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Leskinen, Tuija

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Changes in non-occupational sedentary behaviors across the retirement transition: the Finnish Retirement and Aging Study (FIREA)

Tuija Leskinen 1,2, Anna Pulakka 1, Olli Heinonen 2, Jaana Pentti 1,3, Mika Kivimäki 3,4,5, Jussi Vahtera 1, Sari Stenholm 1

1 Department of Public Health, University of Turku and Turku University Hospital, Turku, Finland;

2 Paavo Nurmi Centre & Department of Health and Physical Activity, University of Turku, Turku, Finland;

3 Clinicum, Faculty of Medicine, University of Helsinki, Helsinki, Finland;

4 Finnish Institute of Occupational Health, Helsinki, Finland;

5 Department of Epidemiology and Public Health, University College London, London, UK

Corresponding author: Dr. Tuija Leskinen, Department of Public Health, FIN-20014 University of Turku, Finland, phone: +35823338440, fax: +358294505040, email: tuija.leskinen@utu.fi

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18 ABSTRACT

19 **Background** Retirement is a major life transition and it may influence health behaviors and
20 time use as people no longer go to work. Very little is known how sedentary behavior changes
21 as a result of increased time availability after the retirement transition. The aim of this study
22 was to examine changes in non-occupational sedentary behaviors across the retirement
23 transition. In addition, we examined which pre-retirement characteristics were associated with
24 these changes.

25 **Methods** The study population consisted of 2,011 participants from the Finnish Retirement
26 and Aging Study (FIREA). Repeated postal survey including questions on sedentary behavior
27 domains (television viewing, computer use at home, sitting in a vehicle and other sitting) were
28 conducted once a year across the retirement transition, covering on average 3.4 study waves.
29 Linear regression analyses with generalized estimating equations (GEE) were used for the
30 analyses.

31 **Results** Total sedentary time increased by 73 (95% CI 66-80) minutes/day to 5.9 hours/day
32 during the retirement transition. Of the domain-specific sedentary behaviors, television
33 viewing time increased by 28 (95% CI 25-32) minutes/day, computer use at home by 19 (95%
34 CI 17-22) minutes/day, and other sitting time by 37 (95% CI 33-41) minutes/day, while time
35 sitting in a vehicle decreased by 6 (95% CI 4-9) minutes/day during the retirement transition.
36 Women and persons who had high occupational sitting time, low physical activity level, sleep
37 difficulties, mental disorders, or poor health before retirement increased mostly time spent on
38 sedentary behaviors during the retirement transition (all P-values for interaction <0.03).

39 **Conclusion** Total and domain-specific sedentary times, except sitting in a vehicle, increased
40 during the retirement transition.

41 **Key words:** sedentary behavior, sitting, retirement, cohort, aging, television viewing

42

43 **What is already known on this subject?**

44 Retirement is associated with increased time spend sedentary.

45 There are no longitudinal studies with repeated measures of sedentary behavior domains

46 across the retirement transition.

47

48 **What this study adds?**

49 Total and domain-specific sedentary behaviors, except sitting in a vehicle, increase during the

50 retirement transition.

51 Total non-occupational sedentary time continued to increase during the post-retirement

52 period.

53 Women, and those who had high occupational sedentary time, low physical activity level,

54 sleep difficulties, mental disorders, or poor health before retirement were most likely to

55 report an increase in total non-occupational sedentary time during the retirement transition.

BACKGROUND

Sedentary behavior, defined as any waking behavior characterized by an energy expenditure ≤ 1.5 metabolic equivalents (METs) whilst in a sitting or reclining posture [1], is highly prevalent among adult population [2]. Older adults are the most sedentary age group spending 65% to 80% of their wake time on sedentary behaviors [3]. This is a major public health concern as sedentary behavior is associated with poor health [4,5] and mortality [6,7].

Retirement is one of the major life transitions which can modify lifestyle after middle life [8]. Retirement is associated with positive lifestyle changes, such as increased leisure physical activity [9] and sleep duration [10] most likely due to increased time availability, restructure of leisure activities and awareness of one's own health and well-being [11,12]. However, retirement has also been listed as a strong determinant for engaging sedentary behavior [13]. To date, only a small number of studies have examined how sedentary behavior changes during the retirement transition [14].

