated from all valid days. If participants had more days at each wave, the arithmetic mean of total PA, MVPA, and sedentary time for all valid days was calculated. Changes in average minutes per day between wave 1 vs. wave 2 were determined for total PA, MVPA and sedentary time.

Self-reported health

The self-rated health question had five response options in both SRS and FIREA, however, the wording was somewhat different. In SRS, the five response alternatives were 1) “Very poor”, 2) “Poor”, 3) “Neither good or bad”, 4) “Good”, and 5) “Very good”, whereas FIREA used the response alternatives 1) “Poor”, 2) “Rather poor”, 3) “Average”, 4) “Rather good”, and 5) “Good”. As there were few participants who reported poor health, we pooled the data for self-rated health into three groups: the first group involved those who reported to one of the first three (1-3) alternatives that represented sub-optimal health. The second group included those who reported good health (4), whereas the third group included those who reported optimal health (5).

Background information

In both SRS and FIREA, questionnaires and registers were used to collect data on background information, such as marital status, chronic diseases, smoking, and body mass index (BMI). In the analysis, we used information from the pre-retirement measurement (wave 1).

Information about sex, age (date of birth), and occupational status were obtained from registers in both SRS (the Swedish longitudinal integrated database for health insurance and labour market studies, LISA) and FIREA (pension insurance institute for the municipal sector in Finland, Keva). Occupational status was based on occupational titles and classified according to the International Standard Classification of Occupations (ISCO) categorization and dichotomised into “Non-manual” (ISCO 1-4) and “Manual” (ISCO 5-9).

Furthermore, questionnaires were used to collect data for marital status, chronic diseases, smoking and body mass index (BMI). However, as the items used in SRS and FIREA were not identical, some of the variables were harmonized to allow for pooling of the data. The harmonized variables are presented in the next section. A detailed overview of the original items is available as supplementary materials.

The variable marital status was dichotomised into “Married or cohabiting” and “Not married or other”. The participants also added information on whether they have had any chronic diseases. The question was “Has your doctor ever told that you have or have had….”, followed by lists of chronic diseases. The participants responded “Yes”, “Yes, doesn’t affect life”, “Yes, affects a little”, “Yes, affects life a lot” (combined into “Yes, before or currently”), and “No” in SRS, and “Yes, before or currently” or “No” in FIREA. The responses for chronic disease were summarised for angina pectoris, cerebrovascular disease, diabetes, fibromyalgia, osteoarthritis, osteoporosis, and sciatica, and trichotomized into none, one, and more than one chronic disease. Data on smoking was collected and dichotomised into “Current smoker” and “Non-smoker (never and former)”. BMI (kg/m^2) was calculated based on self-reported body weight and height.

Statistical analyses

Descriptive data was obtained from wave 1 and presented as proportions (categorial variables) and means and standard deviations (SD) (continuous variables). Chi-Square tests were conducted to analyse differences in self-rated health across the three waves. Ordinal regression analyses were then used to investigate associations between total PA, MVPA and sedentary time, and self-rated health across the retirement transition. We conducted three sets of analyses, separately for total PA, MVPA and sedentary time in 10-minute units. First, total PA, MVPA and sedentary time at wave 1 was used as predictor, and self-rated health at wave 1 was used at the outcome (first set). Then changes in total PA, MVPA and sedentary time between wave 1 and wave 2 were used as predictors, and self-rated health at wave 2 (second set) and wave 3 (third set) were used at the outcomes.

Each set of analyses were conducted with three models: the first model (model 1) was adjusted for accelerometer wear-time, cohort, and sex and age; the second model (model 2) was adjusted for accelerometer wear-time, cohort, sex and age, and occupational status; and the third model (model 3) was adjusted for accelerometer wear-time, cohort, sex and age, occupational status, marital status, and BMI, and smoking. When analysing changes in total PA, MVPA and sedentary time between wave 1 and wave 2, and self-rated health at wave 2 and wave 3, we also adjusted the analyses for self-rated health at wave 1. Possible interactions were tested for the variables sex and occupational status. If present, the analyses were conducted stratified by groups. To explore the robustness of the findings, sensitivity analyses were conducted with linear regression models with the independent variable self-rated health treated as a categorical variable (available as supplementary materials). The IBM SPSS Statistics for Windows software (version 29) was used to conduct the statistical analyses.

