Correlates of Sitting Time in Working Age Australian Women: Who Should Be Targeted With Interventions to Decrease Sitting Time?

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J Phys Act Health. 2012 Feb;9(2):270-87.

Manuscript type: Original research

Keywords: sedentary behaviour, lifestyle, observational study, socio-economic factors, health behaviours

Running title: Correlates of sitting time

Number of pages: 25

Number of words text: 5745 (including reference list and tables, but not the appendix tables)

Number of words abstract: 198

Number of tables: 3 + 2 appendix tables

ABSTRACT

Background: While there is emerging evidence that sedentary behavior is negatively associated with health risk, research on the correlates of sitting time in adults is scarce.

Methods: Self-report data from 7,724 women born between 1973-1978 and 8,198 women born between 1946-1951 were collected as part of the Australian Longitudinal Study on Women's Health. Linear regression models were computed to examine whether demographic, family and caring duties, time use, health and health behavior variables were associated with weekday sitting time.

Results: Mean sitting time (SD) was 6.60 (3.32) hours/day for the 1973-1978 cohort and 5.70 (3.04) hours/day for the 1946-1951 cohort. Indicators of socio-economic advantage, such as full-time work and skilled occupations in both cohorts and university education in the mid-age cohort, were associated with high sitting time. A cluster of 'healthy behaviours' was associated with lower sitting time in the mid-aged women (moderate/high physical activity levels, non-smoking, non-drinking). For both cohorts, sitting time was highest in women in full-time work, in skilled occupations and in those who spent the most time in passive leisure.

Conclusions:

The results suggest that, in young and mid-aged women, interventions for reducing sitting time should focus on both occupational and leisure-time sitting.

INTRODUCTION

In epidemiological studies of physical activity (PA) and health, people are often categorized as 'active' (meeting a PA guideline), 'inactive' (reporting some PA but not meeting the guideline) or 'sedentary' (reporting no PA), based on responses to questions about their participation in moderate and vigorous physical activity (MVPA). In this context, sedentary behavior is conceptualized as a lack of MVPA. However, in recent years the term 'sedentary behavior' has been used to describe participation in activities requiring low energy expenditure, such as sitting or lying down, regardless of participation in MVPA.[1, 2]

There is a rapidly growing body of evidence suggesting that more time spent in sedentary behaviors, independent of MVPA levels, is associated with increased health risk.[3-8] Cross-sectional studies in Australia, the US and the UK have shown positive associations between increased TV time and body mass index (BMI)[5, 6, 8], blood pressure[5, 8], fasting insulin[8] and breast density (a marker of breast cancer risk).[9] Prospective studies have also shown associations between sitting time and obesity,[3, 4, 10, 11] biomarkers of cardiovascular disease risk,[11] and mortality.[12, 13]

Researchers are beginning to explore the feasibility and efficacy of interventions to reduce sitting time. Understanding the correlates of sitting time is vital for informing the development of these interventions and for identifying which population subgroups are most sedentary and thus most likely to benefit from interventions. To date, studies of the correlates of sitting time in adults have predominantly focussed on TV viewing. Australian, US and Scottish studies have shown that high TV time is associated with low socio-economic status (e.g., living in a deprived neighbourhood[14, 15], low education levels[16, 17], low income[14-16]), other demographic

characteristics (e.g., being female[17], older age[16, 17], no paid job[16, 17]) and health risk factors (e.g, low PA levels[17], high energy intake[16], overweight or obese[14, 16, 17]). However, in focusing only on TV viewing, these studies have not considered time spent sitting in other domains, such as transport and work. This is important because data from The Netherlands and Australia indicate that working adults spend about one half to one third of their workday sitting.[18, 19]

The Australian Longitudinal Study on Women's Health (ALSWH) provides an opportunity to examine the correlates of sitting time, including sitting for leisure, during transport and at work, in national samples of working age women. The aim of this study was to identify correlates of weekday sitting time in the ALSWH 1973-1978 and 1946-1951 cohorts. Demographic characteristics, family and caring duties and time use, as well as health and health behavior variables, were considered as potential correlates.

METHODS

Australian Longitudinal Study on Women's Health (ALSWH)

The ALSWH is a prospective study of factors affecting the health and well-being of three cohorts of Australian women (born in 1973-1978, in 1946-1951 and in 1921-1926),[20] randomly selected from the national health insurance database,[21] with oversampling of women from rural and remote areas. More details about the study can be found at www.alswh.org.au. The study was approved by the University of Queensland and the University of Newcastle Ethics Committees, and written informed consent was received from all respondents.

Study sample

These analyses used data collected from the 2003 survey of women born in 1973-1978 (when they were aged 25-30 years) and the 2001 survey of women born in 1946-1951 (when they were aged 50-55 years). These were the first surveys to assess sitting time in both cohorts. Women born between 1921-1926 were not included because they had reached retirement age before their first survey.