Prior longitudinal studies have shown that retirement is associated with increased time spend on television viewing and computer use, and with decreased passive transportation time [8,14–17]. However, previous studies have not been able to repeatedly follow people across the retirement transition nor to illustrate the short and long-term changes in both total and domain-specific sedentary behaviors [8,15–17]. Furthermore, previous studies have examined changes in sedentary behavior only by education or work-related factors [14]. However, multiple other factors, such as lifestyle and health factors, are shown to be associated with sedentary behavior [18] and it is of interest to examine how these factors moderate the changes in sedentary behavior during retirement transition.

To address the limitations of the previous studies, this longitudinal study examined how non-occupational sedentary behavior, namely television viewing, computer use at home, sitting in

a vehicle and other sitting, changed across the retirement transition using repeated annual measurements. We also investigated which pre-retirement characteristics were associated with changes in total and domain-specific sedentary times during the retirement transition.

METHODS

Study population

Finnish Retirement and Aging Study (FIREA) is an ongoing longitudinal cohort study of older adults in Finland established in 2013. The aim of the FIREA study is to follow aging workers from work to full-time retirement and to determine how health behaviors and clinical risk factors change during transition to statutory retirement. The eligible population for the FIREA study cohort included all public sector employees whose individual retirement date was between 2014 and 2019 and who were working in year 2012 in one of the 27 municipalities in Southwest Finland or in the 9 selected cities or 5 hospital districts around Finland. Information on the estimated individual retirement date was obtained from the pension insurance institute for the municipal sector in Finland (Keva). Participants were first contacted 18 months prior to their estimated retirement date by sending a questionnaire, which was thereafter sent annually, four times in total. The actual retirement date was self-reported by the participants. Due to the eligibility criteria, large majority of the FIREA participants retired based on their age, and not due to diseases. The FIREA study was conducted in line with the Declaration of Helsinki, and was approved by the Ethics Committee of Hospital District of Southwest Finland.

By the end of 2017, 6,673 (63% of the eligible sample, n=10,629) of the FIREA cohort members had responded to at least one questionnaire and of them 4,311 had so far responded at least twice to questionnaires, 2,082 both prior and after the actual retirement date reported

by the responders. There were two possible study waves before retirement (wave -2, wave -1) and three possible waves after retirement (wave +1, wave +2, wave +3). Each successive wave was one year apart from each other. To be included in this study, the participants had to have information on total sedentary time immediately before and after transition to statutory retirement (i.e. at wave -1 and at wave +1) (n=2,058). Then we excluded those with missing information on socio-economic status (n=24) and those who were not working full-time or part-time at wave -1 (n=23) resulting in an analytic sample of 2,011 persons. Thus, depending on the retirement date, participants' observations came from one of the following alternative set of waves: 1) wave -2, wave -1, wave +1, wave +2, or, 2) wave -1, wave +1, wave +2, and wave +3. Study waves around retirement are demonstrated in Table 1. On average, these participants provided information on total sedentary time at 3.4 (range 2-4) of the possible four study waves. The analytical sample did not differ from the eligible sample (83 vs. 80% of women, 33 vs. 29% of upper grade non manual, 37 vs. 42% of manual workers, respectively).

Assessment of sedentary behavior

Sedentary behavior was inquired at each study wave with a question: "On average, how many hours on a non-weekend days you spend on sitting: 1) at the office, 2) watching television or videos at home, 3) using computer at home, 4) in a vehicle (car, train, airplane), and 5) other sitting?" Response alternatives for each domain were: 0 (sitting less than an hour or not at all), 1, 2, ..., 9, ≥ 10 hours per day, coded as 0 to 10 hours, respectively. We calculated a total non-occupational sedentary time by summing up sitting times for television viewing, computer use, vehicle and other.

Assessment of covariates

Sex, date of birth, and occupational status were obtained from the pension insurance institute for the municipal sector in Finland (Keva). Occupational status was categorized into three groups according to the occupational titles by the last known occupation preceding retirement: upper-grade non-manual workers (e.g. teachers, physicians), lower-grade non-manual workers (e.g. registered nurses, technicians) and manual workers (e.g. cleaners, maintenance workers). All other covariates were based on the responses in the last questionnaire prior to retirement (wave -1). These covariates were selected because they have been shown to be associated with sedentary behavior [18] and might influence the decision to retire [19]. Work status was divided into full-time or part-time workers and marital status into married/cohabiting or not married/other. Heavy physical work (no vs. yes) was assessed by using validated gender-specific job exposure matrix (JEM) for physical exposures [20,21]. Occupational sedentary time before the retirement transition was categorized into four groups: <4 hours, 4 to <6 hours, 6 to <8 hours and ≥ 8 hours daily.

