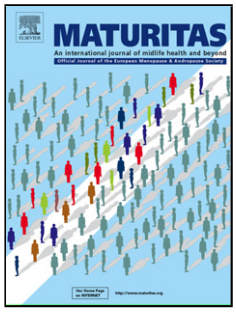


Title: Changes in use of time across retirement: a longitudinal study

Authors: Judy Sprod, Timothy Olds, Wendy Brown, Nicola Burton, Jannique van Uffelen, Katia Ferrar, Carol Maher

PII: S0378-5122(16)30442-X
DOI: http://dx.doi.org/doi:10.1016/j.maturitas.2017.02.018
Reference: MAT 6797

To appear in: *Maturitas*

Received date: 19-12-2016
Revised date: 24-2-2017
Accepted date: 27-2-2017

Please cite this article as: Sprod Judy, Olds Timothy, Brown Wendy, Burton Nicola, van Uffelen Jannique, Ferrar Katia, Maher Carol.Changes in use of time across retirement: a longitudinal study.*Maturitas* http://dx.doi.org/10.1016/j.maturitas.2017.02.018

HighlightsChanges in use of time across retirement were mostly in regular daily activities such as chores.

- Little time was spent in overall physical activity in this cohort.
- Healthier lifestyle patterns should be encouraged at or prior to retirement.

Changes in use of time across retirement: a longitudinal study

Judy Sprod, [a] Timothy Olds,[a] Wendy Brown,[b] Nicola Burton,[b] Jannique van Uffelen, [b,c] Katia Ferrar,[a] & Carol Maher[a]

[a] The University of South Australia, Division of Health Sciences, Adelaide, SA 5001, Australia

[b] The University of Queensland, School of Human Movement & Nutrition Sciences, Brisbane, QLD 4072, Australia

[c] KU Leuven - University of Leuven, Department of Kinesiology, Physical Activity, Sports and Health Research Group, B-3000 Leuven, Belgium

Corresponding author:

Mrs Judy Sprod

Alliance for Research in Exercise Nutrition and Activity (ARENA)

School of Health Sciences

University of South Australia

GPO Box 2471

Adelaide, South Australia 5001

Australia

Judy.sprod@mymail.unisa.edu.au

+61 8 83021741

Abstract

Objectives. This study aimed to investigate how daily use of time changes across the retirement transition and how these changes may differ according to socio-demographic characteristics.

Study design. This longitudinal cohort study was based on interviews with 124 people at pre-retirement and at three, six and 12 months after retirement.

Main outcome measures. The Multimedia Activity Recall for Children and Adults (MARCA), a computer-assisted telephone interview, measured use of time. Random effects mixed modelling (REMM) was used to examine time use changes across retirement, and ANCOVA to investigate the extent of the change by sex, education and health.

Results. Apart from the decrease in time spent in work across retirement (-122 min/day, $p < 0.001$), less time was also spent in both active and passive transport (-26 min/day, $p < 0.001$). There were significant increases in time spent on Chores (+55 min/day, $p < 0.001$), Screen time (+32 min/day, $p < 0.001$), Sleep (+32 min/day, $p < 0.001$), Quiet time (+17 min/day, $p = 0.02$), Self-care (+8 min/day, $p = 0.01$) and Physical activity (+7 min/day, $p = 0.01$). There was little variation in change between sex, education and health sub-groups. Most changes occurred at retirement, with time use patterns fairly stable between three and 12 months post-retirement.

Conclusions. The small amount of time spent in physical activity, combined with less time spent in active transport and increased time spent watching television, indicate the need for a more active lifestyle.

Keywords: Retirement; time use; activity patterns; healthy lifestyle

1. Introduction

1.1 Background

The transition from a working lifestyle to one of retirement involves a reorganisation of daily activities [1] and the choice of activities has health consequences. For example, being more active will help reduce the risk of chronic illness, some cancers and mental health conditions [2, 3], while being more sedentary will increase the risk of all-cause mortality, cardiovascular disease and metabolic syndrome [4, 5]. Given that the population is ageing in most developed countries [6], and therefore there are increased numbers of people who are retired, the health impact of choices relating to use of time is of significant concern. Yet little is known about how use of time changes across retirement.

How people use their time over the retirement transition may differ by socio-demographic factors. For example, although men spend less time doing household chores than women at all life stages, they increase the time spent in chores around retirement, compared with women [7, 8]. Similarly, previous studies have found an overall increase in recreational

physical activity at retirement, but a decrease when considering only retirees from lower socioeconomic backgrounds [9, 10].

Some studies have examined the effect of retirement on a limited range of activities such as physical activity [9], or sedentary behaviours [11], but only a few have looked at the full range of daily activities, using time use surveys [12, 13]. These time use studies have been of a cross-sectional design, which is subject to bias due to different characteristics of the working and retired groups. To our knowledge, no longitudinal studies have investigated daily use of time, in a number of socio-demographic groups, across retirement.

1.2 Objective

This study aimed to investigate how use of time throughout a 24-hour day (within the domains of chores, physical activity, quiet time, screen time, self-care, sleep, sociocultural activities, transport and work) changes across the retirement transition in a cohort of people from pre-retirement to 12 months post-retirement. The secondary aim was to explore how changes in use of time differed based on the socio-demographic characteristics of sex, education (as an indicator of socioeconomic status) and health.