The first ALSWH survey in 1996 was completed by 14,739 women in the 1973-1978 cohort and 14,099 women in the 1946-1951 cohort. These women were broadly representative of the general population in their age groups,[20] although there was over-representation of Australian-born, employed and university-educated women.[21] After losing women to follow-up, the third survey was completed by 9,081 women in the 1973-1978 cohort and 11,200 women in the 1946-1951 cohort. Of these women, those who reported a limited ability to walk 100 meters were excluded to ensure that women included in the analyses were not sitting because they were wheelchair-bound (n=161 for 1973-1978 cohort; n=182 for 1946-1951 cohort), leaving data from 8,920 women in the 1973-1978 cohort and 11,018 women in the 1946-1951 cohort available for inclusion in these analyses.

Measures

Sitting time

The following question was used to assess sitting time: *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 on a usual weekday?* Established protocols were used to clean the data and values exceeding 16 hours/day were set to missing.[22] The question is similar to the one included in the International PA Questionnaire, which, in women, has been

shown to have good reliability and moderate criterion validity against accelerometers (< 100 counts per minute).[23]

Potential correlates of sitting time

Variables hypothesized to be associated with sitting time included demographic characteristics, family and caring duties, time use, health and health behavior variables. Variables were categorized as shown in Table 1.

Demographic characteristics

Demographic variables included area of residence (derived from postal code), country of birth, highest level of education, income management and occupation (from the Australian Standard Coding of Occupations[24]). Income management was assessed in ALSWH as a proxy for income status, because some women were reticent to report their actual income. Occupation was categorized as professional *(manager, administrator)*, skilled *(tradesperson, or advanced clerical or service worker)*, blue collar *(labourer, production/transport worker, elementary/intermediate sales/service worker)* or no paid job.

Family and caring duties

Women were asked about their marital status and their caring duties for people with a long-term illness, disability, or frailty. Women in the 1973-1978 cohort were also asked for the number of children they had and their pregnancy status. Women in the 1946-1951 cohort were also asked to report the frequency of providing care for grandchildren.

Time use

Women reported the hours they spent in the previous week in paid work *(full-time, part-time, casual),* doing home duties *(own/family home),* studying, and in passive leisure *(e.g. TV, listening to music, reading, relaxing).*

Health

BMI was calculated as kg/m^2 based on self-reported weight and height, and categorized in accordance with the World Health Organization classification.[25] Number of chronic diseases was derived from a list of health conditions, including diabetes, cancer, and heart disease, that women reported they had been told they had by a doctor in the previous 3 years.[26] They also reported whether they had sleeping problems or stiff or painful joints in the last 12 months.

Health behaviors

The questions to assess PA were adapted from Active Australia questions, which have acceptable measurement characteristics[27]. They ask about walking, moderate-intensity and vigorous-intensity physical activities in the last week. As reported previously,[28] responses were used to derive a PA score, which was categorized as shown in Table 1.

Energy intake (EI) was assessed using the Cancer Council of Victoria food frequency questionnaire.[29] EI was computed as described previously[30] and quintiles of EI were used in the analysis. Smoking and alcohol status were derived from standard questions.

Statistical analysis

Linear regression modelling was used to examine the associations between potential correlates of sitting time (all categorical variables), and sitting time (continuous, normally distributed

variable). First, separately for each cohort, univariate models were computed to examine associations between each potential correlate and sitting time. Variables that were significantly associated with sitting time were next included in a multivariable model (one model for each cohort). The analyses were conducted using SPSS V16.0. Statistical significance was set at $p \leq 0.05$.

RESULTS

Of the 8,920 women in the 1973-1978 cohort and the 11,018 women in the 1946-1951 cohort who were eligible for the study, women were excluded if they had missing sitting time data (n=364 for 1973-1978 cohort; n=710 for 1946-1951 cohort) or missing data for any potential correlate (n=832 for 1973-1978 cohort; n=2,110 for 1946-1951 cohort). The percentage of missing data was <5% for each potential correlate. The analysis sample was thus 7,724 and 8,198 for the 1973-1978 cohort and 1946-1951 cohorts, respectively. The women who were included in the analysis had higher socio-economic status, had fewer health problems and engaged in more healthy behaviors than those excluded, although differences were small (appendix tables 1 and 2). Characteristics of the women included in the analysis are presented in Table 1. Mean sitting time (SD) was 6.60 (3.32) hours/day for the 1973-1978 cohort and 5.70 (3.04) hrs/day for the 1946-1951 cohort.

In the 1973-1978 cohort, sitting time was significantly higher in women who lived in urban areas, who were born in a non-English speaking country, or who reported that income management was impossible or difficult (Table 2). Women in full-time work and those in skilled occupations sat more, whereas those in full-time home duties or in blue collar occupations sat less, than women in the respective referent category. Women without caring duties (i.e., did not

provide care for adults or children) sat more than women with these duties. Sitting time was also significantly higher in women who reported studying or doing >15 hrs/wk of passive leisure, compared with women in the respective referent category. Health and health behaviour variables were not associated with sitting time, except that sitting time was higher in those with sleeping problems and lower in current smokers, compared with the respective referent category.