Physical activity was assessed with a question on average weekly duration and intensity of leisure and commuting physical activity during the past year. Weekly physical activity was expressed as metabolic equivalent (MET) hours and categorized as: low (<14 MET hours/week), moderate (14 to <30 MET hours/week), and high (≥ 30 MET hours/week) activity levels [22]. Body mass index (BMI) was calculated from self-reported weight and height and categorized into: underweight (<18.5 kg/m²), normal weight (18.5 to <25.0 kg/m²), overweight (25 to <30 kg/m²) and obese (≥ 30 kg/m²) [23]. The participants reported their habitual frequency and amount of beer, wine, and spirits consumption, in weekly units of alcohol. Heavy alcohol use (no vs. yes) was defined as >16 drinks/week for women and >24 drinks/week for men, as these limits correspond with the lower limit for heavy use of alcohol set by the Finnish Ministry of Health and Social Affairs [24]. Smoking status was categorized into non-smokers (never and former) and current smokers. Sleep difficulties were measured

with the Jenkins Sleep Problem Scale [25] and categorized as no sleep difficulties (sleep difficulties ≤ 1 night/week), moderate sleep difficulties (2-4 nights/week), or severe sleep difficulties (5-7 nights/week) [26].

Data on chronic diseases was based on question “Have your doctor ever told that you have or have had ....” and following diseases were taken into account: angina pectoris, myocardial infarction, stroke, claudication, osteoarthritis, osteoporosis, sciatica, fibromyalgia, rheumatoid arthritis, migraine, and malign cancer. For the analyses, participants were categorized into having no chronic disease, having one chronic disease or having more than one chronic diseases. Mental disorders included depression and/or other mental diseases (no vs. yes). Self-rated health was assessed with a 5-point scale (1=good, ..., 5=poor), and was then categorized as good (1-2), average (3), and poor (4-5) health. Psychological distress was measured with the 12-item version of General Health Questionnaire (GHQ-12), which gives a total score ranging from 0 to 12. A cut-off point of three or more symptoms was used to indicate psychological distress (no vs. yes) [27].

Statistical analysis

Characteristics of the study population before retirement (at wave -1) are presented as numbers and percentages for categorical variables and as means and standard deviations (SDs) for continuous variables. We first calculated mean estimates and their 95% confidence intervals (CI) for the total and domain-specific sedentary times in each study wave to illustrate the levels of these behaviors across the retirement transition (from wave -2 to wave +3). We used linear regression analyses with generalized estimating equations (GEE). The GEE models control for the intra-individual correlation between repeated measurements using an exchangeable correlation structure and is not sensitive to measurements missing completely at random

[28,29]. The difference in the mean change in total and domain-specific sedentary times between two specific time periods: the retirement transition period (from wave -1 to wave +1) and the post-retirement period (from wave +2 to wave +3) were tested using a period*time interaction term.

We also examined whether sociodemographic and work-related factors (sex, occupational status, work status, marital status, heavy physical work and occupational sedentary time), lifestyle factors (physical activity, BMI, heavy alcohol use, current smoking status, sleep difficulties), and health factors (number of chronic diseases, mental disorders, self-reported health, and psychological distress) before retirement were associated with the magnitude of changes in total and domain-specific sedentary times during the retirement transition (from wave -1 to wave +1). For these analyses, the interaction term pre-retirement factor*time was added to the GEE models. All models were adjusted for age, sex, and occupational status. The SAS 9.4 Statistical Package was used for all of the analyses (SAS Institute Inc., Cary, NC).

RESULTS

Characteristics of the study population are shown in Table 2. Of the participants, 83% were women, 33% had upper grade non-manual work, and 37% had manual work. Before the retirement transition (at wave -1), the mean age of the study population was 63.2 (SD 1.3) years, 39% had low physical activity level, 38% had normal BMI, and 28% were free of chronic diseases. The mean time spent being sedentary at leisure was 4.7 (95% CI 4.5-4.8) hours/day. The total sedentary time before retirement differed by sex, work and marital status, physical strenuousness of the work, physical activity level, BMI category, alcohol use, severity of sleep difficulties, self-reported health, and psychological distress ($p < 0.05$ for all).

