Nine year changes in sitting time in young and mid-aged Australian women: Findings from the Australian longitudinal study for women's health

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Manuscript Title: Nine year changes in sitting time in young and mid-aged Australian women: findings from the Australian Longitudinal Study for Women's Health

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Highlights

- Over nine years sitting time (ST) decreased in young women and increased in mid-aged women.
- Decreased ST was associated with having a baby, beginning work and decreased income in young women.
- Decreased ST was associated with retirement and decreased income in mid-aged women.

- Increased ST was associated with returning to study and job loss in young women.
- Increased ST was associated with changes at work in mid-aged women.

Abstract

Objective

To examine changes in sitting time (ST) in women over nine years and to identify associations between life events and these changes.

Methods

Young (born 1973-78, n=5215) and mid-aged (born 1946-51, n=6973) women reported life events and ST in four surveys of the Australian Longitudinal Study on Women's Health between 2000 and 2010. Associations between life events and changes in ST between surveys (decreasers ≥2 hrs/day less, increasers ≥2 hrs/day more) were estimated using generalized estimating equations.

Results

Against a background of complex changes there was an overall decrease in ST in young women (median change -0.48 hrs/day, interquartile range [IQR] =-2.54, 1.50) and an increase in ST in mid-aged women (median change 0.43 hrs/day; IQR =-1.29, 2.0) over nine years. In young women, returning to study and job loss were associated with increased ST, while having a baby, beginning work and decreased income were associated with decreased ST. In mid-aged women, changes at work were associated with increased ST, while retiring and decreased income were associated with decreased ST.

Conclusions

ST changed over nine years in young and mid-aged Australian women. The life events they experienced, particularly events related to work and family, were associated with these changes.

Keywords: Sitting, life events, longitudinal study, women

Introduction

There is increasing evidence that time spent in sedentary behaviors (sitting or reclining with low energy expenditure),(Owen, 2012) is associated with poor health outcomes, including obesity, type 2 diabetes, cardiovascular disease and premature mortality (Chau et al., 2013, Thorp et al., 2011, Williams et al., 2008, van der Ploeg et al., 2012, Ford and Caspersen, 2012, Pavey et al., 2012). Over the past 20 years, time spent in sedentary behavior has increased, largely as a result of screen based activities such as watching television and using computers, sedentary modes of transport and sedentary occupations (Chau et al., 2012, Shields and Tremblay, 2008, Church et al., 2011). While studies have reported the prevalence and demographic correlates of sitting time (ST) (Bauman et al., 2011, Clark et al., 2010, Bowman, 2006) and accelerometer-derived sedentary time (Matthews et al., 2008, Hagstromer et al., 2007), very little is known about factors associated with changes in sitting during adulthood.

Life events, historically defined as life stressors, have been associated with health outcomes including higher mortality, smoking, stress and poorer self-rated physical and mental health (Dobson et al., 2005, Zautra et al., 1990, Lantz et al., 2005, Bell and Lee, 2006). Engaging in moderate and vigorous physical activity (PA) has been shown to be influenced by various life events, such as decreasing activity following marriage, declining health, the birth of the first child and transitioning from school to university or the workforce (Bell and Lee, 2006, Butler et al., 2004, Brown et al., 2009). It is conceivable that these life events may also influence ST. While the association of these life events with ST has not previously been examined, higher ST has been associated with a number of socio-demographic correlates including educational level, country of birth, type and hours of work, stress levels and health behaviors such as smoking and drinking (Uijtdewilligen et al., 2014). In addition to targeting certain socio-demographic groups, identifying triggers for changes in ST such as life events would provide researchers with a target for the timing of preventive strategies for prolonged ST.

The aim of this study was to describe the changes in ST over nine years in young and mid-aged women, and to identify life events which predict an increase or decrease in ST over time.

Methods

Participants

The Australian Longitudinal Study on Women's Health (ALSWH) is a prospective cohort study, which assesses women's physical and mental health, psychosocial aspects of health (such as socio-demographic and lifestyle factors) and their use of health services. The aim of the study was to examine the relationships between these factors and to inform governments on implications for health policy and practice. In 1996, three cohorts of women, young (born 1973-1978), mid-aged (born 1946-1951) and older (born 1921- 1926), were recruited. The sample was randomly drawn from the Australian national Medicare health insurance database which includes all Australian citizens and permanent residents (Brown et al., 1998). Women from rural and remote areas were intentionally over sampled; however, the recruited sample was broadly nationally representative (Brown et al., 1998). The women completed a mailed survey every three years. More information is available at: http://www.alswh.org.au/. The study has ethical approval from the Universities of Queensland and Newcastle Ethics Committees, and informed consent was received from all respondents.

At the first survey (1996), participant numbers were 14 247 in the young cohort and 13 715 in the mid-aged cohort. Data for this paper were taken from the 2000, 2003, 2006 and 2009 surveys from the young cohort and the 2001, 2004, 2007 and 2010 surveys of the mid-aged cohort, as these surveys included life events and ST questions. As ST was only collected for one survey in the older cohort, this group could not be examined. Only data from women who answered the ST questions in all four surveys were included in the analyses (37% of the original young cohort and 51% of mid-aged cohort). Flow charts of participants included in analyses and reasons for non-response at each stage for young and mid-aged participants are included in Figure 1.

INSERT FIGURE 1 ABOUT HERE

Measures

Outcome Measures: ST was measured by asking: *How many hours each day do you typically spend sitting down while doing things like visiting friends, driving, reading, watching television or working at a desk or computer i. On a usual weekday; ii. On a usual weekend day?* ST data

were cleaned using previously described procedures (van Uffelen et al., 2010). Changes in ST were calculated for each inter-survey period (i.e. between surveys from 2000 and 2003, 2003 and 2006, 2006 and 2009 in the young cohort and between surveys from 2001 and 2004, 2004 and 2007, 2007 and 2010 in the mid-aged cohort) and participants were categorized as: *decreasers* (ST was ≥2hrs less on the subsequent survey), *stable* (<2hrs change in ST between subsequent surveys) or *increasers* (ST was ≥2hrs more on the subsequent survey). Two hours was chosen to represent a change in sitting as previous studies have shown detrimental health associations with increases in ST of two hours (Ford and Caspersen, 2012, Thorp et al., 2010).

Predictors: Life events were modified from Norbeck's Life Events Questionnaires (Norbeck, 1984). Events appropriate to the life stage of each cohort were included (e.g. birth of first child in the young cohort, going through menopause in the mid-age cohort). The complete list of life events is available on the ALSWH website (www.alswh.org.au/for-researchers/surveys). Participants were asked whether they had experienced any of the events in the previous 12 months with response options of yes/no.

