

## SYSTEMATIC REVIEW

# Changes in sedentary behaviours across the retirement transition: a systematic review

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## Abstract

**Background:** prolonged sedentary behaviour has been associated with a number of chronic health conditions. This issue is compounded by inactivity increasing with age.

**Objective:** this systematic review aimed to identify evidence regarding changes in sedentary behaviours as people move into retirement.

**Search strategy and selection criteria:** nine databases (Ageline, CINAHL, Cochrane, Embase, MEDLINE, ProQuest, PubMed, SportDiscus and Web of Science) were searched in May 2014. Search terms included retirement, time use and a range of sedentary behaviours, with no date limit. Articles were selected and appraised for risk of bias by two independent reviewers. Due to the variations in measures used for reporting, data synthesis of results was qualitative.

**Results:** two studies measured total sitting time and reported declines across retirement. Several studies examined self-reported time spent in specific sedentary leisure activities and generally reported increases in duration, prevalence or frequency (television: 7/9 studies; reading: 4/6 studies). Few other sedentary behaviours were considered.

**Conclusions:** changes in sedentary time across retirement are currently poorly understood with varying patterns of change identified by different study methodologies (total sitting time versus specific leisure sedentary activities). Future research that simultaneously investigates changes in a comprehensive range of sedentary behaviours across retirement is required. To date, findings suggest that interventions aimed at improving the health of this population need to be targeted at specific sedentary behaviours to provide maximum benefit.

**Keywords:** ageing, retirement, use of time, sedentary behaviour, systematic review, older people

## Introduction

### Rationale

The global population is ageing and life expectancy increasing leading to greater numbers of people spending a longer time in the retirement phase of life [1]. When transitioning to retirement, the activities of daily life need to be restructured [2] so it can be an opportunity to increase health-enhancing activities and reduce ones that will be detrimental.

Sedentary behaviour is defined as ‘any waking behaviour characterised by an energy expenditure  $\leq 1.5$  METs while in a sitting or reclining posture’ [3], where ‘one metabolic equivalent (MET) is the amount of oxygen consumed while sitting at rest’ [4]. This differs from physical inactivity that describes a lack of sustained activity of moderate to vigorous intensity [5] and thus has separate health implications [6]. Additionally,

distinguishing between specific sedentary behaviours is important as their correlates and effects on health may differ [7]. For example, time spent sitting watching television, a common sedentary behaviour, has strong associations with obesity and cardiovascular disease, a greater risk of diabetes and higher all-cause mortality [8–12]. Similar detrimental health associations have also been found for total daily sitting time [11, 12]. However, it appears that the context of sitting can alter these health associations as milder negative health effects have been found for occupational sitting compared with sitting watching television [13]. Moreover, activities that engage the brain while sitting may have other compensations such as reducing cognitive decline with age [14].

It has been found that time spent in sedentary behaviour increases as people age [15]. Understanding how sedentary behaviour changes across the retirement transition may assist

in identifying health behaviours that can be key areas of interventions to improve health.

### Objective

This systematic review aims to draw together all relevant evidence from different academic domains such as time use research, gerontology and leisure research, to answer the research question: ‘How do sedentary behaviours change across the retirement transition?’

### Search strategy and selection criteria

This systematic review followed the PRISMA guidelines (Preferred Reporting Items for Systematic reviews and Meta-Analyses) [16].

### Eligibility criteria

Studies were included if participants were aged over 45 years to capture retirement at the end of working life, rather than due to ill-health or disability. Not working due to unemployment or retirement from elite sport were exclusions. Longitudinal and cross-sectional designs were included, with the latter requiring similar socio-demographic characteristics in both working and retired groups. Any sedentary behaviours were included with data from any stage pre- and post-retirement and from multiple time points.

Limits were set for ‘human’, ‘English’ and ‘peer-review’ but not for date of publication. Further refining excluded books, book chapters, reviews and editorials.