In the 1946-1951 cohort, sitting time was significantly higher in women who were single, in urban women, and in women who reported that it was easy managing on their income (Table 3) . In contrast with the younger cohort, mid-age women born in a non-English speaking country sat less than their Australian-born counterparts. As in the young women, sitting time was higher for mid-age women in full-time work and for those in skilled occupations, and lower for those in full-time home duties, without jobs, or in blue collar occupations, compared with women in the respective referent category. Compared with women with low education (no formal education or school certificate), women with a university education sat more and those with a trade/apprenticeship or a certificate/diploma sat less. As in the young women, mid-aged women who reported studying, or doing >15 hrs/wk of passive leisure sat more than women in the respective referent category. Women who reported moderate or high PA levels or were non-drinkers sat less, while overweight and obese women, women with ≥3 chronic conditions, and smokers sat more, than women in the respective referent category.

DISCUSSION

This study provides initial evidence of the factors associated with sitting time in young and mid-age Australian women. A wide range of variables was correlated with sitting time, and although many of these are not easily modifiable, the results are useful for identifying groups of women

who may benefit from targeted interventions to reduce sitting time and for identifying opportunities for intervention.

Most of the demographic and time-use variables that were significantly associated with sitting time were similar between the two age cohorts. Previous studies have shown that indicators of socio-economic disadvantage, such as living in deprived neighbourhoods, [14, 15] low income,[14-16] no paid job,[16, 17] and low education,[16, 17] are associated with higher TV viewing time. In contrast, in the present study, indicators of socio-economic advantage, such as full-time work and skilled occupations in both cohorts and university education in the mid-age cohort, were associated with high sitting time.

Two types of work, home duties and caring duties, however, were associated with lower sitting time. Young and mid-age women who worked full-time in home duties had relatively low sitting time and sitting time in the young women was lower for an increased number of children. Interestingly, sitting time was high in mid-age women who could easily manage on their income and in younger women who found it difficult to manage on their income. This may reflect the fact that many of these younger women, even those in full-time jobs requiring long hours of sitting, may be struggling to manage on their income, especially if they are establishing independent homes and re-paying university fee loans. We conclude that relationships between socio-economic position and sitting time in women reflect their paid work and unpaid family roles, with more highly educated full-time working women having a greater risk of high sitting time than women who are engaged in unpaid family caring duties.

Young and mid-aged women with sleeping problems reported higher sitting time. Lack of sleep may lead to an increase in sedentary behaviours due to tiredness, as has been hypothesized to be the case in children.[31] Overweight or obese mid-aged women sat more than those with a healthy weight, which is in line with recent suggestions that there may be a bidirectional or reverse relationship between sitting time and BMI in mid-aged people.[32, 33] The higher sitting in mid-aged women with ≥3 chronic conditions could also reflect a bidirectional relationship, as sitting is a potential risk factor for chronic conditions,[34] but chronic conditions may also affect the ability to be physically active, thereby indirectly influencing sitting time.

In the mid-aged women, there was evidence of a cluster of healthy behaviours associated with lower sitting time: women with moderate or high activity levels and those who did not smoke or drink had lower sitting times. In contrast, smoking was associated with lower sitting time in the younger women. A potential explanation is that, in this age-group, smoking may be an indication of socio-economic status, with women who smoke being less likely to be in full-time work, and in less skilled occupations. However, our analyses were adjusted for these variables.

It is not yet clear what amount of sitting time would be a meaningful difference in health risk,[34] and although statistically significant, some of the differences in sitting time among the different categories of some variables were small. We found the largest differences in average sitting time, 1-1.25 hours, for working hours, different occupations and time spent in passive leisure in both age groups. Combinations of work and passive leisure resulted in even greater differences in sitting time. For example, full-time working mid-aged women in skilled occupations and engaging in >15 hrs/week of passive leisure sat for 8.8 (SD 3.1) hrs/day (n=158), whereas mid-aged women in professional occupations who did not work full-time and engaged 1-15 hrs/week

in passive leisure sat only 4.9 (SD 2.8) hrs/day (n=839). These findings suggest both occupational sitting and leisure-time sitting offer opportunities for intervention.

The major strength of this study was the use of large national samples of working age women. Because ALSWH addresses a myriad of variables that are important for women, we were able to include some unconventional variables that may be associated with sitting time. Moreover, because data from women at two contrasting life-stages were included in the analyses, we were able to examine potential age and generational differences in sitting-time correlates. The main limitation is the reliance on self-report data, which are vulnerable to bias and measurement error. Self-report data are, however, pragmatic for large population-based studies.[35] In addition, the reliability and validity of the sitting question has not been tested although it is similar to the IPAQ sitting question, which has been shown to have acceptable reliability and validity in women.[23]

In conclusion, young and mid-aged women who are in full-time work, in skilled occupations and those who report high levels of passive leisure should be targeted in interventions to decrease sitting time. These findings suggest that interventions for reducing sitting time should focus on both occupational and leisure-time sitting.