Results

Descriptive pre-retirement data for participant characteristics at wave 1 is presented in Table 1. Among the 245 participants that were included in the analyses, the mean age at wave 1 was 63.9 (±1.5) years. Most participants were married or cohabiting (63%), had non-manual occupations (74%), reported no chronic disease (68%), and were non-smokers (93%).

The mean number of valid days of accelerometer-data at wave 1 and wave 2 was 4.6 (CI: 4.5 to 4.8) and 4.5 (CI: 4.4 to 4.6) days, respectively. The mean accelerometer wear time was 942 (CI: 936 to 948) minutes per day at wave 1, and 921 (CI: 915 to 928) minutes per day at wave 2.

Table 2 presents average levels of total PA, MVPA, and sedentary time at different study waves in the pooled cohort. At wave 1, adjusted analyses (cohort, sex, age, occupational status, and accelerometer wear-time) showed that mean total PA was 355 (CI: 344 to 367) minutes, MVPA 75 (CI: 71 to 78) minutes, and sedentary time 587 (CI: 575 to 598) minutes. Between wave 1 and wave 2, total PA decreased with 11 (CI: -22 to -1) minutes, MVPA was stable (0 [CI: -3 to 3] min per day), and sedentary time decreased non-significantly with 9 (CI: -20 to 1) minutes.

Figure 2 show the proportion of participants who reported sub-optimal health, good health, and optimal health across the three waves in the pooled cohort. Self-rated health differed between all three waves (all, $p < 0.001$). At all three waves, most participants reported good or optimal health. The proportion who reported optimal health was highest at wave 2 (40%) and wave 3 (42%). Between wave 1 and wave 2, 9 percent of the participants reported worse self-rated health, 70 reported identical, and 21 percent reporter better. Furthermore, between wave 1 and 3, 11 percent reported worse self-rated health, 65 percent reported identical, and 24 percent reporter better self-rated health.

Table 3 present the ordinal regression models with total PA, MVPA and sedentary time, and self-rated health across the three waves. There was no significant association between total PA and sedentary time, and self-rated health at wave 1. However, 10 more minutes of MVPA was significantly associated with greater odds of reporting better self-rated health at wave 1 when adjusting for accelerometer wear-time, cohort, sex and age, and occupational status (OR 1.11 (95% CI 1.02-1.22). The association between MVPA and self-rated health was no longer statistically significant when additionally adjusting for marital status, BMI, and smoking (model 3).

Furthermore, there were interactions between MVPA and occupational status at wave 1 ($p < 0.05$). Among non-manual workers, total PA (8 [CI: -4 to 20] min per day) and MVPA (1 [CI: -2 to 5] min per day) increased non-significantly, whereas sedentary time decreased significantly with 29 (CI: -41 to -17) minutes between wave 1 and wave 2. Manual workers significantly decreased their total PA with 67 (CI: -90 to -44) minutes, whereas MVPA changed non-significantly (-4 [CI: -10 to 1] min per day), and sedentary time increased significantly with 47 (CI: 24 to 70) minutes between wave 1 and wave 2.

The ordinal regression models (adjusted for accelerometer wear-time, cohort, sex, and age) showed that 10 more minutes of MVPA was significantly associated with greater odds of reporting better self-rated health among non-manual workers (OR: 1.15 [1.03-1.28]) but not among manual workers (model 2: OR: 1.02 [0.86-1.22]). When additionally adjusting for marital status, BMI, and smoking, no significant association was observed for non-manual and manual workers.

The analyses also showed no significant associations between changes in total PA, MVPA and sedentary time between wave 1 and wave 2, and self-rated health at wave 2 and wave 3, adjusting for the variables stated above, as well as self-rated health at wave 1 (Table 3).

Discussion

This paper used harmonized and pooled data from two longitudinal studies that used similar methods to investigate changes in accelerometer measured total PA, MVPA and sedentary time across retirement transition as a predictor of self-rated health. The main finding of this study was that, while higher MVPA was significantly associated with greater odds of reporting better self-rated health before retirement, no such associations were observed between changes in total PA, MVPA and sedentary time from before to after retirement (wave 1 to wave 2, 6 months later), and later self-rated health (wave 2 to wave 3, 12 months later).