### Information sources

Databases were chosen in consultation with an academic librarian and included Ageline, CINAHL, Cochrane, Embase, MEDLINE, ProQuest, PubMed, SportDiscus and Web of Science. The systematic search was conducted during April and May 2014 followed by hand searching the reference lists of the relevant articles and consultation with experts in the field. Authors of published studies where data were unclear were contacted for further information.

### Search

Search terms included retirement, time use and a range of sedentary behaviours. See Supplementary data, Appendix S1, available in *Age and Ageing* online for the complete search strategy.

### Study selection

Study selection was undertaken in two stages: first titles and abstracts, followed by obtaining full text for all eligible articles or where eligibility was unclear. Two authors independently carried out the selection process with discrepancies discussed until consensus was reached.

### Risk of bias in individual studies

There is currently lack of consensus regarding the most appropriate tool for determining risk of bias in observational studies.

We therefore opted to use the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist [17] as it comprehensively examines numerous aspects of studies’ designs and reporting and has been used for risk of bias scoring in previous systematic reviews [18, 19]. Each of the items or sub-items on the checklist was scored out of one, with a possible total score of 34. If an item was not applicable to the article, n/a was recorded, then a percentage of the total was calculated. Appraisal was conducted by two authors, and differences resolved through discussion.

### Summary measures and synthesis of results

Data extraction by two reviewers recorded the study’s features in a purpose-designed spreadsheet. The primary outcome measure was a reported change in sedentary activities from pre- to post-retirement.

## Results

### Study selection

A total of 12,804 studies were identified, and after duplicates were removed 7,729 studies remained. A final total of 12 studies met all inclusion criteria (see Figure 1).

### Study characteristics

#### Publication dates and settings

The publication dates ranged from 1970 to 2014. The studies were undertaken in a range of countries including USA ( $n = 5$ ), UK ( $n = 3$ ), Australia ( $n = 1$ ), France ( $n = 1$ ), Israel ( $n = 1$ ) and South Korea ( $n = 1$ ).

#### Study design and time frame

Eleven of the 12 studies were longitudinal of which 6 used a prospective design [20–25] with a follow-up time of 1 [22] to 9 years [25], and 5 using a retrospective design [26–30] with a recall time either not specified, or 1 year to >30 years [28]. One further study used a cross-sectional design [31].

#### Sedentary behaviours

Two studies investigated overall sitting time [25, 31] while two studies grouped ‘sitting and thinking’ with other sedentary activities [20, 27]. Of the specific sedentary behaviours, viewing television was the most common and was reported in nine studies [20–24, 27–30], while reading was reported in six studies [20, 22, 27–30]. See Supplementary data, Appendix S2, available in *Age and Ageing* online for details of the included studies. Six studies reported on one or two other sedentary behaviours [20, 22, 26, 27, 29, 30]. The metric for reporting sedentary time varied widely between studies. Given the wide variation in measures, and the small number of included studies, meta-analysis was deemed not possible.

#### Participants

The total number of participants was 15,216. Six of the studies focused exclusively or predominantly on males