2. Methods

2.1 Study design and participants

This study was embedded within the Life After Work Study [14]. Ethics approval was obtained through The University of South Australia Human Research Ethics Committee and The University of Queensland Behavioural and Social Sciences Ethical Review Committee. The committees' ethics frameworks are based on the Australian Code for the Responsible Conduct of Research (2007) [15] with written, informed consent obtained from all participants.

Participants were recruited via recruitment companies and a wide range of advertising, from two cities in Australia, Adelaide and Brisbane, between April 2012 and July 2013. People were eligible for study participation if they were over 50 years of age, worked ≥ 19 hours/week pre-retirement, had plans to retire within the next nine months and were able to speak and write in English. Additional eligibility criteria were to reduce working hours by ≥ 19 hours/week at retirement and work ≤ 11 hours/week once retired. Having a life-threatening health condition or major treatment in the last six months, was the only exclusion criterion.

At the pre-retirement face-to-face assessment, participants completed a survey, undertook physical measures for the Life After Work Study and made appointments for the two use of time phone interviews, which took place in the following week. Use of time interviews and surveys were repeated at three and six months, with most participants completing these surveys online. All assessments were repeated in another face-to-face appointment at 12 months post-retirement. At the completion of each assessment, participants were sent an honorarium of AUD25-50 to acknowledge their time and effort and to assist with travel costs.

2.2 Use of time measurement

The Multimedia Activity Recall for Children and Adults (MARCA) [16], a computer-assisted telephone interview, measured use of time. Participants were asked to recall the two previous days' activities (including at least one work day and one non-work day) in time intervals of five minutes or more. Activities were matched with the MARCA's list of around 550 activities and recorded by the interviewer. The software calculated the daily time spent in each activity, averaged over the four days that were recalled at each assessment point. Activities were grouped to form "macrodomains" and "superdomains" (e.g. "gardening" and "hanging out washing" contributed to the macrodomain "Outside chores", and this was

combined with "Inside chores" to form the superdomain "Chores") (Table 1 in Supplementary material). Note that it is the nature of the activity rather than the context which determined the domain category. For example, computer use falls into the superdomain "Work" regardless of whether it is carried out in a work context or not. Mean daily values for time spent in each domain were calculated, using a weighting for weekdays:weekend days of 5:2.

Each activity is linked to a value for energy expenditure, based on the Ainsworth Compendium of Physical Activities [17] and expressed in metabolic equivalents (METs). Daily energy expenditure was calculated by the MARCA programme and is expressed as MET-minutes [16]. Energy expenditure was categorised as Sleep (<1 MET), Very light physical activity (1-1.9 METs), Light physical activity (2-2.9 METs), Moderate physical activity (3-5.9 METs), and Vigorous physical activity (≥6 METs). Energy expenditure bands are independent of superdomains or macrodomains and thus provide additional information about activity intensity levels.

The MARCA has demonstrated good psychometric properties. The test-retest reliability, conducted on adults on the one day, was high for the domains of screen time and sleep (ICC = 0.990 to 0.997) [16]. Validity for physical activity level is moderate-to-strong compared with doubly labelled water (rho = 0.70) [18] and for sedentary behaviour, moderate to strong compared with ActivPAL (r = 0.77) (r = 0.77) [19].

2.3 Socio-demographic variables

In the survey, participants reported age, sex, living arrangements, occupation, work hours, marital status, education, and income. The last three questions were based on those in the Australian Census [20]. Participants recorded the highest level of education they had completed and for analysis, these were categorised as: low (primary/elementary school, high

school, post-secondary diploma or certificate); medium (bachelor degree); or high (post-graduate qualification).

2.4 Health variable

Health status was measured using the "general health" subscale of the Short-Form Health Survey (SF-36), a commonly used self-report health survey [21, 22]. Five Likert scale items were summed to create a total score (range: 5 to 25) and re-categorised into the tertiles: fair health (5 to 17); good health (18 to 19); or excellent health (20 to 25). The SF-36 has demonstrated moderate to good test-retest reliability (0.60 to 0.81) and satisfactory construct validity compared with four equivalent dimensions of the Nottingham Health Profile [21].

2.5 Data analysis

A priori power calculations, based on four assessment time points, a significance criterion of $\alpha = 0.01$ and a power of 80%, indicated that a sample size of 104 was required to detect a small to medium effect size (Cohen's $d = 0.25$). However, a larger than normal drop-out rate was expected due to the known flexibility of retirement plans. Therefore, to allow for 25% drop-out, a final sample size of 140 was sought.

Data from the two sites were pooled and analysis was conducted on all participants who completed the baseline and at least one other assessment. Where there were missing values data were imputed using a "before and after data" method [23], with values used from the post-retirement time point closest to the missing time point.

Demographic and retirement data were analysed using descriptive statistics, and where possible, compared with available population-based data to help discern the representativeness of the sample.