Figure 1 illustrates the changes in total and domain-specific non-occupational sedentary times across the retirement transition. The total sedentary time, including sitting time for television viewing, computer use, vehicle and other, increased by 73 minutes/day to 5.9 hours/day during the retirement transition and continued to increase by 18 minutes/day to 6.2 hours/day during the post-retirement period. Thus the change in total sedentary time during the retirement transition was four times that of change during the post-retirement period (period*time interaction $p<.0001$). Of the domain-specific sedentary behaviors, television viewing time increased by 28 minutes/day to 2.7 hours/day, computer use at home by 19 minutes/day to 1.1 hours/day, and time spent on other sitting activities by 37 minutes/day to 1.6 hours/day during the retirement transition. Time sitting in a vehicle decreased by 6 minutes/day during retirement transition. Computer use and other sitting times continued to increase during the post-retirement period (by 5 and 8 minutes/day, respectively).

Table 2 presents mean estimates for the change in total non-occupational sedentary time during the retirement transition by the pre-retirement characteristics. Supplemental Tables 1-3 present results for domain-specific sedentary times. Women increased their total sedentary time more than men during the retirement transition (77 vs. 56 minutes/day, sex*time interaction $p=0.01$). Changes in total sedentary time by men and women are shown in Supplement Figure 1.

Those who retired from full-time jobs increased total sedentary time more than those who retired from part-time jobs (78 vs. 62 minutes/day, pre-retirement job status*time interaction $p=0.02$). This was also seen for change in television viewing time (Supplemental Table 1). Those who had high pre-retirement occupational sedentary time reported higher increase in total sedentary time during the retirement transition than those who had low occupational sedentary time (98 vs. 65 minutes/day, pre-retirement occupational sedentary time*time interaction $p<0.0001$). This association was also seen for change in computer use (Supplemental Table 2) and change in other sitting time (Supplemental Table 3). In addition,

those who had low pre-retirement physical activity level reported higher increase in total sedentary time during the retirement transition than those who had high pre-retirement physical activity level (79 vs. 62 minutes/day, pre-retirement activity level*time interaction $p=0.02$). The pre-retirement physical activity level associated also with changes in television viewing time (Supplement Table 1).

Among those with severe sleep difficulties before retirement, the increase in total sedentary time during the retirement transition was reported to be higher than among those who had no pre-retirement sleep difficulties (89 vs. 64 minutes/day, pre-retirement sleep difficulties*time interaction $p=0.002$). Sleep difficulties were also associated with changes in sitting time for computer use (Supplemental Table 2). Those who had chronic diseases reported higher increase in total sedentary time during the retirement transition than those who had no chronic diseases before retirement (79 vs. 61 minutes/day, pre-retirement disease status*time $p=0.03$). Furthermore those who had mental disorders before retirement increased their total sedentary time more than those who had no pre-retirement mental disorders (94 vs. 71 minutes/day, pre-retirement mental health*time interaction $p=0.009$). Also self-reported health before retirement associated with changes in total sedentary time so that those reporting poor health increased their total sedentary time more than those reporting good health (96 vs. 68 minutes/day, pre-retirement health*time interaction $p=0.03$). Self-reported health showed strongest association with increased television viewing time (Supplemental Table 1). In addition, psychological distress before retirement associated with the changes in television viewing time (Supplemental Table 1) and computer use (Supplemental Table 2) during the retirement transition.

DISCUSSION

This is the first longitudinal study examining changes in non-occupational sedentary behavior across the retirement transition. Total sedentary time as well as television viewing time, computer use at home, and other sitting time increased during the retirement transition. Total sedentary time, and especially computer use and other sitting domain, continued to increase during the years following retirement. Women, and those who had high occupational sedentary time, low level of physical activity, sleep difficulties, mental disorders, or poor health before retirement were most likely to report an increase in total sedentary time during the retirement transition. An advantage of the present comprehensive investigation over previous studies is that we examined annual changes in sedentary behavior by using repeated measures of domain-specific sedentary behaviors (television viewing time, computer use at home, sitting in a vehicle and other sitting) across the retirement transition. In addition, we have studied the associations between pre-retirement characteristics and the changes in total and domain-specific sedentary times during the retirement transition.