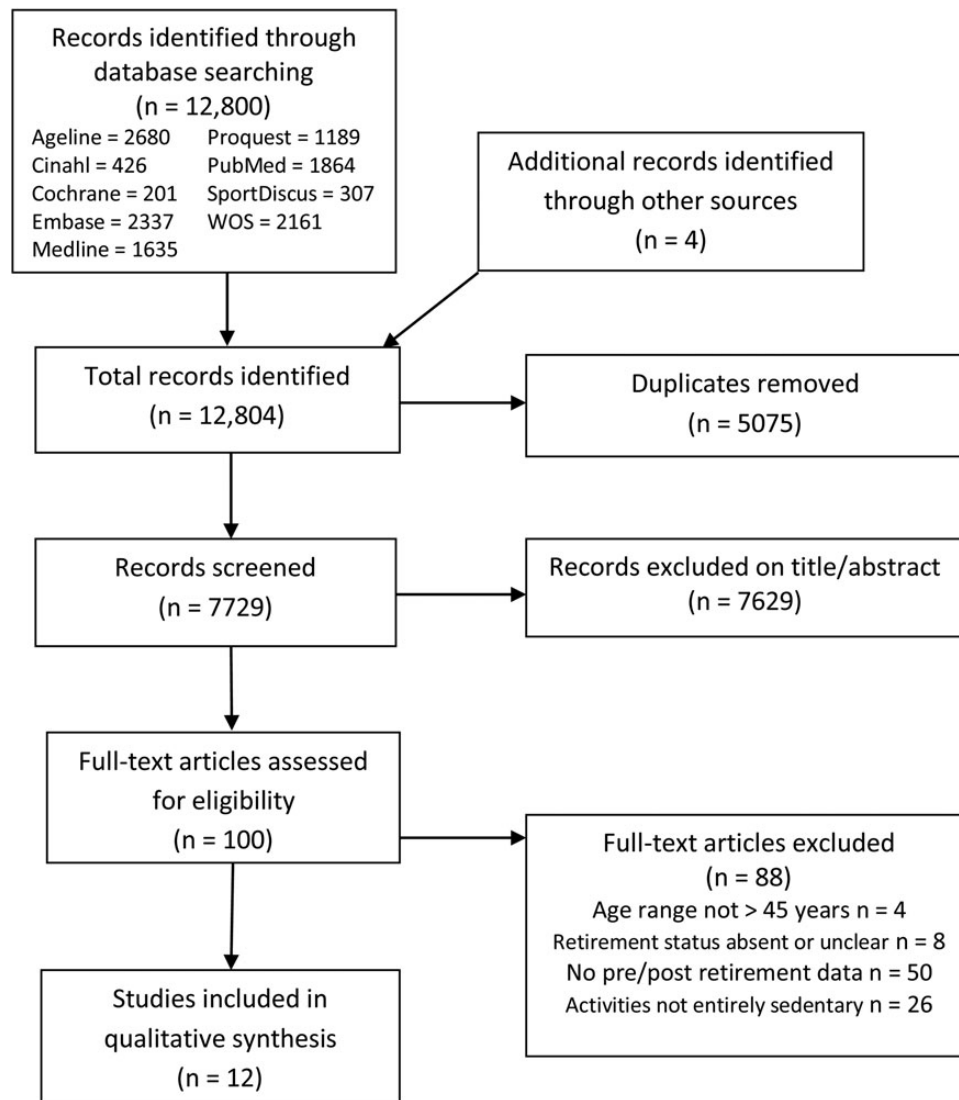


Figure 1. Flowchart.

[20, 22, 26, 27, 29, 30], while one study reported 100% females [25]. Overall, males comprised 48.8% of the total sample. Nine studies reported the age of participants, with the average age ranging from 52.7 to 71.1 years [20, 21, 23, 24, 26–28, 30, 31].

#### Work and retirement status

Retirement was mostly self-reported but defined in three studies as completely or partially leaving work [20, 24, 31]. Four studies did not define how retirement was operationalised [26–28, 30]. The reason for retirement was not provided in any study, although two studies excluded people who were forced to retire due to ill-health or redundancy [21, 24] and two studies quoted a mandatory age of retirement [22, 30].

The extent of working hours prior to retirement was not clear in the majority of studies, but three studies reported that participants were retiring from full-time [22] or full- or part-time employment [28, 29]. Similarly, the extent of working hours in retirement varied, or was not addressed.

For example, two studies categorised participants as retired if not in full-time work [20, 31], whereas one study [24] stated that retirees did not work at all.

#### Risk of bias within studies

Risk of bias scoring found that six studies had relatively high risk of bias (as indicated by scores <39%) [20, 22, 26–29], while five had relatively low risk of bias (indicated by scores >73%) [21, 23–25, 31]. For more details, see Supplementary data, Appendix S3, available in *Age and Ageing* online.