In this study, we found a cross-sectional association between MVPA and self-rated health at pre-retirement. This is similar to a previous cross-sectional study that investigated associations between accelerometer measured PA and self-rated health among older adults aged 65-85 years. [21] When our analyses were stratified by occupational status, this association was present only among non-manual workers, whose higher pre-retirement MVPA was associated with reporting greater self-rated health before retirement. However, caution should be used when interpreting this association, given that it is cross-sectional and may reflect reverse causality, i.e., healthier individuals are more likely to be able to perform MVPA, though, for example, commuting or regular exercise. Also, the results in this study do not indicate whether MVPA was accumulated during work or leisure time.

Moreover, we found that total PA decreased during retirement transition (between wave 1 and wave 2), while MVPA was stable, and sedentary time decreased. The findings for PA are similar to previous studies with both self-reported and accelerometer data. [6,7] Our finding that self-rated health changed across retirement transition is somewhat in line with previous studies, although mixed findings have been reported. [19,20] In this study, changes in PA were not significantly associated with self-rated health at wave 2 and wave 3. Different explanation for the lack of an association over retirement may exist. One explanation could be that we observed somewhat small changes in total PA, and no significant changes in MVPA and sedentary time. In relation to this, the lack of power may be one explanation why no associations in the longitudinal analyses were observed.

An alternative explanation would be that different changes that the non-manual and manual workers made in terms of their PA and sedentary time may counterbalanced each other. For example, between wave 1 and wave 2, we observed that manual workers significantly decreased their total PA and increased their sedentary time. One explanation may be that manual workers reductions in occupational PA, which may improve health, as occupational PA may be detrimental according to the PA paradox, [22,23] are balanced out by increases in sedentary time, which are instead detrimental for health. [1] In addition, manual workers may replace work-related PA not only with sedentary time but also with leisure time PA and sleep which may benefit health. [36] Therefore, future research may explore compositional effects of PA on health, and distinguish between domains of PA, e.g., transportation, occupational, and leisure time. An additional explanation is that, given that the analyses were controlled for baseline self-rated health, selection effects, akin to the "healthy worker effect", may be more important than any beneficial or detrimental health effect due to changes in MVPA and sedentary time. This may be particularly important in the context of retirement, as health has been previously found to be an important predictor of retiring from the labour market, among others. [37] Especially for manual workers being able to perform MVPA type of activities is likely to be linked to remaining in the labour market and having better health.

Further studies should explore longer-term associations between changes in accelerometer measured PA and self-rated health across the retirement transition. Attention can also be paid to whether any associations may differ depending on retirement age or other circumstances related to the retirement process. This would increase our knowledge regarding both timing and ways of retirement and health development among older adults. Furthermore, we acknowledge the interrelationships between 24-h movement behaviors, taking into account changes in not only light PA but also sleep patterns. [38] Therefore, there is need for future studies using other statistical approaches, such as compositional data analysis, [39] to explore these interrelationships with self-related health across the retirement translation.

It this study, the participants had high levels of MVPA, meaning that many reached the physical activity guidelines for adults. The high levels of MVPA may be explained by the methods considered in this study, i.e., thigh-worn accelerometers and using ActiPASS to process accelerometer-data. Comparable levels of MVPA have been reported in studies using similar methods. For example, a study from the international research collaboration the Prospective Physical Activity, Sitting, and Sleep (ProPASS) pooled accelerometer-data from more than 15000 adults (mean-age: 54 years) and reported an average of approximately 75-80 minutes of MVPA per day. [40]

In this longitudinal study, we examined how PA and sedentary time change during retirement, and their potential consequences for self-rated health, a measure of perceived general health often used in population health surveys. [41-43] A strength of this study is that it uses harmonized and pooled data from two longitudinal studies that involved three waves of data collection (before and after retirement follow-ups) with similar methods. PA questionnaires may be associated with limitations such as recall bias and socially desirable. [44] Another strength of this paper is therefore the use of accelerometers. To estimate total PA, MVPA, and sedentary time, we used ActiPASS software that determines the type and duration of different activities and body postures with high sensitivity (80%) and specificity (>90%) during semi-standardized and free-living conditions [29,32]. Limitations include the relatively small sample size, the skewed distribution in terms of sex in favour of women. Another limitation is the selection bias in the two cohorts. In SRS, participants were chosen from the SLOSH and Aging and Working studies through a screening process, excluding individuals who did not meet study criteria (e.g., based on retirement timing, working hours, and sick leave). [25] Among those involved in the FIREA clinical study, smoking was less prevalent, mobility limitations were less common, and participants reported lower BMI and higher non-occupational PA compared to the original FIREA study population. [45] These limitations should be taking into account when interpreting and generalizing the findings.