ACKNOWLEDGEMENTS

The Australian Longitudinal Study on Women's Health (ALSWH), which was conceived and developed by groups of interdisciplinary researchers at the Universities of Newcastle and Queensland, is funded by the Australian Government Department of Health and Ageing. The funding sources had no involvement in the research presented in this paper. Dr. van Uffelen and

Dr. Heesch were supported by a NHMRC program grant (Owen, Bauman and Brown; #301200) in Physical Activity and Health at The University of Queensland, School of Human Movement Studies. We thank Nelufa Begum, PhD, for her help with preparing the ALSWH datasets for the analyses presented in this manuscript.

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Table 1: Sample characteristics of women born between 1973 and 1978 and women born between 1946 and 1951[a]

		1973-1978 cohort N=7,724		1946-1951 cohort N=8,198	
		N	%[b]	N	%[b]
Demographics					
Area of residence	urban	4,536	59	3,131	38
	large rural town	785	10	1,142	14
	small rural town/remote area	2,403	31	3,925	48
Country of birth	Australia	7,173	93	6,343	77
	other English speaking	275	4	1,181	14
	non-English speaking	276	4	674	8
Education	no formal education or school certificate	754	10	3,769	46
	higher school or leaving certificate	1,479	19	1,359	17
	trade/apprenticeship/certificate/diploma	1,939	25	1,708	21
	university	3,552	46	1,326	16
Occupation	professional	3,523	45	2,972	36
	skilled	1,188	16	1,037	13
	blue collar	1,585	21	2,062	25
	no paid job	1,428	19	2,091	26
Income management	impossible/difficult all of the time	883	11	813	10
	difficult some of the time	2,277	30	2,155	26
	not too bad	3,000	39	3,646	45
	easy	1,564	20	1,584	19
Family and caring					
Marital status	married/partnered	1,767	23	6,763	82
	single/separated/divorced/widow	5,936	77	1,435	18
Providing care for others	no	7,305	95	6,142	75
	yes	419	5	2,056	25
Number of children	none	5,333	69	-	-
	1	1,168	15	-	-
	2	873	11	-	-

	≥3	350	5	-	-
Pregnant	no	7,127	92	-	-
	yes	597	8	-	-
Caring for	never	-	-	1,090	13
grandchildren	occasionally	-	-	2,313	28
	daily or weekly	-	-	4,795	59
	Time use				
Hours worked	not in labour force	1,308	17	1,709	21
	part-time	1,994	26	2,922	36
	full-time	4,422	57	3,567	43
Home duties	no home duties	138	2	208	2
	part-time	6,449	84	6,690	82
	full-time	1,137	15	1,300	16
Studying	no	5,722	74	6,757	82
	yes	2,002	26	1,441	18
Passive leisure	no passive leisure	93	1	171	2
	1-15 hours/week	5,146	67	5,529	67
	>15 hours/week	2,538	33	2,498	31
	Health				
BMI	normal weight	4,729	61	3,691	45
	overweight	1,624	21	2,652	32
	obese	1,041	14	1,855	23
Number of	none	4,671	61	3,950	48
chronic	1	2,003	26	2,591	32
conditions	2	683	9	1,119	14
	≥3	246	3	538	7
Sleeping poorly	no	5,314	69	4,447	54
	yes	2,410	31	3,751	46
Stiff or painfull	no	6,043	78	4,303	53
joints	yes	1,681	22	3,746	47
	Health behaviors				

Physical activity [c]	none	666	9	1,382	17
	very low	1,420	18	1,561	19
	low	1,354	18	1,514	19
	moderate	1,790	23	1,688	21
	high	2,422	31	2,053	25
Energy intake [d]	very low	1,548	20	1,591	20
	low	1,620	21	1,547	20
	moderate	1,458	19	1,504	19
	high	1,591	21	1,697	22
	very high	1,507	20	1,534	20
Smoking	never smoked	4,486	58	4,434	54
	ex smoker	1,412	18	2,633	32
	current smoker	1,826	24	1,131	14
Alcohol intake	non-drinker	602	8	982	12
	low risk drinker	4,799	62	4,485	55
	rarely drinker	2,049	27	2,252	28
	risky drinker	274	4	479	6

[a] Data collected in 2003 (1973-1978 cohort) and 2001 (1946-1951 cohort), except country of birth (1996 for both cohorts), education (1996 for 1946-1951 cohort) and alcohol intake (2000 for 1973-1978 cohort); [b] Percentage may not add up to 100% due to rounding; [c] None (<40 MET.min/week), very low (40-<300 MET.min/week), low (300-<600 MET.min/week), moderate (600-<1,200 MET.min/week), high (≥1,200 MET.min/week); [d] Very low (≤4800 KJ for both cohorts), low (>4800-6000 KJ in 1973-1978 cohort; >4800-5800 KJ in 1946-1951 cohort), moderate (>6000-7100 KJ in 1973-1978 cohort; >5800-6800 KJ in 1946-1951 cohort), high (7100-8800 KJ in 1973-1978 cohort; >6800-8300 KJ in 1946-1951 cohort), and very high (>8800 KJ in 1973-1978 cohort; >8300 KJ in 1946-1951 cohort).