Our finding that total sedentary time, television viewing, computer use, and other sitting time increase during the retirement transition corresponds to previous longitudinal findings showing higher increase in total leisure sedentary time [16], television viewing time [8,15,16], and computer time [16] among retiring adults than among those who remained employed. As sedentary behavior in general [2,4] and television viewing specifically [30–32] are related to adverse health outcomes among older adults, our findings, among others, suggest that more attention should be paid to reducing overall sedentary behavior and especially television viewing time after transitioning to retirement. We also observed that total, computer use at home, and other sitting time continued to increase in the years following retirement. However, computer use and other sitting time increased to lower absolute level of sedentary behavior per day than television viewing. It is worth of noting that computer use is mentally activating compared to passive television viewing[33], and may not be as harmful for health among older

adults [34]. Despite the overall increase in sedentary behavior during retirement, we also observed that sitting in a vehicle decreased during the retirement transition. Similarly to our finding, a previous study has shown that passive transportation decreases more among retiring than among already retired adults [17]. This decrease is probably mostly due to absence of commuting-related passive transportation after retirement.

A unique feature in our study compared to previous ones is that we also examined wide range of pre-retirement characteristics that could affect the magnitude of change in total and domain-specific sedentary times during the retirement transition. We found that women increased their total and other sitting time more than men, although men were more sedentary before retirement. Also high occupational sedentary time before the retirement transition was associated with greater increases in total, computer use and other sitting times during the retirement transition. Similar relationship was also seen in previous study where higher work-related sitting associated with greater increase in screen time after retirement [35] and in another study in which less physically demanding job associated with increased time spent watching television after retirement [15]. Although less educated adults [17] and those retiring from manual social class [16] have previously been shown to be more susceptible to increase television viewing time after retirement, we did not observe association between occupational status or heavy physical work and total or domain-specific sedentary times.

According to our findings, high level of physical activity before retirement was associated with less increase in total and television viewing times during the retirement transition. Another novel finding is that those who had sleep difficulties, mental disorders or poor health before retirement were most likely to report an increase in total sedentary time during the retirement transition. Sleep difficulties were associated with increased sitting time for computer use whereas poor self-reported health associated with increased television viewing time. Also pre-retirement psychological distress was associated with increased television viewing and

computer use after retirement. These findings adds to previous studies which have found that sedentary behavior associate with poor sleep quality [36], poor mental health [37,38] and with increased risk of depression [39,40].

The main limitation of this longitudinal study is the reliance on self-reported data in relation to the behavioral changes, which is commonly used in large data collection but can lead to bias and underreporting of sedentary time [3]. To our knowledge the questionnaire used in this study is not validated against objective measurements of sedentary behavior. However, the assessment of sedentary behavior as self-reported hours/day is frequently used in observational studies [7]. In addition, since we calculated the total non-occupational sedentary time based on the time used in different domains, we were not able to control the simultaneity of domain-specific sedentary behaviors. This may have lead slight overestimation of the total sedentary time. Future studies with objective monitoring of sedentary time are therefore needed to fully understand the changes in sedentary behavior during the retirement transition. There are also some other methodological issues that deserve discussion. We only assessed sedentary time on non-weekend days. This can be a limitation, because sedentary time may be different in weekend vs. non-weekend days among older adults [41]. On the other hand, by focusing on week-days only we were able to better capture changes in sedentary behavior when week-day routines change after moving into retirement. In addition, we did not include occupational sedentary time in the calculation of total sedentary time because occupational sitting disappears after retiring from work [16] and this would have masked the increase in non-occupational sedentary behavior [14]. Instead we examined changes in sedentary behavior during the retirement transition based on the levels of pre-retirement occupational sedentary time. Finally, the study population is representative of the Finnish public sector employees, however, the results may not necessarily be generalizable to other sectors.

Conclusions

Total non-occupational sedentary time in general and television viewing, computer use and other sitting time increased during the retirement transition. Total sedentary time continued to increase during the post-retirement period. Women and adults who had high occupational sedentary time, low physical activity level, sleep difficulties, mental disorders, or poor health before retirement were most likely to report an increase in time spend sedentary after the retirement transition. However, objective measurements of sedentary behavior are needed to fully understand the changes in sedentary behavior across the retirement transition.

Contributionship SS and JV designed this study and the data collection. TL analyzed the data and drafted the manuscript. All authors contributed to data interpretation, revised article critically, and approved the final version of manuscript.

Competing interest: None declared.

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Data sharing The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Ethical approval The FIREA study is conducted in line with the Declaration of Helsinki, and was approved by the Ethics Committee of Hospital District of Southwest Finland.