Conclusions

In conclusion, we found a cross-sectional association between higher MVPA and greater odds of reporting better self-rated health before retirement, but this association was present only among non-manual workers. Although total PA decreased during retirement transition, and self-rated health changed between all three waves, no longitudinal associations were observed between changes in total PA, MVPA and sedentary time from before to after retirement, and later self-rated health.

Acknowledgments

The authors want to thank the SRS participants for their participation in the study and the SRS study staff members, in particular Sara Gershagen, for their contribution in the data collection. The authors also want to thank the FIREA participants for their willingness to participate in the study and the FIREA study staff members for their contribution in the data collection. Furthermore, we acknowledge Peter Johansson, Department of Medical Sciences, Occupational and Environmental Medicine, Uppsala University, as collaborator from the ActiPASS analyses.

Funding source

This work was supported by a grant by Swedish Research Council for Health Working Life and Welfare (#2020-00478). The FIREA study was also supported by funding granted by the Academy of Finland (#286294, #319246, #294154, #332030 to S.S.), Finnish Ministry of Education and Culture (to S.S.); Juho Vainio Foundation (to S.S.), and Competitive State Research Financing of the Expert Responsibility Area of the Turku University Hospital (to S.S.). This work was also supported by funding granted by the Swedish Council for Working Life and Social Research (#2021-01561).

Conflicts of Interest

The authors declare no conflict of interest.

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Table 1. Descriptive data for participant pre-retirement characteristics at wave 1 in the pooled dataset and stratified by the two cohorts.

			Cohort	
		Pooled **n=245**	**SRS** **n=83**	**FIREA** **n=162**
Sex and age	Men, % (n)	27 (65)	40 (33)	20 (32)
	Women, % (n)	74 (180)	60 (50)	80 (130)
	Years, mean (±SD) (n)	64 (±1.5) (245)	65 (±1.8) (83)	64 (±1.1) (162)
Marital status	Married and cohabiting, % (n)	63 (151)	82 (68)	54 (83)
	Not married or other, % (n)	37 (87)	18 (15)	47 (72)
Occupational status	Non-manual, % (n)	74 (180)	83 (67)	70 (113)
	Manual, % (n)	26 (63)	17 (14)	30 (49)
Chronic diseases	0, % (n)	68 (155)	71 (59)	66 (96)
	1, % (n)	27 (62)	28 (23)	27 (39)
	>1, % (n)	5 (11)	1 (1)	7 (10)
Smoking	Non-smoker (never and former), % (n)	93 (222)	89 (74)	96 (148)

	Current smoker, % (n)	7 (16)	11 (9)	5 (7)
BMI (kg/m^2)	Mean (±SD)	26 (±4.0) (229)	26 (±3.6) (79)	26 (±4.3) (150)

Abbreviations: BMI, Body mass index; FIREA; Finnish Retirement and Aging study SRS; Swedish Retirement Study.

Note: An overview of the original items from the questionnaire used in SRS and FIREA, and harmonized variables is available as supplementary materials.

Table 2. Descriptive data for total PA, MVPA, and sedentary time in the pooled cohort, and among non-manual and manual workers, respectively. Significant associations shown in bold.