Table 2: Correlates of sitting time in women born between 1973 and 1978 [a]

		Univariate N=7,724			Multivariable N=7,724		
		Mean sitting time (hrs/day)	95% CI	p-value	Mean sitting time (hrs/day)	95% CI	p-value
Demographics							
Area of residence	urban	7.06	(6.96 - 7.16)		6.28	(5.82 - 6.74)	
	large rural town	6.18	(5.96 - 6.41)	**<.001**	5.69	(5.19 - 6.19)	**<.001**
	small rural town/remote area	5.87	(5.74 - 6.00)	**<.001**	5.59	(5.13 - 6.06)	**<.001**
Country of birth	Australia	6.56	(6.48 - 6.63)		5.62	(5.19 - 6.05)	
	other English speaking	6.72	(6.31 - 7.13)	1.00	5.64	(5.08 - 6.20)	.90
	non-English speaking	7.70	(7.31 - 8.06)	**<.001**	6.31	(5.75 - 6.87)	**<.001**
Education	no formal education or school certificate	5.58	(5.35 - 5.80)		5.74	(5.24 - 6.24)	
	higher school or leaving certificate	6.30	(6.13 - 6.47)	**<.001**	5.97	(5.50 - 6.45)	.09
	trade/apprenticeship/certificate/ diploma	6.51	(96.37 - 6.66)	**<.001**	5.81	(5.33 - 6.29)	.61
	university	6.99	(6.88 - 7.10)	**<.001**	5.90	(5.42 - 6.37)	.28
Occupation	professional	6.99	(6.88 - 7.10)		5.72	(5.23 - 6.20)	
	skilled	7.68	(7.50 - 7.87)	**<.001**	6.66	(6.16 - 7.15)	**<.001**
	blue collar	5.96	(5.80 - 6.12)	**<.001**	5.31	(4.83 - 5.79)	**<.001**
	no paid job	5.46	(5.31 - 5.60)	**<.001**	5.74	(5.25 - 6.22)	.90

Income	not too bad	6.64	(6.52 - 6.75)		5.72	(5.25 - 6.19)	
management	easy	7.03	(6.86 - 7.20)	**.001**	5.80	(5.31 - 6.29)	.42
	difficult some of the time	6.36	(6.23 - 6.49)	**.02**	5.83	(5.36 - 6.29)	.24
	impossible/difficult all of the time	6.35	(6.13 - 6.58)	.16	6.07	(5.59 - 6.56)	**.005**
			Family and caring				
Providing care	no	6.64	(6.57 - 6.72)		6.07	(5.62 - 6.51)	
for others	yes	5.86	(5.55 - 6.17)	**<.001**	5.64	(5.13 - 6.16)	**.007**
Number of	none	7.22	(7.13 - 7.31)		6.62	(6.15 - 7.08)	
children	1	5.48	(5.32 - 5.64)	**<.001**	5.83	(5.35 - 6.31)	**<.001**
	2	5.14	(4.96 - 5.33)	**<.001**	5.70	(5.20 - 6.20)	**<.001**
	≥3	4.62	(4.33- - 4.90)	**<.001**	5.28	(4.72 - 5.84)	**<.001**
Pregnant	no	6.64	(6.57 - 6.72)		5.94	(5.26 - 6.28)	
	yes	6.12	(5.87 - 6.36)	**<.001**	5.77	(5.26 - 6.28)	.20
			Time use				
Hours worked	full-time	7.31	(7.21 - 7.41)		6.47	(5.99 - 6.95)	
	part-time	5.73	(5.60 - 5.87)	**<.001**	5.52	(5.05 - 5.99)	**<.001**
	not in labour force	5.54	(5.39 - 5.70)	**<.001**	5.58	(5.08 - 6.07)	**<.001**
Home duties	part-time	6.88	(6.80 - 6.96)		5.88	(5.45 - 6.32)	
	full-time	4.91	(4.75 5.06)	**<.001**	5.28	(4.82 - 5.74)	**<.001**
	no home duties	7.59	(7.03 8.16)	**.031**	6.40	(5.73 - 7.07)	.052
Studying	no	6.46	(6.38 6.55)		5.66	(5.20 - 6.11)	
	yes	7.00	(6.85 7.41)	**<.001**	6.05	(5.58 - 6.53)	**<.001**