Using SPSS version 20, and controlling for sex, general health and education level, random effects mixed modelling (REMM) was used to examine changes across retirement in use of time in the different superdomains. ANCOVA was then used to investigate the extent of the change, contrasting pre-retirement with only the final time point (12 months post-retirement) as time use patterns were relatively stable between three to 12 months post retirement. In addition, the baseline value was used as a covariate since it may influence the amount of change. Where data were not normally distributed they were transformed using log (Self-care and Transport superdomains) and square root (Quiet time, Screen time and Sociocultural superdomains) transformations. Sequential Bonferroni adjustment was used to correct for multiple comparisons.

3. Results

3.1 Participant numbers

Baseline assessments were completed by 139 participants. After baseline, 14 participants were ineligible as they did not retire as planned. A further five participants withdrew later in the study, mostly due to returning to work and an additional four people could not be contacted. After imputing for missing values, the final number of participants for longitudinal analysis was 124 (Adelaide n = 87, Brisbane n = 37) with an overall retention rate of 83.5%.

3.2 Participant characteristics

At baseline, the age range was 50 to 79 years with a mean (SD) age of 62.3 (4.3) years (Table 1). The majority of participants were married (67%), while 21% lived alone. Participants worked on average 34.3 hours per week, and the main occupational category was professional (35%). More than half the participants had a university education or higher

(53%). Health was reported as "fair" by 42% of participants, "good" by 33% and "excellent" by 24%.

The sample in the current study was representative of the general Australian population except for an overrepresentation of higher SES (higher education and income). There were no significant differences between participants from Adelaide and Brisbane. Those who withdrew from the study were significantly younger than the rest of the sample (t = 2.1, p = 0.04) but there were no significant differences in any other characteristics.

3.3 Distribution of use of time pre- and post-retirement

Prior to retirement, the largest component of the 24-hour day was Sleep (mean (SD) 462 (52) min/day) followed by Work (mean (SD) 231 (98) min/day) and Chores (mean (SD) 160 (71) min/day) (Figure 1 & Table 2). After retirement, Sleep was still the largest component (mean (SD) 494 (62) min/day). The next most time-consuming activity became Chores (mean (SD) 215 (81) min/day) followed by Screen time (mean (SD) 147 (99) min/day). The least amount of time was spent in the superdomain of Physical activity both pre- (mean (SD) 14 (25) min/day) and post-retirement (mean (SD) 21 (40) min/day).

3.4 Changes in use of time across retirement

There were significant differences in the changes in time spent in all use of time superdomains, except for Sociocultural (Table 2). These differences remained significant after sequential Bonferroni correction.

The superdomain with the greatest difference from baseline to post-retirement was Work, which reduced by just over two hours/day overall (p <0.001). This decrease was due to less time spent in the macrodomains of Employment (-53 min/day) and Computer (-73 min/day). The other main decrease at the superdomain level was in Transport (p <0.001), due to

decreases in both Active and Passive transport (-13 min/day each). Nearly 60% of participants reduced their time in Transport, with an overall decrease of almost half an hour per day.

Time in min/day with vertical axis showing the minutes per day spent in each category (each spoke).

Conversely, the time spent in Chores increased (+55 min/day, $p < 0.001$), with the greatest increase being in Inside chores (+37 min/day), rather than Outside chores (+18 min/day). Nearly 20% of participants increased their time in Chores by more than 2 hours/day. The time spent in each of Sleep and Screen time increased overall by half an hour a day (+32 min/day, $p < 0.001$ for both superdomains). The increase in Screen activity was mostly due to an increase in the time spent watching television.

Similar patterns were seen when daily activities were considered on the basis of time spent in energy expenditure bands (Table 2 in Supplementary material). There was a reduction in the time spent in Very light physical activity (-57 min/day, $p < 0.001$). Light and Moderate physical activity increased significantly in the early retirement period (+20 min/day and +17 min/day respectively). The increase in Light physical activity was sustained but Moderate physical activity reduced to pre-retirement levels by 12 months post-retirement. Time spent in Vigorous physical activity did not significantly change across the retirement transition.

3.5 Differences and changes in time use by sex, education and health

Although there were some differences between men and women in the time spent in some domains across retirement, these findings did not retain significance after sequential Bonferroni correction (Table 3). However, there were a few differences across retirement by education and health. Those with a higher education level spent more time in Work than the two lower educational groups ($p = 0.004$) (Table 4). In addition, participants with "fair" health spent significantly less time in Chores ($p = .002$) than the other health groups and watched significantly more television ($p = .002$) (Table 5).

There were no significant differences after sequential Bonferroni correction for any of the sub-groups in the extent that the time spent in each superdomain changed across retirement (Tables 3, 4 & 5).

4. Discussion

4.1 Main findings

This study found that, apart from the decrease in time spent in work across retirement, less time was also spent in both active and passive forms of transport. Correspondingly, there were significant increases in the time spent in Chores, Screen time, Sleep, Quiet time, Self-care and Physical activity. Most changes occurred soon after retirement, with time use patterns fairly stable between three and 12 months post-retirement.

The decrease in time spent in work equated to an average of two hours per day, which seems less than expected. As all participants reduced their paid pre-retirement job by the prescribed 19 hours/week, the discrepancy can be explained by the following reasons. Firstly, the time spent in Work was averaged over the seven-day week. Secondly, some activities such as transport for work reasons were recorded in the Transport superdomain and not Work.