Covariates: Age, area of residence, country of birth, highest education level, marital status, work status, smoking, alcohol intake, physical activity, height and weight were self-reported. For alcohol status, women were categorized as: nondrinker; rarely drinker (<1 drink/week); low-risk drinker (1‑14 drinks/week); or risky drinker (≥15 drinks/week). Body mass index (BMI; kg/m2) was calculated using self-reported weight and height and classified using the World Health Organization categories (World Health Organisation, 2000). PA was measured using questions about frequency and duration of brisk walking and moderate and vigorous intensity leisure-time PA in the last week which occurred in bouts of 10 minutes or more. A PA score of MET (metabolic equivalent) minutes/week was calculated as the sum of the products of total weekly minutes in each of the three categories of PA [(walking minutes×3.0 METs) + (moderate-intensity PA minutes×4.0 METs) + (vigorous intensity PA minutes×7.5 METs) (Brown and Bauman, 2000).

Statistical Analysis

Characteristics of increasers, decreasers and stable groups at the first survey period were compared using chi-square tests for categorical variables and ANOVA for continuous variables. ST at each survey was described as medians and interquartile ranges (IQR).

The associations between life events and changes in ST between surveys were estimated using logistic regression models, to provide odds ratios (OR) and 99% confidence intervals (CI) for increasing (reference category: stable or decreasing) and decreasing ST (reference category: stable or increasing). Two models were examined for each outcome and for each inter-survey period: (i) a simple model which included life events and area of residence as explanatory variables; and (ii) an adjusted model that also included the other socio-demographic, biological, and behavioral variables as described above. Only those variables that were significantly associated with life events and change in ST were included in the multivariable models. In order to assess the effects across the four surveys, all data from each inter-survey period were included in generalized estimating equations (GEE) for both simple and multivariable models, with the added inclusion of survey year in the model. As there was a large amount of missing data (63% of the young cohort and 49% of mid-aged cohort), multiple imputation by chained equations was used to impute ST data. Sensitivity analyses using the imputed data were done to examine the influence of these missing values on the results. Pooled results of the bootstrapped samples (60 for young and 50 mid-aged participants) are presented.

All analyses were completed using SPSS (version 21, IBM). To account for the multiple comparisons, the significance level was set at $p<0.01$ and 99% confidence intervals were presented.

Results

Compared with those excluded due to missing life events and ST data, included participants were more likely to have been born in Australia, have a post-school qualification, be employed and in the healthy BMI range at the first survey. In the young women, decreasers, stable, and increasers over the first inter-survey period differed in marital status and work status; and in the mid-age women, the three groups differed in country of birth, PA and BMI (Table 1). In both cohorts, increasers had lower baseline ST, while decreasers had higher baseline ST. Changes could, therefore, be partially explained by regression to the mean.

INSERT TABLE 1 ABOUT HERE

In the young cohort, ST was significantly lower in 2006 and 2009 than it was in 2000 with a median change over nine years of -0.48 hrs/day (IQR =-2.54, 1.50; Table 2). In contrast, median ST reported by the mid-aged cohort was higher in 2004, 2007 and 2010 than in 2001. Median change over nine years was 0.43 hrs/day (IQR= -1.29, 2.0). Just over 40% of the young cohort (2000-2003: 42.1%, 2003-2006: 42.5%, 2006-2009: 42.7%) and over 30% of the mid-aged cohort (2001-2004: 35.9%, 2004-2007: 33.1%, 2007-2010: 34.2%) showed a change in reported ST (≥2hrs) between each consecutive survey. The proportion of women who changed was higher in the young than in the mid-age cohort ($p<0.001$), although many women remained stable (<2hrs change) over all the inter-survey periods (young cohort 24%, mid-aged cohort 35%).

INSERT TABLE 2 ABOUT HERE

The number of participants reporting each life event ranged from 107 for young women moving out of home (between 2000 and 2003) and 2127 for mid-aged women reporting the decline in health of a close family member or friend (between 2001 and 2004). Numbers of women reporting each life event are reported in Tables 3 and 4.

Associations of life events with decreased or increased ST in the young cohort are shown in Table 3. In multivariable models, the strongest predictor of change for young women was the birth of a child, with women who reported this life event being more likely to decrease their ST and less likely to increase their ST than women who did not. Also, young women who reported beginning work or having decreased income were more likely to decrease their ST than women who did not report these events. Conversely, young women who returned to study or lost their job were more likely to increase their ST than women without these life events. The associations for having a baby and decreased income were consistent over time and remained statistically significant in the GEE model, while associations with returning to study, beginning work and losing a job were significant for some, but not all, inter-survey periods.

INSERT TABLE 3 ABOUT HERE

In multivariable analyses (Table 4), mid-aged women who reported retirement or decreased income were more likely to decrease their ST than those who did not. Women who reported changes at work were more likely to have increased ST than those who did not; whereas women who reported the decline in health of a close family or friend were less likely to show increased ST, than those who did not. For the mid-aged women, no relationship was consistent over time. The strongest association was for retirement, which was significant in the most recent inter-survey period and in the GEE analysis.

The sensitivity analyses using the imputed data for ST (data not shown) showed findings were similar to those for the complete case analyses.

INSERT TABLE 4 ABOUT HERE

Discussion

The aim of this study was to examine changes in ST over nine years in young and mid-aged women, and to determine whether these changes were explained by life events. ST changed by around half an hour over the nine years in both cohorts, although the direction of change was different, with young women showing an overall decrease and mid-aged women showing an overall increase in ST. Changes in ST were, however, highly variable within each cohort, and several life events were associated with either decreasing or increasing ST.

In the young cohort, changes in ST were particularly marked for those reporting the birth of a child, with both an increased risk of decreasing ST and a corresponding decreased risk of increasing sitting. These results concur with a previous study that examined steps and ST in young mothers and full-time workers which found that the mothers of young children accumulated less ST than the full-time working women without a new baby (Brown et al., 2003). In the young cohort, decreased income was also associated with decreasing ST, but this finding may reflect changes in sitting subsequent to the birth of a baby, as in Australia, there is limited maternity pay and new mothers on maternity leave are likely to experience a drop in income. Beginning work was also associated with decreased ST in the young women, a finding which may reflect a transition to jobs such as nursing, teaching, service etc., which typically have lower ST than managers and office workers (Thorp et al., 2012, Jans et al., 2007).

In terms of health risks, it is useful to identify predictors of increased ST, as prolonged ST has been detrimentally associated with multiple health risks and mortality (Chau et al., 2013, Thorp et al., 2011). In the young cohort, returning to study and the loss of a job showed higher odds of increasing ST. The findings on returning to study are not surprising, as many activities involved in study (listening to lectures, computer work and reading) are sedentary (Owen, 2012). The finding that loss of a job was also associated with increased ST may once again reflect the fact that many jobs at this life stage require women to be on their feet most of the day.