Passive leisure	1-15 hours/week	6.27	(6.18 - 6.37)		5.63	(5.29 - 5.97)	
	>15 hours/week	7.28	(7.16 - 7.41)	**<.001**	6.84	(6.49 - 7.19)	**<.001**
	no passive leisure	5.49	(4.36 - 6.61)	.41	5.10	(4.09 - 6.11)	0.28
			Health				
Sleeping	no	6.52	(6.44 - 6.61)		5.70	(5.24 - 6.16)	
problems	yes	6.77	(6.64 - 6.91)	**.002**	6.01	(5.54 - 6.47)	**<.001**
			Health behaviors				
Energy intake	very low	6.88	(6.72 - 7.05)		5.85	(5.37 - 6.33)	
	low	6.73	(6.57 - 6.90)	1.00	5.84	(5.36 - 6.32)	.93
	moderate	6.56	(6.39 - 6.73)	**0.07**	5.81	(5.33 - 6.29)	.75
	high	6.49	(6.33 - 6.65)	**.01**	5.84	(5.36 - 6.32)	.95
	very high	6.33	(6.17 - 6.50)	**<.001**	5.94	(5.47 - 6.41)	.41
Smoking	never smoked	6.71	(6.61 - 6.81)		5.92	(5.45 - 6.38)	
	ex-smoker	6.58	(6.41 - 6.75)	.57	6.04	(5.57 - 6.52)	.19
	current smoker	6.37	(6.20 - 6.51)	**<.001**	5.61	(5.14 - 6.08)	**.001**
Alcohol intake	low risk drinker	6.76	(6.66 - 6.85)		5.83	(5.37 - 6.29)	
	rarely drinker	6.30	(6.16 - 6.44)	**<.001**	5.85	(5.39 - 6.31)	.77
	risky drinker	7.14	(6.76 - 7.53)	.37	6.08	(5.49 - 6.66)	.19
	non-drinker	6.13	(5.86 - 6.40)	**<.001**	5.66	(5.17 - 6.16)	.23

[a] Data collected in 2003, except country of birth (1996) and alcohol intake (2000). [b] Very low (≤4800 KJ), low (>4800-6000 KJ), moderate (>6000-7100 KJ), high (7100-8800 KJ), and very high (>8800 KJ); Underline indicates the referent category; **Boldface** indicates significant difference in sitting time compared with the referent category for that variable.

Table 3: Correlates of sitting time in women born between 1946 and 1951[a]

		Univariate N=8,198			Multivariable N=8,198		
		Mean sitting time (hrs/day)	95% CI	p-value	Mean sitting time (hrs/day)	95% CI	p-value
Demographics							
Area of residence	urban	6.13	(6.02 - 6.24)		6.08	(5.84 - 6.32)	
	large rural town	5.59	(5.42 - 5.77)	< **0.001**	5.60	(5.32 - 5.87)	< **.001**
	small rural town/remote area	5.39	(5.30 - 5.48)	< **0.001**	5.49	(5.24 - 5.73)	< **.001**
Country of birth	Australia	5.67	(5.59 - 5.74)		5.78	(5.56 - 6.01)	
	other English speaking	6.08	(5.91 - 6.25)	**<.001**	5.95	(5.68 - 6.22)	.071
	non-English speaking	5.36	(5.13 - 5.59)	**.041**	5.43	(5.13 - 5.73)	**.002**
Education	no formal education or school certificate	5.55	(5.46 - 5.65)		5.66	(5.42 - 5.90)	
	higher school or leaving certificate	5.88	(5.72 - 6.05)	**.003**	5.82	(5.55 - 6.09)	.081
	trade/apprenticeship/certificate/ diploma	5.49	(5.35 - 5.63)	1.00	5.43	(5.17 - 5.69)	**.009**
	university	6.20	(6.03 - 6.36)	**<.001**	5.97	(5.69 - 6.25)	**.004**
Occupation	professional	5.89	(5.78 - 6.01)		5.59	(5.34 - 5.84)	
	skilled	7.04	(6.85 - 7.24)	**<.001**	6.80	(6.50 - 7.09)	**<.001**
	blue collar	5.32	(5.20 - 5.45)	**<.001**	5.36	(5.10 - 5.63)	**0.014**
	no paid job	5.16	(5.04 - 5.28)	**<.001**	5.14	(4.87 - 5.41)	**<.001**
Income	not too bad	5.63	(5.53 - 5.72)		5.65	(5.40 - 5.89)	

management	easy	6.02	(5.86 - 6.18)	**<.001**	5.93	(5.66 - 6.20)	**.001**
	difficult some of the time	5.62	(5.50 - 5.75)	1.00	5.67	(5.42 - 5.93)	.96
	impossible/difficult all of the time	5.62	(5.41 - 5.83)	1.00	5.64	(5.35 - 5.92)	.73
Family and caring							
Marital status	married/partnered	5.59	(5.51 - 5.66)		5.55	(5.32 - 5.78)	
	single/separated/divorced/widow	6.24	(6.08 - 6.41)	**<.001**	5.90	(5.63 - 6.16)	**<.001**
Providing care	no	5.77	(5.69 - 5.84)		5.78	(5.55 - 6.02)	
for others	yes	5.50	(5.37 - 5.63)	**.001**	5.66	(5.41 - 5.91)	.086
Caring for	never	5.38	(5.21 - 5.56)		5.63	(5.35 - 5.91)	
grandchildren	occasionally	5.64	(5.52 - 5.77)	.060	5.76	(5.51 - 6.01)	.21
	daily or weekly	5.80	(5.71 - 5.89)	**<.001**	5.77	(5.54 - 6.01)	.15
Time use							
Hours worked	full-time	6.28	(6.17 - 6.39)		6.13	(5.88 - 6.38)	
	part-time	5.21	(5.12 - 5.31)	**<.001**	5.32	(5.07 - 5.57)	**<.001**
	not in labour force	5.31	(5.18 - 5.44)	**<.001**	5.72	(5.42 - 6.01)	**.001**
Home duties	part-time	5.91	(5.84 - 5.99)		6.06	(5.85 - 6.28)	
	full-time	4.68	(4.54 - 4.81)	**<.001**	5.27	(5.01 - 5.53)	**<.001**
	no home duties	5.28	(4.86 - 5.70)	**.008**	5.83	(5.42 - 6.25)	.27
Studying	no	5.66	(5.59 - 5.73)		5.62	(5.39 - 5.85)	
	yes	5.88	(5.73 - 6.04)	**.013**	5.82	(5.56 - 6.09)	**.015**
Passive leisure	1-15 hours/week	5.37	(5.29 - 5.45)		5.54	(5.32 - 5.76)	
	>15 hours/week	6.52	(6.41 - 6.64)	**<.001**	6.78	(6.55 - 7.01)	**<.001**