REFERENCES

- 1 Sedentary Behaviour Research Network. Letter to the Editor: Standardized use of the terms 'sedentary' and 'sedentary behaviours'. *Appl Physiol Nutr Metab* 2012;**37**:540–549. doi:10.1139/h2012-024
- 2 Wullems JA, Verschueren SMP, Degens H, *et al.* A review of the assessment and prevalence of sedentarism in older adults, its physiology/health impact and non-exercise mobility counter-measures. *Biogerontology* 2016;**17**:547–65. doi:10.1007/s10522-016-9640-1
- 3 Harvey JA, Chastin SFM, Skelton DA. How Sedentary Are Older People? A Systematic Review of the Amount of Sedentary Behavior. *J Aging Phys Act* 2015;**23**:471–87. doi:10.1123/japa.2014-0164
- 4 de Rezende LF, Rey-Lopez JP, Matsudo VK, *et al.* Sedentary behavior and health outcomes among older adults: a systematic review. *BMC Public Health* 2014;**14**:333. doi:10.1186/1471-2458-14-333
- 5 Biswas A, Oh PI, Faulkner GE, *et al.* Sedentary Time and Its Association With Risk for Disease Incidence, Mortality, and Hospitalization in Adults. *Ann Intern Med* 2015;**162**:123. doi:10.7326/M14-1651
- 6 Biddle SJH, Bennie JA, Bauman AE, *et al.* Too much sitting and all-cause mortality: is there a causal link? *BMC Public Health* 2016;**16**:635. doi:10.1186/s12889-016-3307-3
- 7 Ekelund U, Steene-Johannessen J, Brown WJ, *et al.* Does physical activity attenuate, or even eliminate, the detrimental association of sitting time with mortality? A harmonised meta-analysis of data from more than 1 million men and women. *Lancet* 2016;**388**:1302–10. doi:10.1016/S0140-6736(16)30370-1

- 367   8   Barnett I, van Sluijs E, Ogilvie D, *et al.* Changes in household, transport and
368   recreational physical activity and television viewing time across the transition to
369   retirement: longitudinal evidence from the EPIC-Norfolk cohort. *J Epidemiol*
370   *Community Health* 2014;**68**:747–53. doi:10.1136/jech-2013-203225

- 371   9   Stenholm S, Pulakka A, Kawachi I, *et al.* Changes in physical activity during transition
372   to retirement: a cohort study. *Int J Behav Nutr Phys Act* 2016;**13**:51.
373   doi:10.1186/s12966-016-0375-9

- 374   10   Myllyntausta S, Salo P, Kronholm E, *et al.* Changes in Sleep Duration During
375   Transition to Statutory Retirement: A Longitudinal Cohort Study. *Sleep* Published
376   Online First: 24 May 2017. doi:10.1093/sleep/zsx087

- 377   11   Baxter S, Johnson M, Payne N, *et al.* Promoting and maintaining physical activity in
378   the transition to retirement: a systematic review of interventions for adults around
379   retirement age. *Int J Behav Nutr Phys Act* 2016;**13**:12. doi:10.1186/s12966-016-0336-3

- 380   12   McDonald S, O’Brien N, White M, *et al.* Changes in physical activity during the
381   retirement transition: a theory-based, qualitative interview study. *Int J Behav Nutr*
382   *Phys Act* 2015;**12**:25. doi:10.1186/s12966-015-0186-4

- 383   13   Brug J, Chinapaw M. Determinants of engaging in sedentary behavior across the
384   lifespan; lessons learned from two systematic reviews conducted within DEDIPAC. *Int*
385   *J Behav Nutr Phys Act* 2015;**12**:134. doi:10.1186/s12966-015-0293-2

- 386   14   Sprod J, Ferrar K, Olds T, *et al.* Changes in sedentary behaviours across the retirement
387   transition: A systematic review. *Age Ageing* 2015;**44**:918–25.
388   doi:10.1093/ageing/afv140

- 389   15   Touvier M, Bertrais S, Charreire H, *et al.* Changes in leisure-time physical activity and