In the mid-aged cohort, retirement was the most important predictor of change (reduction) in ST. However, as there was no corresponding decrease in odds of increasing ST, this finding may not be as robust as the association of ST with having a baby in the young cohort. The shift away from the workplace, which often involves high ST (Jans et al., 2007, Miller and Brown, 2004, Thorp et al., 2012), may allow more time for active leisure pursuits in retirement. This is supported by the findings from a previous ALSWH study which showed that retirement was associated with increases in moderate and vigorous PA (Brown et al., 2009).

In the mid-aged cohort, changes at work were positively associated with increased ST. This may reflect increasing seniority and managerial responsibilities, which are associated with increasing ST (Jans et al., 2007). It is also possible that the overall upward trend in ST in the mid-age cohort reflects the increasing computerization of many types of work (Straker and Mathiassen, 2009).

Implications for public health prevention

Life events such as having a baby (young women) and retirement (mid-aged women), are associated with a decrease in ST, which is a positive health behavior change. These findings suggest that interventions targeting a reduction in ST may not be a priority at these times. However, young women beginning study or losing a job and mid-aged women experiencing workplace change, are at risk of increasing their ST. Preventive strategies for avoiding prolonged sitting may be indicated at these times and could be included in job loss counseling, and in orientation sessions for study and work, particularly for positions involving prolonged sitting such as computer-based work.

Strengths and Limitations

The major strength of this study was the prospective design which allowed examination of relationships between life events and ST over almost a decade in two large cohorts of women. The sample was initially broadly representative of Australian women; however, as with all cohort studies, the sample has become less representative over time (Lee et al., 2005). As a consequence, these findings cannot be assumed to be nationally representative. Additionally, interpretation of findings cannot be extended to the whole population as the sample was limited to women. A further limitation is the large amount of missing data for ST; however, multiple imputation of ST was undertaken and analyses using the imputed data did not show differences in the main findings. As is often the case in such large cohort studies, the data were self-reported. While the ST question was similar to that included in the validated International Physical Activity Questionnaire (Craig et al., 2003), single item questions typically underestimate ST (Healy et al., 2011) so estimates of ST are likely to be low. If any underestimation is consistent over time, then changes in ST are likely to be unaffected; however, precise effects of any error and bias cannot be estimated. Recall of life events is subject to telescoping, where events are reported more recently than they may have occurred (Dobson et al., 2005). However, as we included only those life events which were reported to have occurred in the 12 months prior to the survey, we are confident that the events did occur within the specific three year inter-survey period.

Conclusion

Against a background of considerable variation in ST over nine years, during young adulthood, there was a tendency for women to decrease their ST, while during the transition through middle age there was a tendency for ST to increase, at least until retirement. A number of life events were associated with changes in ST, and of these, the strongest predictors of decreased ST were having a baby in the younger cohort and retirement in the mid-aged women. Predictors of increases in ST were returning to study and loss of a job in the young women and changes in work in the mid-aged women. These life events may provide suitable time point targets for preventive measures against increasing ST in the population.

Conflicts of interests

The authors declare that there are no conflicts of interests.

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Table 1: Demographic characteristics of the young (survey year 2000) and mid-aged (survey year 2001) cohorts.

	Young cohort				Mid-aged cohort			
	Decrease sitting (n=1119)	Stable (n=3022)	Increase sitting (n=1074)	*P*	Decrease sitting (n=1200)	Stable (n=4471)	Increase sitting (n=1302)	*P*
Age in years, Mean (SD)	24.7(1.5)	24.6 (1.5)	24.5 (1.5)	0.08	52.5 (1.4)	52.5 (1.5)	52.5 (1.4)	0.55
Baseline sitting hours/day, Median (interquartile range)	8.57 (7.00, 10.57)	5.82 (4.00, 7.79)	4.78 (3.42, 6.43)	<0.001	8.57 (6.86, 10.71)	4.71 (3.43, 6.57)	4.29 (3.00, 6.00)	<0.001
Area of residence								
Urban	618 (55.2)	1668 (55.2)	593 (55.2)		436 (36.3)	1689 (37.8)	509 (39.1)	
Rural	444 (39.7)	1232 (40.8)	451 (42.0)	0.11	700 (58.3)	2531 (56.6)	727 (55.8)	0.82
Remote	55 (4.9)	109 (3.6)	30 (2.8)		59 (4.9)	226 (5.1)	62 (4.8)	
Missing	2 (0.2)	13 (0.4)	0 (0)		5 (0.4)	25 (0.6)	4 (0.3)	
Country of Birth								
Australia	1080 (96.5)	2922 (96.7)	1043 (97.1)	0.57	1102 (91.8)	4117 (92.1)	1161 (89.2)	<0.01
Other country	29 (2.6)	89 (2.9)	23 (2.1)		87 (7.3)	318 (7.1)	129 (9.9)	
Missing	10 (0.9)	11 (0.4)	8 (0.7)		11 (0.9)	36 (0.8)	12 (0.9)	
Highest level of education								
Less than Year 12	83 (7.4)	248 (8.2)	87 (8.1)		555 (46.3)	1965 (43.9)	598 (45.9)	
Year 12	273 (24.4)	636 (21.0)	198 (18.4)	0.02	211 (17.6)	761 (17.0)	189 (14.5)	0.06
Trade/Certificate/ College/University	726 (64.9)	2058 (68.1)	754 (70.2)		425 (35.4)	1714 (38.3)	510 (39.2)	
Missing	37 (3.3)	80 (2.6)	35 (3.3)		9 (0.8)	31 (0.7)	5 (0.4)	
Marital status								
Married or de facto relationship	534 (47.7)	1563 (51.7)	592 (55.1)	<0.01	967 (80.6)	3746 (83.8)	1057 (81.2)	0.02
Single/divorced/widowed	565 (50.5)	1403 (46.4)	464 (43.2)		227 (18.9)	714 (16.0)	239 (18.4)	
Missing	20 (1.8)	56 (1.9)	18 (1.7)		6 (0.5)	11 (0.2)	6 (0.5)	
Work status								
Professional	538 (48.1)	1566 (51.8)	493 (45.9)		424 (35.3)	1586 (35.5)	467 (35.9)	
Skilled	361 (32.3)	858 (28.4)	345 (32.1)	<0.001	317 (26.4)	1090 (24.4)	310 (23.8)	0.91
Blue collar	75 (6.7)	244 (8.1)	115 (10.7)		134 (11.2)	522 (11.7)	138 (10.6)	
Not in paid work	97 (8.7)	242 (8.0)	69 (6.4)		238 (19.8)	980 (21.9)	308 (23.7)	
Missing	48 (4.3)	112 (3.7)	52 (4.8)		87 (7.3)	293 (6.6)	79 (6.1)	