	Wave 1 (pre-retirement)		**Wave 2 (post-retirement)**		**Change between Wave 1 and Wave 2**	
	Unadjusted	*Adjusted* [a]	*Unadjusted*	*Adjusted* [a]	*Unadjusted*	*Adjusted* [a]
Total	*n=245*	*n=243*	*n=245*	*n=243*	*n=245*	*n=243*
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Total PA, min per day	355 (343 to 368)	355 (344 to 367)	344 (332 to 356)	344 (332 to 355)	**-12 (-23 to -0.1)**	**-11 (-22 to -1)**
MVPA, min per day	75 (71 to 78)	75 (71 to 78)	75 (71 to 78)	75 (71 to 78)	0 (-3 to 3)	0 (-3 to 3)
Sedentary time, min per day	586 (573 to 600)	587 (575 to 598)	577 (565 to 590)	577 (566 to 589)	-9 (-21 to 3)	-9 (-20 to 1)
	Unadjusted	*Adjusted* [b]	*Unadjusted*	*Adjusted* [b]	*Unadjusted*	*Adjusted* [b]
Non-manual workers	*n=180*	*n=180*	*n=180*	*n=180*	*n=180*	*n=180*
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)
Total PA, min per day	336 (322 to 350)	336 (322 to 350)	344 (330 to 358)	344 (331 to 358)	8 (-4 to 20)	8 (-4 to 20)
MVPA, min per day	74 (71 to 78)	74 (71 to 78)	76 (72 to 80)	76 (72 to 80)	1 (-2 to 5)	1 (-2 to 5)
Sedentary time, min per day	609 (594 to 624)	609 (595 to 623)	580 (565 to 594)	580 (566 to 593)	**-29 (-42 to -17)**	**-29 (-41 to -17)**
	Unadjusted	*Adjusted* [b]	*Unadjusted*	*Adjusted* [b]	*Unadjusted*	*Adjusted* [b]
Manual workers	*n=63*	*n=63*	*n=63*	*n=63*	*n=63*	*n=63*
	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)	Mean (95% CI)

Total PA, min per day	409 (388 to 432)	409 (388 to 430)	343 (318 to 368)	343 (319 to 367)	**-67 (-89 to -44)**	**-67 (-90 to -44)**
MVPA, min per day	75 (68 to 82)	75 (69 to 82)	71 (64 to 78)	71 (64 to 78)	-4 (-10 to 2)	-4 (-10 to 1)
Sedentary time, min per day	524 (500 to 548)	524 (503 to 545)	571 (544 to 599)	571 (547 to 595)	**47 (23 to 72)**	**47 (24 to 70)**

Abbreviations: MVPA, Moderate-to-vigorous PA; PA, Physical activity.

[a] Adjusted for cohort, sex, age, occupational status, and accelerometer wear-time.

[b] Adjusted for cohort, sex, age, and accelerometer wear-time.

Table 3. Ordinal regression models with total PA, MVPA and sedentary time (per 10-minute units), and self-rated health. Significant associations shown in bold.

	Pre-retirement PA (wave 1) vs self-rated health (wave 1)	**Change in PA (wave 1 to wave 2) vs self-rated health (wave 2) [d]**	**Change in PA (wave 1 to wave 2) vs self-rated health (wave 3) [d]**
	Odds ratio (95% CIs)	**Odds ratio (95% CIs)**	**Odds ratio (95% CIs)**
Model 1 [a]	*n=240*	*n=236*	*n=213*
Total PA	1.00 (0.97 to 1.02)	1.01 (0.98 to 1.04)	1.00 (0.96 to 1.03)
MVPA	**1.11 (1.02 to 1.22)**	0.99 (0.88 to 1.12)	1.02 (0.90 to 1.16)
Sedentary time	1.00 (0.98 to 1.03)	0.99 (0.96 to 1.02)	1.00 (0.97 to 1.04)
Model 2 [b]	*n=238*	*n=234*	*n=212*
Total PA	1.00 (0.98 to 1.03)	1.02 (0.98 to 1.05)	1.01 (0.97 to 1.04)
MVPA	**1.11 (1.02 to 1.22)**	1.00 (0.88 to 1.13)	1.03 (0.90 to 1.16)
Sedentary time	1.00 (0.98 to 1.02)	0.98 (0.95 to 1.02)	0.99 (0.96 to 1.03)
Model 3 [c]	*n=220*	*n=217*	*n=196*
Total PA	0.98 (0.95 to 1.01)	1.02 (0.98 to 1.06)	1.01 (0.98 to 1.05)
MVPA	1.07 (0.97 to 1.18)	1.01 (0.89 to 1.15)	1.03 (0.91 to 1.18)
Sedentary time	1.02 (0.99 to 1.05)	0.98 (0.95 to 1.02)	0.99 (0.95 to 1.02)

Abbreviations: MVPA, Moderate-to-vigorous PA; PA, Physical activity

Note: The analyses were conducted separately for total PA, MVPA and sedentary time

[a] Adjusted for accelerometer wear-time, cohort, and sex and age

[b] Adjusted for accelerometer wear-time, cohort, sex and age, and occupational status

[c] Adjusted for accelerometer wear-time, cohort, sex and age, occupational status, marital status, and BMI, and smoking

[d] Analyses additionally adjusted for pre-retirement self-rated health (wave 1)