Thirdly, some time was spent in Work post-retirement due to people undertaking part-time paid or voluntary work, personal computer use or activities categorised under Employment (e.g. home modifications).

The increased time spent in chores across retirement found in this longitudinal study is consistent with the findings of cross-sectional studies that compare retired people to those still working [7, 8, 12]. It may be that the demands of work put time pressure on carrying out chores, while retirement allows chores to be carried out at a more leisurely pace. Doing chores also provides a routine to the day that is lost through leaving work and leads to a sense of being meaningfully occupied [24], which is associated with higher positive affect [25].

This study found an overall increase in the time spent in the superdomain of Physical activity across retirement that occurred in early retirement and weakened in later retirement. A similar pattern for leisure-time physical activity was found by a number of previous studies [9, 26]. However, when including other aspects of Physical activity, including active transport modes such as walking or riding a bike, there was a decrease across retirement. This is consistent with other studies that investigate overall physical activity [26-28]. These findings suggest that active transport, which probably occurred in a work context before retirement, was not fully replaced with active transport in other contexts after retirement (for example, walking to the shops).

Although men increased their time spent in Chores across retirement more than women, they spent less time doing chores in retirement than women. Men also spent more time in Work than women, but less time in Quiet time (e.g. reading, listening to music) and Sociocultural (e.g. sitting talking, family get-togethers and playing music) activities. These results show consistent, differing trends in time use between the sexes that are similar to those reported in

Australian time use data [29]. They indicate that, even into retirement, men and women retain established stereotypical roles.

The finding that those with poorer health spent more time in sedentary behaviours, such as watching television, across retirement than their healthier peers is especially relevant in an older population. In Australia in 2012, 87% or people aged over 65 years reported having a chronic illness compared with 32% of people aged less than 65 years [30] and this creates a significant financial burden on governments' health budgets.

4.2 Strengths

This study is the first to our knowledge to provide longitudinal analysis of comprehensive use of time data in a cohort transitioning from working life to retirement. Recruiting from two major cities within Australia and the wide variety of recruitment methods improved generalisability of the findings.

The MARCA instrument is well validated for various aspects of time use measurement and the use of only two trained interviewers ensured consistency. Sampling both weekdays and weekend days captured potential differences in time use patterns due to the day of the week. The inclusion of all daily activities produced richer data than the investigation of single, proxy activities as well as a better estimation of total time spent in any domain.

4.3 Limitations and recommendations for future research

Although the short time frame of the study reduced the potential for changes due to age, it was not possible to completely distinguish between age-related and retirement-related changes. In future studies, a control group of age-matched peers who are still working would help clarify this.

The recall method used by the MARCA appeared to be difficult for some participants especially in the post-retirement phase when daily activities could be less routine without the structure of work. Some participants made brief notes, but this in turn could have led to reactivity and influenced their activities. The MARCA program reduced this issue by anchoring activities to key points such as mealtimes. Another recommendation for future studies is to record where the activity took place in order to determine whether an activity occurred for work or personal reasons.

4.4 Implications of the findings

Although restructuring of use of time at retirement would seem to be an ideal opportunity to adopt new activities, this did not appear to eventuate. Instead, increases in time spent in regular daily routines, such as performing household chores, watching television and extra sleep, supports the continuity theory proposed by Atchley [31]. Although the increase in household chores involves a low level of physical activity, the increase in time spent watching television combined with less time spent in active transport and overall low levels of physical activity is a concern. Efforts to encourage people to be more active at an earlier stage of life may be particularly relevant, especially if established active lifestyles can be continued into retirement.

4.5 Conclusion

This study found that apart from the expected decrease in the time spent in work, time spent in active transport also decreased. Increases were found in the time spent in other activity domains, especially regular daily routines such as chores, watching television and sleep. Given that activity patterns were fairly stable in retirement, interventions should target people

before they retire, to establish healthier use of time that could be carried across into retirement.

Contributors

JS coordinated data collection at the South Australian site, participated in data collection from Queensland, carried out all analysis and wrote the paper.

TO participated in the conception, design and oversight of the study and contributed to the editing process.

WB participated in the design and oversight of the study and contributed to the editing process.

NB participated in the design of the study, recruitment and data collection at the Queensland site, oversight of the study and contributed to the editing process.

JvU participated in the design of the study, oversight of the study and contributed to the editing process.

KF participated in the oversight of the study and contributed to the editing process.

CM participated in the design and overseeing of the study, dealt with multisite issues and recruitment efforts at the South Australian site, and contributed to the editing process.

All authors saw and approved the final version.

Conflict of interest

The authors declare that they have no conflict of interest.

Funding

This study was supported by an Australian Research Council Discovery Project Grant DP110101738, Retirement activity planning: a randomised controlled trial. The financial sponsors played no role in the design, execution, analysis and interpretation of data, or writing of the study.

Carol Maher was supported by a Post-Doctoral Research Fellowship from the Australian National Heart Foundation.