Physical activity								
None <40 MET min/week	100 (8.9)	246 (8.1)	100 (9.3)		228 (19.0)	643 (14.4)	217 (16.7)	
Low 40–<600 MET min/week	401 (35.8)	1023 (33.9)	363 (33.8)	0.13	447 (37.3)	1612 (36.1)	498 (38.2)	<0.001
Active ≥600 MET min/week	605 (54.1)	1716 (56.8)	604 (56.2)		491 (50.0)	2105 (47.1)	552 (42.4)	
Missing	13 (1.2)	37 (1.2)	7 (0.7)		34 (2.8)	111 (2.5)	35 (2.7)	
Smoking status								
Never smoker	650 (58.1)	1885 (62.4)	657 (61.2)		725 (60.4)	2830 (63.3)	801 (61.5)	
Ex-smoker	167 (14.9)	401 (13.3)	154 (14.3)	0.13	305 (25.4)	1121 (25.1)	321 (24.7)	0.10
Current smoker	297 (26.5)	716 (23.7)	297 (26.5)		168 (14.0)	509 (11.4)	176 (13.5)	
Missing	5 (0.4)	20 (0.7)	5 (0.5)		2 (0.1)	11 (0.2)	4 (0.3)	
Alcohol intake								
Non drinker	94 (8.4)	232 (7.7)	72 (6.7)		164 (13.7)	610 (13.6)	178 (13.7)	
Low risk drinker	974 (87.0)	2654 (87.8)	950 (88.5)	0.69	928 (77.3)	3477 (77.8)	1023 (78.6)	0.97
Risky drinker	35 (3.1)	99 (3.3)	34 (3.2)		85 (7.1)	307 (6.9)	84 (6.5)	
Missing	16 (1.4)	37 (1.2)	18 (1.7)		23 (1.9)	77 (1.7)	17 (1.3)	
Body Mass Index kg/m^2								
Underweight, BMI <18.5	76 (6.8)	178 (5.9)	59 (5.5)		17 (1.4)	65 (1.5)	11 (0.8)	
Normal weight ≥18.5-<25	631 (56.4)	1858 (61.5)	652 (60.7)	0.17	467 (38.9)	1884 (42.1)	506 (38.9)	<0.001
Overweight ≥25-< 30	194 (17.3)	545 (18.0)	196 (18.2)		363 (30.3)	1413 (31.6)	387 (29.7)	
Obese ≥30	116 (10.4)	254 (8.4)	106 (9.9)		291 (24.3)	890 (19.9)	329 (25.3)	
Missing	102 (9.1)	187 (6.2)	61 (5.7)		62 (5.2)	69 (5.3)	69 (5.3)	

Data from the Australian Longitudinal Study on Women's Health. Young cohort data at survey in 2000 when aged 22-27years and mid-aged cohort data at survey in 2001 when aged 50-55 years (except data on alcohol intake from 2004 survey as not available in 2001 survey).
Participants categorised into sitting time decreased (≥2hrs less per day), remained stable (<2hrs change) or increased (≥2hrs more per day) over the following three years.
Data are n (%) except where indicated.

Table 2: Self-reported ST (hours/day) for young (born in 1973-1978) and mid-aged (born 1946-1951) participants

	Year of Survey (young/mid-aged)			
	2000/2001	2003/3004	2006/2007	2009/2010
Young cohort (n=5215)	6.14 (4.29, 8.29)	6.14 (4.14, 8.43)	5.93 (4.00, 8.29)*	5.43 (3.71, 8.00)*
Mid-aged cohort (n=6973)	5.14 (3.57, 7.43)	5.29 (4.00, 7.43)*	5.71 (4.00, 7.86)*	5.57 (4.00, 7.71)*

Data from the Australian Longitudinal Study on Women's Health.
* Significantly different from 2000/2001 (Wilcoxon Signed Rank test for related samples) $p<0.01$

Table 3: Odds ratios for change in ST by life events in the young (born 1973-1978) cohort (N=5215)

	Sitting decreases ≥2hrs		Sitting increases ≥2hrs	
Number (%)				
2000-2003	1119 (21.5%)		1074 (20.6%)	
2003-2006	1250 (24%)		964 (18.5%)	
2006-2009	1299 (24.9%)		927 (17.8%)	
	Simple	Multivariable	Simple	Multivariable
Major illness or surgery				
2000-2003 (n=607)	1.07 (0.82, 1.40)	1.02 (0.73, 1.42)	0.98 (0.74, 1.29)	1.08 (0.80, 1.47)
2003-2006 (n=668)	1.17 (0.92, 1.49)	1.13 (0.84, 1.53)	1.08 (0.82, 1.41)	1.06 (0.79, 1.44)
2006-2009 (n=765)	0.98 (0.77, 1.24)	0.88 (0.66, 1.18)	1.27 (0.99, 1.64)	1.25 (0.95, 1.63)
Over all surveys (GEE)	1.06 (0.94, 1.19)	1.02 (0.89, 1.17)	1.10 (0.97, 1.25)	1.12 (0.97, 1.30)
Birth of first child				
2000-2003 (n=306)	1.91 (1.38, 2.26)	2.60 (1.72, 3.93)	0.65 (0.43, 1.01)	0.67 (0.42, 1.06)
Birth of child				
2000-2003 (n=539)	1.99 (1.55, 2.57)	2.65 (1.87, 3.78)	0.58 (0.41, 0.81)	0.58 (0.40, 0.86)
2003-2006 (n=838)	2.17 (1.76, 2.67)	2.71 (2.06, 3.57)	0.74 (0.57, 0.97)	0.76 (0.55, 1.03)
2006-2009 (n=832)	2.02 (1.64, 2.49)	2.16 (1.67, 2.79)	0.64 (0.48, 0.85)	0.69 (0.51, 0.94)
Over all surveys (GEE)	2.01 (1.81, 2.24)	2.11 (1.85, 2.40)	0.64 (0.55,0.74)	0.70 (0.59, 0.82)
Marry or begin living together				
2000-2003 (n=641)	0.87 (0.66, 1.14)	1.00 (0.72, 1.40)	1.05 (0.81, 1.37)	0.99 (0.74, 1.33)
2003-2006 (n=505)	0.73 (0.54, 0.99)	0.79 (0.55, 1.14)	1.27 (0.95, 1.71)	1.11 (0.80, 1.54)
2006-2009 (n=314)	0.83 (0.57, 1.19)	0.98 (0.64, 1.51)	1.34 (0.93, 1.93)	1.26 (0.84, 1.89)
Over all surveys (GEE)	0.84 (0.72, 0.97)	0.88 (0.75, 1.05)	1.14 (0.99,1.33)	1.12 (0.95, 1.32)
Return to study				
2000-2003 (n=618)	0.99 (0.76, 1.30)	0.94 (0.67, 1.31)	1.05 (0.80, 1.38)	1.10 (0.81, 1.49)
2003-2006 (n=514)	0.80 (0.59, 1.07)	0.88 (0.61, 1.25)	1.39 (1.05, 1.85)	1.35 (0.99, 1.85)
2006-2009 (n=457)	0.88 (0.65, 1.19)	0.90 (0.63, 1.29)	1.20 (0.87, 1.65)	1.17 (0.84, 1.64)
Over all surveys (GEE)	0.91 (0.80, 1.05)	0.95 (0.81, 1.11)	1.21 (1.05, 1.39)	1.21 (1.03, 1.42)
Begin work				
2000-2003 (n=378)	1.38 (1.01, 1.89)	1.76 (1.18, 2.62)	0.93 (0.66, 1.32)	0.79 (0.53, 1.18)
2003-2006 (n=628)	1.29 (1.01, 1.65)	1.49 (1.09, 2.04)	0.91 (0.67, 1.21)	0.86 (0.62, 1.19)
2006-2009 (n=623)	1.05 (0.81, 1.35)	1.17 (0.86, 1.59)	0.98 (0.73, 1.31)	0.97 (0.71, 1.31)
Over all surveys (GEE)	1.24 (1.09, 1.41)	1.28 (1.10, 1.49)	0.87 (0.75, 1.01)	0.88 (0.75, 1.05)