#### Results of studies

The changes in each sedentary activity type are detailed in Table 1, with key findings summarised in text below.

#### Changes in overall sitting time

A reduction in overall sitting time was reported in the two studies that investigated total sitting or sedentary time.

## Changes in sedentary behaviours across the retirement transition

**Table 1.** Summarised results of studies: changes in sedentary behaviours after retirement

	Change direction	Watching television pre-/post-retirement	Change direction	Reading pre-/post-retirement	Change direction	Sitting time pre-/post-retirement	Change direction	Other sedentary behaviours pre-/post-retirement
.....								
Barnett 2014 [24]								
Men: non-manual	↑	Increase of 5.4 h/week		–		–		–
Women: non-manual	↑	Increase of 5.3 h/week		–		–		–
Men: manual	↑	Increase of 6.6 h/week		–		–		–
Women: manual	↑	Increase of 6.6 h/week		–		–		–
Touvier 2010 [23]								
Men	↑	Increase of 4.8 h/week from 12.8 h/week		–		–		–
Women	↑	Increase of 4 h/week from 12.7 h/week		–		–		–
Evenson 2002 [21]								
Men: African American	↑	Increase of 14% from 43.3% who view TV often or very often		–		–		–
Women: African American	↑	Increase of 9.8% from 35.6% who view TV often or very often		–		–		–
Men: White	↑	Increase of 5.3% from 34% who view TV often or very often		–		–		–
Women: White	↑	Increase of 5.7% from 26.9% who view TV often or very often		–		–		–
Bosse 1981 [20]	↑	Increase in mean frequency rating (1–9) for aggregated solitary activities (including watching television)	↑	Increase in mean frequency rating (1–9) for aggregated solitary activities (including reading)		–	↑	Increase in mean frequency rating (1–9) for aggregated solitary activities (including sitting and thinking)
Clark 2014 [25]								
Retired 2001–4	–			–	↓	OR sitting decreases ≥2 h 1.53 (0.96, 2.44)		–
Retired 2004–7	–			–	→	OR sitting decreases ≥2 h 1.30 (0.87, 1.96)		–
Retired 2007–10	–			–	↓	OR sitting decreases ≥2 h 2.13 (1.52, 2.98)		–
Long 1987* [22]	↑	Increase of 7.6 h/week from 13.9 h/week	↑	Increase of 5.9 h/week from 4 h/week		–		–
Rosenkoetter 2001* [28]								
Men	↑	Increase to 15.3 h/week	↑	Increase to 9.24 h/week		–		–
Women	↑	Increase to 16.05 h/week	↑	Increase to 8.42 h/week		–		–
Kremer 1982* [30]	↑	Increase of 0.6 in mean frequency rating (1–5) from 3.67	↑	Increase of 0.1 in mean frequency rating (1–5) from 3.5		–	↑	Increase of 0.2 in mean frequency rating (1–5) from 3.8 (listening to radio or music)
							↓	Decrease of 0.4 in mean frequency rating (1–5) from 2.5 (attending movies, theatre)
Peppers 1976* [27]	→	Maintenance of 2 for participation ranking (1–10)	↓	Decrease of 1 in participation ranking (1–10) from 4		–	↑	Increase of 3 in participation ranking (1–10) from 9 (sitting and thinking)

Table 1. Continued

	Change direction	Watching television pre-/post-retirement	Change direction	Reading pre-/post-retirement	Change direction	Sitting time pre-/post-retirement	Change direction	Other sedentary behaviours pre-/post-retirement
Lee 2005* [29]	↓	Decrease of 16% of sample	↓	Decrease of 8% of sample	–	–	↓	Decrease of 8% of sample (card/board games) ↓ Decrease of 1.6% of sample (listening to radio or music) ↓ Decrease of 9.2% of sample (using computer)
Bultena 1970* [26]	–	–	–	–	–	–	↑	67% of sample much more, more active (card/board games)
Godfrey 2014* [31]	–	–	–	–	↓	Number of daytime bouts >20 min: 48 to 46 >30 min: 31 to 29 >55 min: 15 to 13	–	–

\*Denote univariate analysis.  
OR, odds ratio; –, no data.