Ethical approval

Ethical approval was obtained through the University of South Australia Human Research Ethics Committee (protocol number 0000023494) and the University of Queensland Behavioural and Social Sciences Ethical Review Committee (protocol number 2011001152). The committees' ethics frameworks are based on the Australian Code for the Responsible Conduct of Research (2007). Written, informed consent was obtained from all participants at the commencement of the first face-to-face assessment.

Provenance and peer review

This article has undergone peer review.

Declaration of Sources of Funding

This study was supported by an Australian Research Council Discovery Project Grant DP110101738. *Retirement activity planning: a randomised controlled trial*.

The financial sponsors played no role in the design, execution, analysis and interpretation of data, or writing of the study.

Carol Maher was supported by a Post-Doctoral Research Fellowship from the Australian National Heart Foundation.

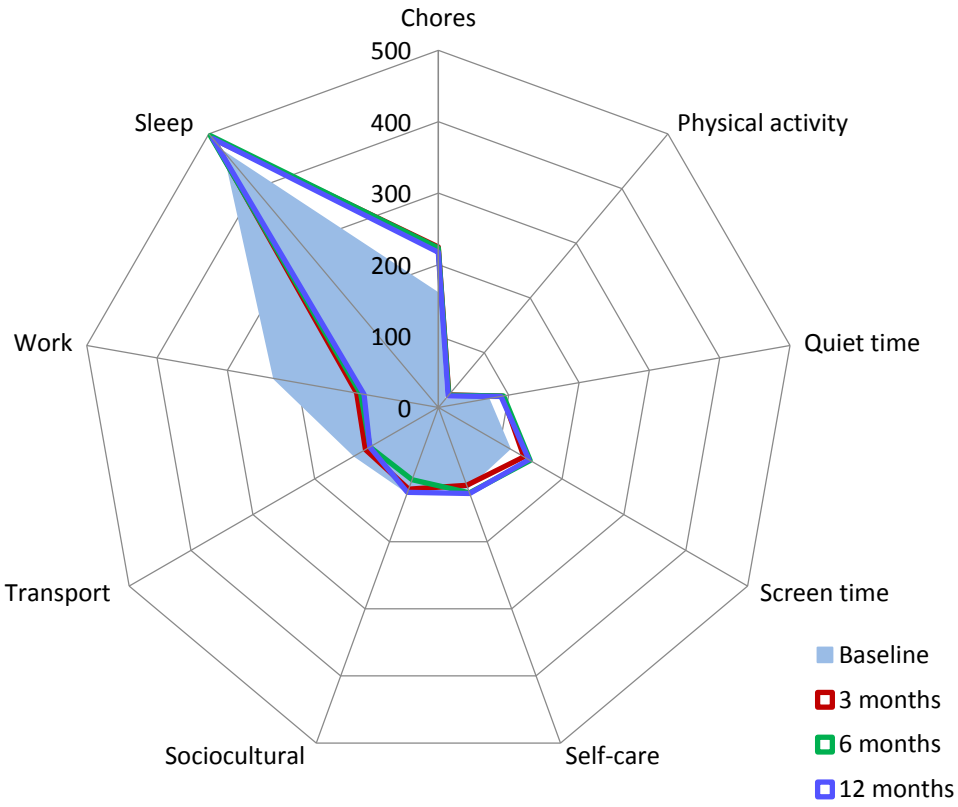
References

1. van Solinge, H. and K. Henkens, *Adjustment to and satisfaction with retirement: two of a kind?* Psychology and Aging, 2008. **23**(2): p. 422–434.
2. Sigurdson, K. and N. Ayas, *The public health and safety consequences of sleep.* Canadian Journal of Physiology and Pharmacology, 2007. **85**(1): p. 179-183.
3. Lee, I., et al., *Effect of physical inactivity on major non-communicable diseases worldwide: an analysis of burden of disease and life expectancy.* Lancet, 2012. **380**: p. 219–229.
4. de Rezende, L.F.M., et al., *Sedentary Behavior and Health Outcomes: An Overview of Systematic Reviews.* PloS One, 2014. **9**(8): p. e105620.
5. Owen, N., et al., *Too much sitting: the population-health science of sedentary behavior*. Exercise and Sport Sciences Reviews, 2010. **38**(3): p. 105–113.
6. Organisation for Economic Co-operation and Development. *OECD factbook: economic, environmental and social statistics 2014*. OECD Factbook: Economic, Environmental and Social Statistics 2014 [cited 2015 26th March 2015]; Available from: http://www.oecd-ilibrary.org/docserver/download/3013081e.pdf?expires=1427335444&id=id&accname=guest&checksum=347A2D3F036BB02AA011D3754EC583C2.
7. Gauthier, A.H. and T.M. Smeeding, *Time use at older ages : cross-national differences.* Research on Aging 2003. **25**(3): p. 247-274.
8. Dosman, D., et al., *Retirement and productive activity in later life.* Journal of Family and Economic Issues, 2006. **27**(3): p. 401–419.
9. Barnett, I., C. Guell, and D. Ogilvie, *The experience of physical activity and the transition to retirement: a systematic review and integrative synthesis of qualitative and quantitative evidence.* International Journal of Behavioral Nutrition and Physical Activity, 2012. **9**(97).
10. Phillips, M., S. Arber, and J. Ginn, *Physical activity among men and women in midlife: variations by class and employment status.* Education and Ageing, 2001. **16**(2): p. 135-162.
11. Sprod, J.A., et al., *Changes in sedentary behaviours across the retirement transition: a systematic review.* Age and Ageing, 2015. **44**: p. 918–925.
12. Stancanelli, E. and A. van Soest, *Retirement and time use in couples: a regression discontinuity approach*. 2011, Le Centre National de la Recherche Scientifique (CNRS),

Université Cergy Pontoise, Network for Studies on Pensions, Ageing and Retirement (Netspar) at Tilburg University, RAND and The Institute for the Study of Labor (IZA). p. 1-44.