Moving out of home				
2000-2003 (n=107)	0.96 (0.51, 1.79)	1.01 (0.47, 2.17)	0.82 (0.42, 1.58)	0.69 (0.32, 1.50)
Loss of job				
2000-2003 (n=198)	1.08 (0.69, 1.69)	1.12 (0.64, 1.94)	1.24 (0.80, 1.92)	1.23 (0.74, 2.04)
2003-2006 (n=185)	1.11 (0.72, 1.73)	0.90 (0.52, 1.55)	1.19 (0.74, 1.90)	1.25 (0.74, 2.11)
2006-2009 (n=197)	1.16 (0.76, 1.77)	0.85 (0.51, 1.43)	1.49 (0.96, 2.32)	1.66 (1.01, 2.73)
Over all surveys (GEE)	1.15 (0.93, 1.41)	1.10 (0.86, 1.41)	1.26 (1.01, 1.56)	1.22 (0.95, 1.57)
Decreased Income				
2000-2003 (n=1172)	1.34 (1.10, 1.64)	1.41 (1.09, 1.81)	0.93 (0.75, 1.15)	0.94 (0.74, 1.20)
2003-2006 (n=1299)	1.40 (1.16, 1.69)	1.42 (1.12, 1.79)	0.92 (0.74 , 1.14)	0.95 (0.74, 1.20)
2006-2009 (n=1351)	1.45 (1.20, 1.74)	1.39 (1.12, 1.73)	0.94 (0.76, 1.17)	0.99 (0.79, 1.25)
Over all surveys (GEE)	1.38 (1.26, 1.51)	1.40 (1.26, 1.56)	0.94 (0.85, 1.05)	0.96 (0.86, 1.08)

Data from the Australian Longitudinal Study on Women's Health.

Sitting decreases: Odds of decreasing sitting by ≥2hrs compared to stable or increasing sitting by ≥2hrs. Sitting increases: Odds of increasing sitting by ≥2hrs compared to stable or decreasing sitting by ≥2hrs. OR (99%CI)

Simple model is adjusted for area of residence. The multivariable model is additionally adjusted for baseline sitting, marital status, smoking status, occupational status, BMI category and exercise group. GEE additionally adjusted for survey in both simple and adjusted models. *<0.01, **<0.001

Age range at surveys: 2000: 22-27yrs, 2003: 25-30yrs, 2006: 28-33yrs, 2009: 31-36yrs

Table 4: Odds ratios for change in ST by life events in the mid-aged (born 1946-1951) cohort (N= 6973)

	Sitting decreases ≥2hrs		Sitting increases ≥2hrs	
Number (%)				
2001-2004	1200 (17.2%)		1302 (18.7%)	
2004-2007	1098 (15.7%)		1216 (17.4%)	
2007-2010	1396 (20.0%)		993 (14.2%)	
	Simple	Multivariable	Simple	Multivariable
Major illness or surgery				
2001-2004 (n=724)	1.07 (0.82, 1.40)	1.10 (0.79,1.52)	1.30 (1.02, 1.66)	1.22 (0.93, 1.60)
2004-2007 (n=788)	1.04 (0.80, 1.36)	0.91 (0.66, 1.27)	0.98 (0.76, 1.27)	0.94 (0.71, 1.25)
2007-2010 (n=819)	1.30 (1.03, 1.63)	1.25 (0.95, 1.64)	1.05 (0.80, 1.37)	1.07 (0.80, 1.43)
Over all surveys (GEE)	1.10 (0.97, 1.25)	1.01 (0.86, 1.19)	1.15 (1.02, 1.31)	1.12 (0.98, 1.29)
Menopause				
2001-2004 (n=1817)	0.97 (0.81, 1.17)	1.07 (0.84, 1.35)	0.98 (0.81, 1.17)	0.97 (0.80, 1.18)
2004-2007 (n=900)	1.01 (0.79, 1.30)	0.97 (0.72, 1.31)	0.90 (0.71, 1.16)	0.93 (0.72, 1.22)
2007-2010 (n=369)	0.85 (0.59, 1.22)	0.98 (0.65, 1.50)	0.92 (0.62, 1.38)	0.94 (0.62, 1.42)
Over all surveys (GEE)	0.98 (0.87, 1.11)	1.05 (0.90, 1.23)	0.92 (0.82, 1.04)	0.92 (0.80, 1.05)
Decline health of close family or friend				
2001-2004 (n=2127)	1.02 (0.86, 1.22)	1.05 (0.84, 1.31)	0.90 (0.75, 1.07)	0.89 (0.74, 1.08)
2004-2007 (n=2116)	1.04 (0.87, 1.25)	0.98 (0.79, 1.23)	0.91 (0.76, 1.09)	0.90 (0.74, 1.10)
2007-2010 (n=2033)	1.02 (0.87, 1.21)	1.02 (0.83, 1.25)	0.90 (0.74, 1.09)	0.87 (0.71, 1.07)
Over all surveys (GEE)	1.01 (0.92, 1.10)	0.99 (0.88, 1.11)	0.90 (0.82, 0.99)	0.88 (0.79, 0.97)
New relationship				
2001-2004 (n=168)	1.23 (0.75, 2.03)	1.09 (0.57, 2.11)	1.23 (0.76, 2.01)	1.29 (0.76, 2.17)
2004-2007 (n=125)	1.21 (0.67, 2.21)	1.68 (0.83, 3.38)	0.85 (0.44, 1.62)	0.86 (0.43, 1.69)
2007-2010 (n=121)	1.15 (0.65, 2.03)	1.06 (0.55, 2.07)	0.60 (0.26, 1.36)	0.66 (0.29, 1.51)
Over all surveys (GEE)	1.30 (0.98, 1.72)	1.24 (0.87, 1.78)	0.89 (0.65, 1.22)	0.96 (0.69, 1.33)
Divorce or break-up				
2001-2004 (n=244)	1.12 (0.73, 1.73)	1.21 (0.70, 2.08)	0.80 (0.50, 1.27)	0.79 (0.49, 1.30)
2004-2007 (n=227)	1.01 (0.63, 1.63)	0.96 (0.54, 1.69)	0.98 (0.62, 1.56)	0.96 (0.58, 1.58)
2007-2010 (n=174)	0.94 (0.57, 1.56)	0.95 (0.52, 1.73)	1.16 (0.68, 1.99)	1.21 (0.70, 2.12)
Over all surveys (GEE)	1.08 (0.86, 1.37)	1.07 (0.79, 1.44)	0.93 (0.72, 1.19)	0.95 (0.73, 1.25)
Change at work				