Self-reported daily sitting time was adjusted for exercise, BMI, highest qualification, marital status, smoking, location, country of birth and baseline values of sitting. A significant decrease was found (OR for sitting decreasing  $\geq 2$  h of 1.49 to 1.94) for two cohorts of participants who retired in three follow-up periods, while the cohort from the third follow-up period showed a non-significant trend for less sitting time [25]. Similarly, using a week of accelerometry, the number of daytime bouts of sitting/lying time was less for retired people compared with those still employed [31]. However, when combining sitting with thinking, participation was ranked three ranks higher post-retirement, indicating that more sitting and thinking occurred after retirement [27]. When ‘sitting and thinking’ was also aggregated with other sedentary behaviours, a significant increase in frequency ( $P < 0.05$ ) was indicated in the age-adjusted means figure for retirees compared with workers [20].

**Changes in specific sedentary activities**

Nine studies examined television viewing [20–24, 27–30] of which seven found increases across retirement in time [22–24, 28], prevalence [21] or frequency [20, 30] and four found an increase in retired compared with non-retired peers [20, 21, 23, 24]. Of the seven studies, four used multivariate analysis [20, 21, 23, 24], adjusting most commonly for age followed by education, health status and the baseline value of the variable. The magnitude of the increase appeared to be quite large, ranging from 4 to 6.6 h/week [22–24], and resulted in a range of 16.7 to 21.5 h/week spent watching television post-retirement. In contrast, one descriptive study reported no change in the ranking of participation in television viewing [27] while another univariate study reported a decreasing trend in prevalence [29].

Six studies examined reading behaviours across retirement [20, 22, 27–30] with four studies finding increases in frequency [20, 30] or time [22, 28]. Only one study was multivariate [20], adjusting for age and the baseline value of reading. Additional time spent reading in one study equated to around 6/week [22] and resulted in post-retirement levels of reading of 9 to 10 h/week which was similar to those of another study [28]. Two other studies, one adjusting for age and the baseline level of the variable [20], showed small increases across retirement in the frequency of reading [20, 30] while the data in two studies suggested a decreased prevalence [29] or frequency [27] in reading time across retirement.

The less commonly investigated sedentary behaviours yielded contrasting results. One study suggested an overall decrease in the prevalence of playing cards and board games, listening to music or singing and using a computer [29]. Conversely, a greater overall prevalence of people who were active in playing cards and board games was reported in one study [26] and another study reported a small net increase in the frequency of listening to music or singing [30].

**Discussion**

**Summary of evidence**

To date, only a small number of studies have examined changes in sedentary behaviours across retirement. Overall, total sitting or sedentary time reduced. With one exception [29], studies that examined specific behaviours, such as watching television, reading, or ‘sitting and thinking’, found that such behaviours increased in duration, prevalence or frequency after retirement. The majority of the studies that investigated television viewing used multivariate analysis. Therefore, we can have some confidence in the conclusion

that time spent watching television increases across retirement. However, the strength of the other findings is somewhat diminished by the lack of consideration of the many factors that may concurrently influence time spent in sedentary behaviours across retirement.

### *Changes in sitting time*

While reductions in sitting time across retirement were found in two studies, one using a week of accelerometry [31] and the other using self-report of sitting time throughout the day [25], the two studies that found an increase in sitting only measured specific activities such as sitting and thinking [20, 27]. Such time is likely to only account for a small percentage of total daily sitting time [32]. The most logical interpretation of these findings is that while time spent in some specific leisure-orientated sedentary behaviours may increase over retirement, there is an overall reduction in sitting time primarily due to reduced occupational sitting.