13. Piekkola, H. and L. Leijola, *Time use, health and retirement*, in *ENEPRI Research Report publications*. 2004, European Network of Economic Policy Research Institutes: Helsinki, Finland. p. 101.
14. Maher, C.A., et al., *Changes in use of time, activity patterns, and health and wellbeing across retirement: design and methods of the life after work study.* BMC Public Health, 2013. **13**: p. 952.
15. National Health and Medical Research Council, Australian Research Council, and Universities Australia. *Australian code for the responsible conduct of research*. 2007 [cited 2016 14th March 2016]; Available from: https://http://www.nhmrc.gov.au/guidelines-publications/r39.
16. Gomersall, S.R., T.S. Olds, and K. Ridley, *Development and evaluation of an adult use-of-time instrument with an energy expenditure focus.* Journal of Science and Medicine in Sport, 2011. **14**(2): p. 143–148.
17. Ainsworth, B.E., et al., *Compendium of physical activities: an update of activity codes and MET intensities.* Medicine and Science in Sports and Exercise, 2000. **32**(9 Suppl): p. S498–504.
18. Foley, L.S., et al., *Doubly labeled water validation of a computerized use-of-time recall in active young people.* Metabolism, 2013. **62**(1): p. 163-169.
19. Gomersall, S.R., et al., *Validity of a self-report recall tool for estimating sedentary behaviour in adults.* Journal of Physical Activity and Health, 2015. **12**(11): p. 1485-91.
20. Australian Bureau of Statistics. *How Australia takes a census: 2011 household form*. 2011 12 May 2011 [cited 2015 14th February 2015]; Available from: http://www.abs.gov.au/ausstats/abs@.nsf/lookup/2903.0Main Features162011.
21. Brazier, J.E., et al., *Validating the SF-36 health survey questionnaire: new outcome measure for primary care.* British Medical Journal, 1992. **305**: p. 160-4.
22. Ware, J.E.J. and C.D. Sherbourne, *The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection.* Med Care, 1992. **30**(6): p. 473-83.
23. Engels, J.M. and P. Diehr, *Imputation of missing longitudinal data: a comparison of methods.* Journal of Clinical Epidemiology, 2003. **56**: p. 968–976.
24. Atchley, R.C. and A.S. Barusch, *Social forces and aging: an introduction to social gerontology*. 10th ed. 2004, Belmont, USA: Thomson Wadsworth.
25. Pushkar, D., et al., *Testing continuity and activity variables as predictors of positive and negative affect in retirement.* Journal of Gerontology Series B: Psychological Sciences and Social Sciences, 2010. **65**(1): p. 42–49.

26. Zantinge, E.M., et al., *Retirement and a healthy lifestyle: opportunity or pitfall? A narrative review of the literature.* European Journal of Public Health, 2014. **24**(3): p. 433-9.
27. Barnett, I., E.M.F. van Sluijs, and D. Ogilvie, *Physical activity and transitioning to retirement: a systematic review.* American Journal of Preventive Medicine, 2012. **43**(3): p. 329-36.
28. Slingerland, A.S., et al., *Aging, retirement, and changes in physical activity: prospective cohort findings from the GLOBE Study.* American Journal of Epidemiology, 2007. **165**(12): p. 1356–1363.
29. Australian Bureau of Statistics. *How Australians use their time*. 2006 [cited 2016 14th February 2016]; Available from: http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4153.0Main Features22006?opendocument&tabname=Summary&prodno=4153.0&issue=2006&num=&view=.
30. Australian Bureau of Statistics. *Disability, ageing and carers, Australia: summary of findings, 2012: older people - long-term health conditions*. 2012 6th April 2016]; Available from: http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/682B6E1F8ACC3D5DCA257C21000E5085?opendocument.
31. Atchley, R.C., *A continuity theory of normal aging.* The Gerontologist, 1989. **29**(2): p. 183-190.



<InlineImage1>

Figure 1: Distribution of use of time in all superdomains at all time points.