2001-2004 (n=1572)	1.12 (0.93, 1.36)	1.01 (0.79, 1.29)	1.09 (0.90, 1.31)	1.14 (0.93, 1.40)
2004-2007 (n=1490)	1.12 (0.92, 1.38)	1.00 (0.78, 1.28)	1.20 (0.99, 1.46)	1.20 (0.97, 1.48)
2007-2010 (n=1108)	1.09 (0.89, 1.35)	0.95 (0.74, 1.22)	1.24 (0.98, 1.56)	1.38 (1.08, 1.76)
Over all surveys (GEE)	1.12 (1.01, 1.24)	0.98 (0.86, 1.12)	1.17 (1.05, 1.29)	1.21 (1.08, 1.36)
Retirement				
2001-2004 (n=312)	1.49 (1.04, 2.12)	1.53 (0.96, 2.44)	0.95 (0.64, 1.40)	0.94 (0.61, 1.43)
2004-2007 (n=418)	1.18 (0.84, 1.66)	1.30 (0.87, 1.96)	0.98 (0.70, 1.39)	1.06 (0.73, 1.53)
2007-2010 (n=427)	1.94 (1.47, 2.57)	2.13 (1.52, 2.98)	0.91 (0.62, 1.33)	0.92 (0.61, 1.37)
Over all surveys (GEE)	1.54 (1.30, 1.82)	1.70 (1.39, 2.07)	0.93 (0.77, 1.14)	0.93 (0.76, 1.15)
Retirement of spouse				
2001-2004 (n=349)	1.13 (0.79, 1.62)	1.20 (0.76, 1.91)	0.85 (0.58, 1.24)	0.91 (0.61, 1.37)
2004-2007 (n=416)	0.92 (0.64, 1.32)	0.95 (0.61, 1.48)	0.87 (0.61, 1.24)	0.90 (0.62, 1.32)
2007-2010 (n=423)	1.07 (0.78, 1.47)	1.15 (0.79, 1.68)	0.86 (0.58, 1.27)	0.81 (0.54, 1.23)
Over all surveys (GEE)	1.02 (0.85, 1.22)	1.05 (0.84, 1.32)	0.84 (0.69, 1.02)	0.84 (0.67, 1.03)
Decreased income				
2001-2004 (n=1297)	1.26 (1.03, 1.54)	1.29 (1.00, 1.68)	1.07 (0.87, 1.31)	1.09 (0.88, 1.36)
2004-2007 (n= 1297)	1.05 (0.84, 1.30)	1.12 (0.86, 1.45)	1.08 (0.88, 1.33)	1.03 (0.82, 1.29)
2007-2010 (n=1402)	1.17 (0.97, 1.42)	1.14 (0.91, 1.43)	0.97 (0.78, 1.21)	0.97 (0.77, 1.22)
Over all surveys (GEE)	1.20 (1.09, 1.33)	1.20 (1.06, 1.37)	1.02 (0.92, 1.14)	1.02 (0.90, 1.14)
Child leaving home				
2001-2004 (n=730)	1.00 (0.77, 1.31)	1.15 (0.82, 1.61)	1.07 (0.83, 1.38)	0.95 (0.71, 1.26)
2004-2007 (n=424)	0.78 (0.54, 1.15)	0.83 (0.53, 1.29)	1.12 (0.80, 1.55)	1.08 (0.75, 1.55)
2007-2010 (n=240)	0.90 (0.58, 1.39)	0.96 (0.58, 1.60)	1.01 (0.62, 1.63)	1.07 (0.65, 1.75)
Over all surveys (GEE)	0.87 (0.73, 1.04)	0.96 (0.78, 1.19)	1.03 (0.88, 1.22)	0.95 (0.79, 1.14)
Moving home				
2001-2004 (n=730)	1.23 (0.96, 1.59)	1.30 (0.94, 1.79)	1.10 (0.85, 1.41)	1.18 (0.90, 1.55)
2004-2007 (n=652)	1.19 (0.90, 1.57)	1.11 (0.79, 1.56)	0.99 (0.75, 1.31)	1.01 (0.74, 1.37)
2007-2010 (n=515)	1.27 (0.96, 1.68)	1.03 (0.73, 1.46)	0.75 (0.52, 1.09)	0.78 (0.53, 1.15)
Over all surveys (GEE)	1.24 (1.08, 1.43)	1.16 (0.97, 1.38)	0.94 (0.82, 1.09)	0.98 (0.84, 1.15)

Data from the Australian Longitudinal Study on Women's Health.

Sitting decreases: Odds of decreasing sitting by ≥2hrs compared to stable or increasing sitting by ≥2hrs. 2001-2004 (n=312) Sitting increases: Odds of increasing sitting by ≥2hrs compared to stable or decreasing sitting by ≥2hrs. OR (99%CI)

Simple model is adjusted for area of residence. Adjusted for baseline sitting, exercise group, BMI group, highest qualification, marital status, smoking status, area of residence and country of birth. GEE additionally adjusted for survey in both simple and adjusted models. *<0.01, **<0.001

Age range at surveys: 2001: 50-55yrs, 2004: 53-58yrs, 2007: 56-61yrs, 2010: 59-64yrs