### *Effect of pre-retirement factors*

Contrasting results were reported for how the type of pre-retirement work affected television viewing post-retirement. One study [23] found a greater increase in television viewing time after retirement for those who had had a less manual occupation, while another [24] reported the reverse. Moreover, for those studies who sampled only manual or only non-manual workers, mixed results were found. Another pre-retirement factor considered in some studies was whether the person was habitually active or sedentary. A number of the studies [20, 22, 26, 27, 29, 30] reported that the pre-retirement leisure activity pattern of the individual continued, albeit at a higher rate, post-retirement. It is therefore possible that pre-retirement activity patterns may be a stronger predictor than pre-retirement occupation on time spent in sedentary behaviours post-retirement.

### *Consistency of findings*

Although findings of increased leisure-based sedentary behaviours across retirement were generally consistent, in contrast one study [29] found a contrasting decreasing trend. As this was the only study from an Asian culture, these findings may be due to different cultural patterns. However, results may also have been compromised by methodological considerations as the risk of bias for this study was very high, as indicated by the low score.

### **Strengths and limitations**

A strength of this review was the comprehensive range of databases and search terms that were used to maximise the number of studies found. In addition, use of the PRISMA guidelines [16] ensured a thorough reporting framework and the STROBE checklist [17] led to rigorous critical appraisal. Moreover, the majority of studies reported similar findings, especially with respect to time spent watching television, and

the studies originated from a variety of countries which assist in generalisation of the findings.

However, despite the extensive search, there were few, high-quality studies on this topic. This highlights a gap in the literature and limits the conclusions that can be drawn. The variety in reporting styles, as well as the small number of eligible studies, meant that meta-analysis was not possible. In addition, the critical appraisal process revealed low scores for half the studies [20, 22, 26–29], and this reduces the confidence in their findings.

### **Considerations for future research**

Three studies in this review used the commonly applied, self-reported measure of television viewing as a proxy of overall sedentary behaviour [21, 23, 24]. This proxy measure is now in question as the contextual factors and subsequent health outcomes may differ from other sedentary behaviours [7, 13, 33]. Thus, television viewing alone is not a reliable indication of total sedentary time.

In future research, a combination of approaches is recommended. Longitudinal studies of 24-h time use, using objective methods such as accelerometry and subjective measures such as recalled use of time, will capture volume, type and patterns of the different sedentary behaviours and identify compensatory shifts from sedentary to other types of activity. To date, we can only speculate whether the increases in ambulatory and physical activity found in two studies [25, 31] compensate for the decrease in overall sitting time. In addition, multivariate analysis will allow examination of a range of factors that may influence the use of time at retirement. The restructure of daily activity patterns at retirement [2] is an opportunity where the additional information gained by these approaches can be applied to strategies that enhance the health of this population so they can accurately target key areas.

This review identified a lack of clarity, or absence of, the definition of retirement, work hours and the timeframes investigated. Definitions of retirement may vary due to the many pathways to retirement [34, 35], so a specific definition would facilitate comparisons. In addition, the extended follow-up periods into retirement in some of the studies [28, 29] make it hard to determine whether findings were due to the effect of retirement or those of ageing.

### **Conclusion**

This review identified a limited number of studies that investigated the change and variation in sedentary behaviours across retirement. Studies typically report that leisure-time sedentary behaviours, such as television viewing, have increased in duration, prevalence or frequency after retirement. In contrast, studies examining total sitting time have found a reduction in sedentary time. Although this discrepancy may be due to variations in occupational compared with leisure sedentary activity, multivariate studies that comprehensively examine variability and change in 24-h sedentary

behaviour across all domains and activities are required to verify this.

## Key points

- A limited number of studies have investigated the change in sedentary behaviours across the transition into retirement.
- In general, total sitting time declined after retirement while specific sedentary behaviours, such as television viewing and reading showed increased duration, prevalence or frequency.
- More studies are required which provide objective and detailed information on the volume, pattern, type and timing of sedentary behaviours.

## Conflicts of interest

None declared.

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## Supplementary data

Supplementary data mentioned in the text are available to subscribers in *Age and Ageing* online.

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