Table 1: Participant characteristics at baseline (n = 124)

Age (years)	
Mean (SD)	62.3 (4.3)
Range	50.1 - 78.6
Sex (%)	
Male	49
Female	51
Marital status (%)	
Married	67
Single/separated/widowed	31
Prefer not to say/missing	2
Living arrangements (%)	
Alone	22
With other (partner only, partner and children, children, combination of family, other person)	79
Self-rated Health (mean (SD)	

General Health (score/100)	65.2 (9.8)
BMI (kg/m^2)	27.2
Education (%)	
Low (high school, post-secondary)	46
Medium (degree)	23
High (post-graduate)	32
Missing	-
Income (%)	
Low (< $15,599 - $72,799)	37
Medium ($72,800 - $129,999)	37
High (> $130,000)	26
Prefer not to say/missing	1
Occupations (%)	
Professional	38
Associate professional	16
Manager	15
Advanced clerical	14
Intermediate clerical	8
Trade	3
Elementary clerical	4
Intermediate production	2
Not applicable/missing	-
Work hours	
Mean (SD) (hours/week)	34.5 (8.6)

Table 2: Time (min/day) spent in all domains across retirement

Superdomain Macrodomain	Baseline	3 months	6 months	12 months	p value
Chores	160 (71)[abc]	226 (98)[a]	219 (93)[b]	215 (81)[c]	**<0.001***
Inside chores	140 (67)	188 (86)	184 (81)	177 (69)	
Outside chores	20 (27)	38 (44)	36 (43)	38 (44)	
Physical Activity	14 (25)[ab]	23 (40)[a]	22 (38)[b]	21 (40)	**0.01***
Quiet time	73 (50)[abc]	91 (64)[a]	93 (66)[b]	90 (63)[c]	**0.02***
Reading	43 (40)	61 (57)	64 (59)	63 (60)	
Non-reading	31 (29)	29 (37)	29 (35)	26 (34)	
Screen time	115 (71)[abc]	138 (86)[a]	151 (100)[b]	147 (99)[c]	**<0.001***
Television	111 (68)	135 (85)	146 (94)	140 (85)	
Videogames	4 (15)	3 (12)	5 (19)	7 (32)	
Self-care	119 (33)[ab]	117 (31)[cd]	124 (34)[ac]	127 (34)[bd]	**0.01***
Eating	68 (26)	71 (26)	81 (29)	82 (30)	
Grooming	50 (17)	45 (19)	44 (17)	45 (18)	
Sleep	462 (52)[abc]	491 (59)[a]	493 (63)[b]	494 (62)[c]	**<0.001***
Sociocultural	130 (68)	122 (68)	111 (60)	127 (67)	0.05
Communication	109 (64)	90 (57)	78 (40)	89 (51)	
Socialising	17 (21)	29 (41)	28 (41)	29 (36)	
Cultural	4 (17)	3 (12)	4 (16)	9 (24)	
Transport	137 (56)[abc]	118 (52)[a]	112 (55)[b]	111 (52)[c]	**<0.001***
Active transport	52 (40)	40 (30)	39 (30)	39 (29)	
Passive transport	85 (40)	77 (26)	73 (42)	72 (39)	
Work	231 (98)[abc]	117 (99)[a]	114 (93)[b]	109 (89)[c]	**<0.001***
Employment	83 (85)	28 (44)	27 (45)	30 (45)	
Study	6 (14)	9 (20)	9 (18)	10 (23)	
Computer	142 (99)	80 (78)	78 (79)	69 (71)	

values = means (SD) (standard deviation); p value for REMM (random effects mixed model analysis); bold = significant to 0.05; * = significant after sequential Bonferroni correction; superscript letters = significant pairwise comparisons; covariates = site, sex, education, health; education levels = low (primary/elementary school, high school, post-secondary diploma or certificate), medium (bachelor degree) or high (post-graduate qualification); health groups = fair (5-17/25), good (18-19/25) or excellent (20-25/25) health

Table 3: Time (min/day) spent, and change in time spent, in all superdomains across retirement by sex

Superdomain	Baseline		12 months		p value for difference between men and women	Change baseline to 12 months		p value for differences in changes between men and women
	men (n = 61)	women (n = 63)	men (n = 61)	women (n = 63)		men (n = 61)	women (n = 63)	
Chores	138 (61)	181 (74)	207 (84)	223 (78)	**0.01**	+68 (81)	+43 (90)	0.94
Physical activity	17 (31)	11 (18)	23 (46)	19 (32)	0.09	+7 (38)	+8 (35)	0.90
Quiet time	66 (45)	80 (53)	80 (61)	98 (63)	**0.03**	+14 (61)	+18 (60)	0.31
Screen	122 (79)	109 (63)	156 (115)	137 (79)	0.72	+35 (83)	+29 (63)	0.60
Self-care	117 (31)	120 (34)	128 (34)	126 (35)	0.88	+11 (35)	+5 (35)	0.51
Sleep	463 (55)	461 (50)	498 (64)	491 (61)	0.39	+36 (49)	+29 (58)	0.46
Sociocultural	126 (64)	134 (72)	113 (65)	139 (67)	**0.02**	-12 (79)	+5 (88)	**0.04**
Transport	145 (60)	128 (51)	112 (53)	111 (51)	0.69	-33 (83)	-18 (61)	0.83

Work	247 (98)	215 (97)	123 (97)	96 (79)	**0.01**	-124 (97)	-119 (119)	0.26

values = means (SD) (standard deviation); p value for difference = REMM (random effects mixed model analysis); bold = significant to 0.05; covariates = site, sex, education, health; education levels = low (primary/elementary school, high school, post-secondary diploma or certificate), medium (bachelor degree) or high (post-graduate qualification); health groups = fair (5-17/25), good (18-19/25) or excellent (20-25/25) health; p value for change = ANCOVA (analysis of covariance); covariates = sex, baseline value of dependent variable