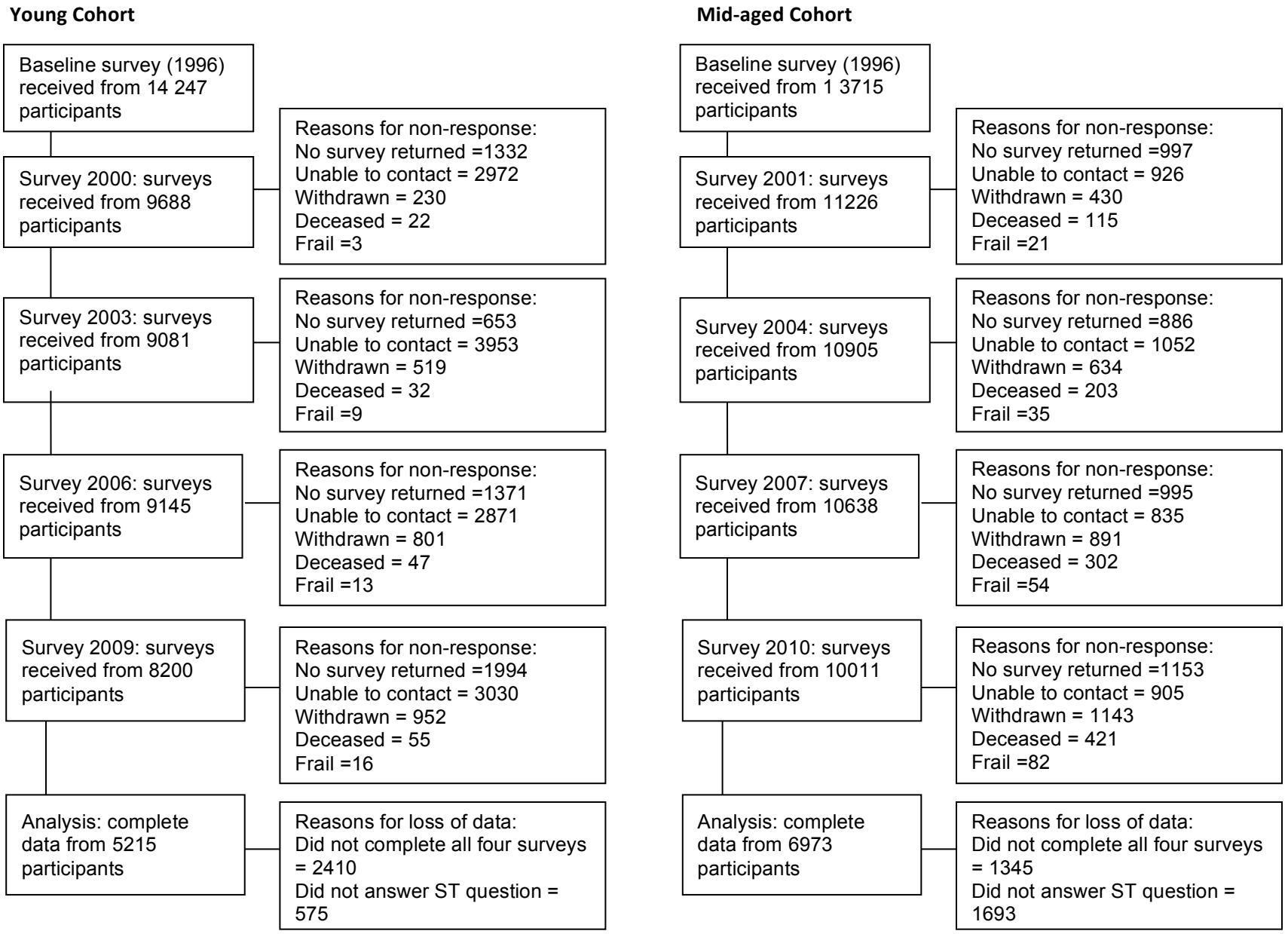
Young Cohort
Baseline survey (1996) received from 14 247 participants
Survey 2000: surveys received from 9688 participants
Reasons for non-response:
No survey returned =1332
Unable to contact = 2972
Withdrawn = 230
Deceased = 22
Frail =3
Survey 2003: surveys received from 9081 participants
Reasons for non-response:
No survey returned =653
Unable to contact = 3953
Withdrawn = 519
Deceased = 32
Frail =9
Survey 2006: surveys received from 9145 participants
Reasons for non-response:
No survey returned =1371
Unable to contact = 2871
Withdrawn = 801
Deceased = 47
Frail =13
Survey 2009: surveys received from 8200 participants
Reasons for non-response:
No survey returned =1994
Unable to contact = 3030
Withdrawn = 952
Deceased = 55
Frail =16
Analysis: complete data from 5215 participants
Reasons for loss of data:
Did not complete all four surveys = 2410
Did not answer ST question = 575
Mid-aged Cohort
Baseline survey (1996) received from 1 3715 participants
Survey 2001: surveys received from 11226 participants
Reasons for non-response:
No survey returned =997
Unable to contact = 926
Withdrawn = 430
Deceased = 115
Frail =21
Survey 2004: surveys received from 10905 participants
Reasons for non-response:
No survey returned =886
Unable to contact = 1052
Withdrawn = 634
Deceased = 203
Frail =35
Survey 2007: surveys received from 10638 participants
Reasons for non-response:
No survey returned =995
Unable to contact = 835
Withdrawn = 891
Deceased = 302
Frail =54
Survey 2010: surveys received from 10011 participants
Reasons for non-response:
No survey returned =1153
Unable to contact = 905
Withdrawn = 1143
Deceased = 421
Frail =82
Analysis: complete data from 6973 participants
Reasons for loss of data:
Did not complete all four surveys = 1345
Did not answer ST question = 1693

Figure 1: Flow charts of participants in the Australian Longitudinal Study on Women's Health (2000–2010).

References

BAUMAN, A., AINSWORTH, B. E., SALLIS, J. F., HAGSTROMER, M., CRAIG, C. L., BULL, F. C., PRATT, M., VENUGOPAL, K., CHAU, J. & SJOSTROM, M. 2011. The descriptive epidemiology of sitting. A 20-country comparison using the International Physical Activity Questionnaire (IPAQ). *Am J Prev Med,* 41**,** 228-35.

BELL, S. & LEE, C. 2006. Does timing and sequencing of transitions to adulthood make a difference? Stress, smoking, and physical activity among young Australian women. *Int J of Behav Med,* 13**,** 265-74.

BOWMAN, S. A. 2006. Television-viewing characteristics of adults: correlations to eating practices and overweight and health status. *Prev Chronic Dis,* 3**,** A38.

BROWN, W. J. & BAUMAN, A. E. 2000. Comparison of estimates of population levels of physical activity using two measures. *Aust N Z J Public Health,* 24**,** 520-525.

BROWN, W. J., BRYSON, L., BYLES, J. E., DOBSON, A. J., LEE, C., MISHRA, G. & SCHOFIELD, M. 1998. Women's Health Australia: recruitment for a national longitudinal cohort study. *Women Health,* 28**,** 23-40.

BROWN, W. J., HEESCH, K. C. & MILLER, Y. D. 2009. Life events and changing physical activity patterns in women at different life stages. *Ann Behav Med,* 37**,** 294-305.

BROWN, W. J., MILLER, Y. D. & MILLER, R. 2003. Sitting time and work patterns as indicators of overweight and obesity in Australian adults. *Int J Obes Relat Metab Disord,* 27**,** 1340-6.

BUTLER, S. M., BLACK, D. R., BLUE, C. L. & GRETEBECK, R. J. 2004. Change in diet, physical activity, and body weight in female college freshman. *Am J Health Behav,* 28**,** 24-32.