	no passive leisure	4.54	(4.04 - 5.03)	**.001**	4.84	(4.39 - 5.30)	**.002**
Health							
BMI	normal weight	5.45	(5.35 - 5.54)		5.44	(5.19 - 5.68)	
	overweight	5.69	(5.57 - 5.80)	**.007**	5.60	(5.35 - 5.85)	**.024**
	obese	6.26	(6.11 - 6.41)	**<.001**	6.13	(5.87 - 6.39)	**<.001**
Number of	none	5.65	(5.55 - 5.74)		5.62	(5.38 - 5.86)	
chronic	1	5.61	(5.49 - 5.72)	1.00	5.55	(5.31 - 5.80)	.38
conditions	2	5.89	(5.71 - 6.07)	.11	5.77	(5.50 - 6.05)	.11
	≥3	6.15	(5.88 - 6.41)	**.002**	5.94	(5.62 - 6.26)	**.017**
Sleeping	no	5.65	(5.56 - 5.74)		5.67	(5.43 - 5.91)	
problems[b]	yes	5.76	(5.67 - 5.86)	.087	5.78	(5.53 - 6.02)	.09
Health behaviors							
Physical	none	6.00	(5.83 - 6.17)		5.90	(5.64 - 6.16)	
activity[c]	very low	5.92	(5.76 - 6.08)	1.00	5.84	(5.57 - 6.10)	.56
	low	5.85	(5.69 - 6.00)	1.00	5.81	(5.54 - 6.08)	.38
	moderate	5.64	(5.50 - 5.78)	**.011**	5.65	(5.38 - 5.91)	**0.016**
	high	5.28	(5.15 - 5.40)	**<.001**	5.41	(5.16 - 5.67)	**<.001**
Smoking	never smoked	5.61	(5.53 - 5.70)		5.65	(5.41 - 5.89)	
	ex-smoker	5.75	(5.64 - 5.87)	.19	5.66	(5.41 - 5.91)	0.88
	current smoker	5.92	(5.73 - 6.10)	**.008**	5.86	(5.59 - 6.13)	**.034**
Alcohol intake	low risk drinker	5.82	(5.73 - 5.91)		5.82	(5.58 - 6.06)	
	rarely drinker	5.61	(5.48 - 5.73)	**.042**	5.67	(5.43 - 5.92)	.057

risky drinker	5.89	(5.60 - 6.17)	1.00	5.78	(5.45 - 6.12)	.81
non-drinker	5.29	(5.11 - 5.48)	**<.001**	5.61	(5.34 - 5.89)	**.049**

[a] Data collected in 2003, except country of birth (1996) and education (1996); [b] Having sleeping problems was associated with sitting time in the univariate analysis, which including all women who provided sitting time data (n=10,308), but the variable was not significant (p-value=0.09) in the smaller sample included in the multivariable analysis and whose data are shown here for both the univariate and multivariate models (n=8,198); [c] None (<40 MET.min/week), very low (40-<300 MET.min/week), low (300-<600 MET.min/week), moderate (600-<1,200 MET.min/week), high (≥1,200 MET.min/week); Underline indicates the referent category; **Boldface** indicates significant difference in sitting time compared with the referent category for that variable.

Appendix table 1: Comparison of women from the 1973-1978 birth cohort whose data were included in the analysis and women whose data were excluded [a]