- 390 sedentary behaviour at retirement: a prospective study in middle-aged French subjects.
391 *Int J Behav Nutr Phys Act* 2010;**7**:14. doi:10.1186/1479-5868-7-14
- 392 16 Menai M, Fezeu L, Charreire H, *et al.* Changes in sedentary behaviours and
393 associations with physical activity through retirement: A 6-year longitudinal study.
394 *PLoS One* 2014;**9**. doi:10.1371/journal.pone.0106850
- 395 17 Van Dyck D, Cardon G, De Bourdeaudhuij I. Longitudinal changes in physical activity
396 and sedentary time in adults around retirement age: what is the moderating role of
397 retirement status, gender and educational level? *BMC Public Health* 2016;**16**:1125.
398 doi:10.1186/s12889-016-3792-4
- 399 18 Chastin SFM, Buck C, Freiburger E, *et al.* Systematic literature review of determinants
400 of sedentary behaviour in older adults: a DEDIPAC study. *Int J Behav Nutr Phys Act*
401 2015;**12**:127. doi:10.1186/s12966-015-0292-3
- 402 19 Virtanen M, Oksanen T, Batty GD, *et al.* Extending employment beyond the
403 pensionable age: a cohort study of the influence of chronic diseases, health risk factors,
404 and working conditions. *PLoS One* 2014;**9**:e88695. doi:10.1371/journal.pone.0088695
- 405 20 Solovieva S, Pehkonen I, Kausto J, *et al.* Development and validation of a job
406 exposure matrix for physical risk factors in low back pain. *PLoS One* 2012;**7**:e48680.
407 doi:10.1371/journal.pone.0048680
- 408 21 Stenholm S, Solovieva S, Viikari-Juntura E, *et al.* Change in body mass index during
409 transition to statutory retirement: an occupational cohort study. *Int J Behav Nutr Phys*
410 *Act* 2017;**14**:85. doi:10.1186/s12966-017-0539-2
- 411 22 Physical Activity Guidelines Advisory Committee. Physical Activity Guidelines
412 Advisory Committee Report. *Washingt DC US* 2008;**67**:683. doi:10.1111/j.1753-

413 4887.2008.00136.x

414 23 World Health Organisation. Obesity: Preventing and managing the global epidemic.
415 Report of a WHO Consultation. Geneva: 2000.

416 24 Finnish Institute of Occupational Health and Finnish Ministry of Social Affairs and
417 Health. Riskikulutuksen varhainen tunnistaminen ja mini-interventio -hoitosuosituksen
418 yhteenveto. 2006.

419 25 Jenkins CD, Stanton BA, Niemcryk SJ, *et al.* A scale for the estimation of sleep
420 problems in clinical research. *J Clin Epidemiol* 1988;**41**:313–
421 21.<http://www.ncbi.nlm.nih.gov/pubmed/3351539> (accessed 12 May2017).

422 26 Salo P, Oksanen T, Sivertsen B, *et al.* Sleep disturbances as a predictor of cause-
423 specific work disability and delayed return to work. *Sleep* 2010;**33**:1323–
424 31.<http://www.ncbi.nlm.nih.gov/pubmed/21061854> (accessed 12 May2017).

425 27 Goldberg D. *The detection of psychiatric illness by questionnaire; a technique for the*
426 *identification and assessment of non-psychotic psychiatric illness*. London: : Oxford
427 University Press 1972.

428 28 Zeger SL, Liang KY. Longitudinal data analysis for discrete and continuous outcomes.
429 *Biometrics* 1986;**42**:121–30.

430 29 Diggle P, Liang K, Zeger S. *Analysis of Longitudinal Data*. London: : Oxford
431 University Press 1994.

432 30 García-Esquinas E, Andrade E, Martínez-Gómez D, *et al.* Television viewing time as a
433 risk factor for frailty and functional limitations in older adults: results from 2 European
434 prospective cohorts. *Int J Behav Nutr Phys Act* 2017;**14**:54. doi:10.1186/s12966-017-

435 0511-1

436 31 Smith L, Hamer M. Television viewing time and risk of incident diabetes mellitus: the
437 English Longitudinal Study of Ageing. *Diabet Med* 2014;**31**:1572–6.
438 doi:10.1111/dme.12544

439 32 Smith L, Fisher A, Hamer M. Television viewing time and risk of incident obesity and
440 central obesity: the English longitudinal study of ageing. *BMC Obes* 2015;**2**:12.
441 doi:10.1186/s40608-015-0042-8

442 33 Heinonen I, Helajärvi H, Pahkala K, *et al.* Sedentary behaviours and obesity in adults:
443 the Cardiovascular Risk in Young Finns Study. *BMJ Open* 2013;**3**.
444 doi:10.1136/bmjopen-2013-002901

445 34 Kikuchi H, Inoue S, Sugiyama T, *et al.* Distinct associations of different sedentary
446 behaviors with health-related attributes among older adults. *Prev Med (Baltim)*
447 2014;**67**:335–9. doi:10.1016/j.ypmed.2014.08.011

448 35 Van Dyck D, Cardon G, Deforche B, *et al.* The contribution of former work-related
449 activity levels to predict physical activity and sedentary time during early retirement:
450 Moderating role of educational level and physical functioning. *PLoS One* 2015;**10**:1–
451 14. doi:10.1371/journal.pone.0122522