CHAU, J., MEROM, D., GRUNSEIT, A., RISSEL, C., BAUMAN, A. & VAN DER PLOEG, H. 2012. Temporal trends in non-occupational sedentary behaviours from Australian Time Use Surveys 1992, 1997 and 2006. *Int J Behav Nutr Phys Act,* 9**,** 76.

CHAU, J. Y., GRUNSEIT, A. C., CHEY, T., STAMATAKIS, E., BROWN, W. J., MATTHEWS, C. E., BAUMAN, A. E. & VAN, D. P. H. P. 2013. Daily sitting time and all-cause mortality: a meta-analysis. *PLoS ONE,* 8**,** e80000.

CHURCH, T., THOMAS, D., TUDOR-LOCKE, C., KATZMARZYK, P., EARNEST, C., RODARTE, R., MARTIN, C., BLAIR, S. & BOUCHARD, C. 2011. Trends over 5 Decades in U.S. Occupation-Related Physical Activity and Their Associations with Obesity. *PLoS ONE,* 6**,** e19657.

CLARK, B. K., SUGIYAMA, T., HEALY, G. N., SALMON, J., DUNSTAN, D. W., SHAW, J. E., ZIMMET, P. Z. & OWEN, N. 2010. Socio-demographic correlates of prolonged television viewing time in Australian men and women: the AusDiab study. *J Phys Act Health,* 7**,** 595-601.

CRAIG, C. L., MARSHALL, A. L., SJOSTROM, M., BAUMAN, A. E., BOOTH, M. L., AINSWORTH, B. E., PRATT, M., EKELUND, U., YNGVE, A., SALLIS, J. F. & OJA, P. 2003. International Physical Activity Questionnaire: 12 country reliability and validity. *Med Sci Sports Exerc,* 35**,** 1381-95.

DOBSON, A., SMITH, N. & PANCHANA, N. 2005. Some problems with life event lists and health outcomes. *Int J of Behav Med,* 12**,** 199-205.

FORD, E. S. & CASPERSEN, C. J. 2012. Sedentary behaviour and cardiovascular disease: a review of prospective studies. *Int J Epidemiol,* 41**,** 1338-1353.

HAGSTROMER, M., OJA, P. & SJOSTROM, M. 2007. Physical activity and inactivity in an adult population assessed by accelerometer. *Med Sci Sports Exerc,* 39**,** 1502-1508.

HEALY, G. N., CLARK, B. K., WINKLER, A. E., GARDINER, P. G., BROWN, W. J. & MATTHEWS, C. E. 2011. Measurement of adults' sedentary time in population-based studies. *Am J Prev Med,* 41**,** 216-227.

JANS, M. P., PROPER, K. I. & HILDEBRANDT, V. H. 2007. Sedentary behavior in Dutch workers: differences between occupations and business sectors. *Am J Prev Med,* 33**,** 450-4.

LANTZ, P. M., HOUSE, J. S., MERO, R. P. & WILLIAMS, D. R. 2005. Stress, life events, and socioeconomic disparities in health: results from the Americans' Changing Lives Study. *J Health Soc Behav,* 46**,** 274-88.

LEE, C., DOBSON, A. J., BROWN, W. J., BRYSON, L., BYLES, J., WARNER-SMITH, P. & YOUNG, A. F. 2005. Cohort Profile: The Australian Longitudinal Study on Women's Health. *Int J Epidemiol,* 34**,** 987-991.

MATTHEWS, C. E., CHEN, K. Y., FREEDSON, P. S., BUCHOWSKI, M. S., BEECH, B. M., PATE, R. R. & TROIANO, R. P. 2008. Amount of time spent in sedentary behaviors in the United States, 2003-2004. *American Journal of Epidemiology,* 167**,** 875-81.

MILLER, R. & BROWN, W. 2004. Steps and sitting in a working population. *Int J of Behav Med,* 11**,** 219-24.

NORBECK, J. S. 1984. Modification of life event questionnaires for use with female respondents. *Res Nurs Health,* 7**,** 61-71.

OWEN, N. 2012. Sedentary behavior: understanding and influencing adults' prolonged sitting time. *Prev Med,* 55**,** 535-9.

PAVEY, T. G., PEETERS, G. G. & BROWN, W. J. 2012. Sitting-time and 9-year all-cause mortality in older women. *Br J Sports Med*.

SHIELDS, M. & TREMBLAY, M. S. 2008. Screen time among Canadian adults: a profile. *Health Rep,* 19**,** 31-43.

STRAKER, L. & MATHIASSEN, S. E. 2009. Increased physical work loads in modern work--a necessity for better health and performance? *Ergonomics,* 52**,** 1215-25.

THORP, A., HEALY, G., OWEN, N., SALMON, J., BALL, K., SHAW, J., ZIMMET, P. & DUNSTAN, D. 2010. Deleterious associations of sitting time and television viewing time with cardiometabolic risk biomarkers: Australian Diabetes, Obesity and Lifestyle (AusDiab) study 2004-2005. *Diabetes Care,* 33**,** 327 - 334.

THORP, A., HEALY, G., WINKLER, E., CLARK, B., GARDINER, P., OWEN, N. & DUNSTAN, D. 2012. Prolonged sedentary time and physical activity in workplace and non-work contexts: a cross-sectional study of office, customer service and call centre employees. *Int J Behav Nutr Phys Act,* 9**,** 128.

THORP, A. A., OWEN, N., NEUHAUS, M. & DUNSTAN, D. W. 2011. Sedentary behaviors and subsequent health outcomes in adults a systematic review of longitudinal studies, 1996-2011. *Am J Prev Med,* 41**,** 207-15.

UIJTDEWILLIGEN, L., TWISK, J., SINGH, A., CHINAPAW, M., VAN MECHELEN, W. & BROWN, W. 2014. Biological, socio-demographic, work and lifestyle determinants of sitting in young adult women: a prospective cohort study. *Int J Behav Nutr Phys Act,* 11**,** 7.

VAN DER PLOEG, H. P., CHEY, T., KORDA, R. J., BANKS, E. & BAUMAN, A. 2012. Sitting time and all-cause mortality risk in 222 497 australian adults. *Arch Intern Med,* 172**,** 494-500.

VAN UFFELEN, J. G. Z., WATSON, M. J., DOBSON, A. J. & BROWN, W. J. 2010. Sitting Time Is Associated With Weight, but Not With Weight Gain in Mid-Aged Australian Women. *Obesity,* 18**,** 1788-1794.

WILLIAMS, D. W., RAYNOR, H. A. & CICCOLO, J. T. 2008. A review of TV viewing and its association with health outcomes in adults. *Am J Lifestyle Med,* 2**,** 250-259.

WORLD HEALTH ORGANISATION 2000. Obesity: Preventing and Managing the Global Epidemic. Geneva: World Health Organisation.

ZAUTRA, A. J., REICH, J. W. & GUARNACCIA, C. A. 1990. Some everyday life consequences of disability and bereavement for older adults. *J Pers Soc Psychol,* 59**,** 550-61.