Table 4: Time (min/day) spent, and change in time spent, in all superdomains across retirement by education

Superdomain	Baseline			12 months			p value for difference between education groups	Change baseline to 12 months			p value for differences in changes between education groups
	low (n =57)	medium (n = 28)	high (n = 39)	low (n =57)	medium (n = 28)	high (n = 39)		low (n =57)	medium (n = 28)	high (n = 39)	
Chores	155 (60)	155 (67)	170 (88)	226 (84)	208 (84)	203 (75)	0.44	+71 (87)	+52 (76)	+33 (88)	0.17
Physical activity	16 (32)	13 (18)	11 (18)	22 (42)	21 (37)	19 (38)	0.07	+6 (33)	+8 (38)	+8 (41)	0.99
Quiet time	79 (58)	67 (45)	69 (38)	88 (74)	81 (51)	98 (52)	0.84	+9 (64)	+14 (49)	+28 (61)	0.39
Screen	117 (65)	123 (93)	107 (63)	154 (76)	164 (144)	124 (86)	**0.02**	+37 (75)	+41 (82)	+17 (62)	0. 28
Self-care	117 (34)	123 (36)	118 (28)	129 (35)	127 (35)	123 (33)	0.27	+12 (37)	+4 (34)	+5 (33)	0.52
Sleep	459 (54)	455 (58)	471 (44)	495 (64)	488 (67)	497 (58)	0.35	+36 (56)	+33 (57)	+27 (48)	0.85
Sociocultural	138 (67)	134 (76)	115 (64)	126 (69)	131 (60	124 (71)	0.94	-12 (86)	-3 (80)	+9 (83)	0.92

Transport	139 (61)	141 (58)	131 (46)	102 (47)	125 (59)	115 (52)	0.93	-37 (75)	-16 (81)	-15 (63)	0.14
Work	220 (100)	229 (82)	249 (107)	97 (80)	95 (102)	137 (88)	**0.004***	-123 (109)	-134 (97)	-112 (117)	0.12

values = means (SD) (standard deviation); p value for difference = REMM (random effects mixed model analysis); bold = significant to 0.05; * = significance retained after sequential Bonferroni correction; superscript letters = significant pairwise comparisons; covariates = site, sex, education, health; education levels = low (primary/elementary school, high school, post-secondary diploma or certificate), medium (bachelor degree) or high (post-graduate qualification); health groups = fair (5-17/25), good (18-19/25) or excellent (20-25/25) health; p value for change = ANCOVA (analysis of covariance); covariates = education, baseline value of dependent variable

Table 5: Time (min/day) spent, and change in time spent, in all superdomains across retirement by health

Superdomain	Baseline			12 months			p value for difference between health groups	Change baseline to 12 months			p value for differences in changes between health groups
	fair (n = 49)	good (n = 44)	excellent (n = 30)	fair (n = 49)	good (n = 44)	excellent (n = 30)		fair (n = 49)	good (n = 44)	excellent (n = 30)	
Chores	142 (59)	165 (72)	180 (84)	204 (71)	211 (74)	239 (103)	**0.002***	+62 (75)	+46 (85)	+60 (105)	0.42
Physical activity	16 (28)	13 (23)	12 (25)	26 (42)	19 (33)	18 (45)	0.69	+10 (38)	+6 (36)	+6 (36)	0.75
Quiet time	68 (39)	69 (46)	85 (66)	95 (62)	81 (56)	90 (74)	0.67	+27 (66)	+12 (61)	+5 (47)	0.37

Screen	141 (80)	92 (56)	107 (65)	178 (116)	121 (77)	135 (84)	**0.002 ***	+37 (80)	+29 (67)	+28 (72)	0.66
Self-care	125 (38)	119 (27)	107 (29)	128 (40)	127 (30)	124 (31)	0.48	+3 (39)	+9 (37)	+17 (22)	0.80
Sleep	462 (54)	468 (45)	456 (58)	487 (54)	501 (61)	498 (77)	0.77	+26 (47)	+34 (55)	+42 (63)	0.44
Sociocultural	120 (62)	146 (75)	125 (64)	109 (65)	144 (73)	129 (56)	0.53	-11 (84)	-2 (91)	+4 (70)	0.10
Transport	135 (53)	143 (55)	132 (63)	109 (45)	120 (60)	100 (48)	0.63	-25 (73)	-23 (72)	-32 (77)	0.29
Work	232 (89)	225 (108)	237 (102)	104 (90)	116 (86)	107 (95)	0.80	-129 (102)	-109 (121)	-131 (102)	0.68

values = means (SD) (standard deviation); p value for difference = REMM (random effects mixed model analysis); bold = significant to 0.05; * = significance retained after sequential Bonferroni correction; superscript letters = significant pairwise comparisons; covariates = site, sex, education, health; education levels = low (primary/elementary school, high school, post-secondary diploma or certificate), medium (bachelor degree) or high (post-graduate qualification); health groups = fair (5-17/25), good (18-19/25) or excellent (20-25/25) health; p value for change = ANCOVA (analysis of covariance); covariates = health, baseline value of dependent variable