452 36 Buman MP, Kline CE, Youngstedt SD, *et al.* Sitting and television viewing: Novel risk
453 factors for sleep disturbance and apnea risk? Results from the 2013 National Sleep
454 Foundation Sleep in America poll. *Chest* 2015;**147**:728–34. doi:10.1378/chest.14-1187

455 37 Hamer M, Coombs N, Stamatakis E. Associations between objectively assessed and
456 self-reported sedentary time with mental health in adults: an analysis of data from the
457 Health Survey for England. *BMJ Open* 2014;**4**:e004580. doi:10.1136/bmjopen-2013-

004580

- 38 Hamer M, Stamatakis E, Mishra GD. Television- and Screen-Based Activity and Mental Well-Being in Adults. *Am J Prev Med* 2010;**38**:375–80. doi:10.1016/j.amepre.2009.12.030
- 39 Zhai L, Zhang Y, Zhang D. Sedentary behaviour and the risk of depression: a meta-analysis. *Br J Sports Med* 2015;**49**:705–9. doi:10.1136/bjsports-2014-093613
- 40 Lucas M, Mekary R, Pan A, *et al.* Relation between clinical depression risk and physical activity and time spent watching television in older women: a 10-year prospective follow-up study. *Am J Epidemiol* 2011;**174**:1017–27. doi:10.1093/aje/kwr218
- 41 Visser M, Koster A. Development of a questionnaire to assess sedentary time in older persons--a comparative study using accelerometry. *BMC Geriatr* 2013;**13**:80. doi:10.1186/1471-2318-13-80

474 **Figure Labels**

475 **Figure 1. Total and domain-specific sedentary times across the retirement transition.**
476 **Adjusted for age, sex and occupational status.**

477

478 **Tables**

479 **Table 1. Study design. Annual study waves around retirement and the construction of the**
 480 **pre-retirement, retirement transition and post-retirement periods.**

Pre-retirement period	Retirement transition			Post-retirement period	
<i>n</i> =955	<i>n</i> =2,011	RETIREMENT	<i>n</i> =2,011	<i>n</i> =1,211	<i>n</i> =547
	wave -1		wave +1	wave +2	wave +3
wave -2	wave -1		wave +1	wave +2	

481

Sleep difficulties									0.002
No	985	49	4.54	4.38	4.69	1.06	0.91	1.21	
Moderate	460	23	4.78	4.57	4.99	1.22	1.00	1.44	
Severe	565	28	4.77	4.58	4.97	1.48	1.28	1.68	
Number of chronic diseases									0.03
0	540	28	4.60	4.42	4.79	1.02	0.83	1.21	
1	745	38	4.64	4.45	4.82	1.29	1.12	1.47	
≥2	655	34	4.71	4.52	4.89	1.32	1.13	1.50	
Mental disorders									0.01
No	1527	84	4.63	4.49	4.78	1.18	1.05	1.31	
Yes	285	16	4.80	4.53	5.07	1.56	1.29	1.83	
Self-reported health									0.03
Good	1492	74	4.52	4.38	4.65	1.13	1.00	1.26	
Average	438	22	4.92	4.70	5.13	1.40	1.18	1.63	
Poor	78	4	5.70	5.07	6.34	1.60	1.11	2.10	
Psychological distress									0.08
No	1760	88	4.62	4.48	4.75	1.18	1.06	1.30	
Yes	243	12	4.90	4.61	5.18	1.46	1.16	1.77	

485

486

487 **Supplement material**

488

489 **Supplemental Figure 1. Total sedentary time across the retirement transition for men and women.**

490

491 **Supplemental Table 1. Television viewing time before retirement (wave -1) and mean changes in television viewing time during the**
492 **retirement transition period (from wave -1 to wave +1) by pre-retirement characteristics of the population. All models adjusted for age,**
493 **sex and occupational status.**

494

495 **Supplemental Table 2. Computer use at home before retirement (wave -1) and mean changes in computer use during the retirement**
496 **transition period (from wave -1 to wave +1) by pre-retirement characteristics of the population. All models adjusted for age, sex and**
497 **occupational status.**

498

499 **Supplemental Table 3. Other sitting time before retirement (wave -1) and mean changes in other sitting time during the retirement**
500 **transition period (from wave -1 to wave +1) by pre-retirement characteristics of the population. All models adjusted for age, sex and**
501 **occupational status.**