	Included (N=7,724)		Excluded (N=1,357)		
	N	% [b]	N	% [b]	p-value [c]
Demographics					
Area of residence					**<.001**
urban	4,536	59	699	52	
large rural town	785	10	157	12	
small rural town/remote area	2,403	31	498	37	
missing			3	0.2	
Country of birth					.41
Australia	7,173	93	1,213	89	
other English speaking	275	4	44	3	
non-English speaking	276	4	37	3	
missing			63	5	
Education					**<.001**
no formal education or school certificate	754	10	180	13	
higher school or leaving certificate	1,479	19	249	18	
trade/apprenticeship/certificate/ diploma	1,939	25	335	25	
university	3,552	46	379	28	
missing			214	16	
Occupation					**<.001**
professional	3,523	46	430	32	
skilled	1,188	15	187	14	
blue collar	1,585	21	323	24	
no paid job	1,428	19	301	22	
missing			116	9	
Income management					**<.001**
impossible/difficult all of the time	883	11	199	15	
difficult some of the time	2,277	30	443	33	
not too bad	3,000	39	468	35	
easy	1,564	20	200	15	
missing			47	4	
Family and caring					
Marital status					.28
married/partnered	1,767	23	290	21	
single/separated/divorced/widow	5,936	77	1052	78	
missing			15	1	
Providing care for others					**.003**
no	7,305	95	1263	93	
yes	419	5	94	7	
Number of children					**<.001**
none	5,333	69	831	61	
1	1,168	15	276	20	
2	873	11	173	13	
≥3	350	5	77	6	

Pregnant					0.40
no	7,127	92	1052	78	
yes	597	8	97	7	
missing			208	15	
Time use					
Hours worked					**<.001**
not in labour force	1,308	17	104	8	
part-time	1,994	26	598	44	
full-time	4,422	57	601	44	
missing			54	4	
Home duties					**0.01**
no home duties	138	2	24	2	
part-time	6,449	84	993	73	
full-time	1,137	15	222	16	
missing			118	9	
Studying					0.12
no	5,722	74	892	66	
yes	2,002	26	278	21	
missing	-	-	187	14	
Passive leisure					0.18
no passive leisure	93	1	12	1	
1-15 hours/week	5,146	67	867	64	
>15 hours/week	2,538	33	433	32	
missing	-	-	45	3	
Health					
BMI					.06
normal weight	4,729	61	785	58	
overweight	1,624	21	255	19	
obese	1,041	14	206	15	
missing			111	8	
Number of chronic conditions					**.04**
none	4,671	61	764	56	
1	2,003	26	373	28	
2	683	9	148	11	
≥3	246	3	47	4	
Sleeping poorly					0.10
no	5,314	69	886	65	
yes	2,410	31	446	33	
missing			25	2	
Stiff or painfull joints					**.02**
no	6,043	78	1009	74	
yes	1,681	22	323	24	
missing			25	2	
Health behaviors					
Physical activity [d]					**.001**
none	666	9	147	11	
very low	1,420	18	225	17	
low	1,354	18	207	15	
moderate	1,790	23	257	19	
high	2,422	31	428	32	

missing	-	-	93	7	
Energy intake [e]					**0.03**
very low	1,548	20	281	21	
low	1,620	21	255	19	
moderate	1,458	19	238	18	
high	1,591	21	269	20	
very high	1,507	20	309	23	
missing			5	0.4	
Smoking					**<.001**
never smoked	4,486	58	685	51	
ex-smoker	1,412	18	262	19	
current smoker	1,826	24	377	28	
missing			33	2	
Alcohol intake					**<.001**
non-drinker	602	8	129	10	
low risk drinker	4,799	62	723	53	
rarely drinker	2,049	27	413	30	
risky drinker	274	4	55	4	
missing			37	3	

[a] Data collected in 2003, except country of birth (1996) and alcohol intake (2000); [b] Percentage may not add up to 100% due to rounding; [c] P-values refer to differences in proportions between categories listed in the rows, using Pearson's chi square tests. [d] None (<40 MET.min/week), very low (40-<300 MET.min/week), low (300-<600 MET.min/week), moderate (600-<1,200 MET.min/week), high (≥1,200 MET.min/week); [e] Very low (≤4800 KJ), low (>4800-6000 KJ), moderate (>6000-7100 KJ), high (7100-8800 KJ), and very high (>8800 KJ).

Appendix table 2: Comparison of women from the 1946-1951 birth cohort whose data were included in the analysis and women whose data were excluded [a]

	Included N=8,198		Excluded N=3,002		
	N	% [b]	N	% [b]	p-value [c]
Demographics					
Area of residence					**.004**
urban	3,131	38	1,065	36	
large rural town	1,142	14	370	12	
small rural town/remote area	3,925	48	1,515	51	
missing	-	-	52	2	
Country of birth[a]					**<.001**
Australia	6,343	77	2,242	75	
other English speaking	1,181	14	312	10	
non-English speaking	674	8	318	11	
missing	-	-	130	4	
Education					**<.001**
no formal education or school certificate	3,769	46	1,627	54	
higher school or leaving certificate	1,359	17	466	16	
trade/apprenticeship/certificate/ diploma	1,708	21	508	17	
university	1,326	16	313	10	
missing	-	-	88	3	
Occupation					**<.001**
professional	2,972	36	801	27	
skilled	1,073	13	302	10	
blue collar	2,062	25	730	24	
no paid job	2,091	26	834	28	
missing	-	-	335	11	
Income management					**<.001**
impossible/difficult all of the time	813	10	434	15	
difficult some of the time	2,155	26	857	29	
not too bad	3,646	45	1,164	39	
easy	1,584	19	405	14	
missing	-	-	142	5	
Family and caring					
Marital status					**<.001**
married/partnered	6,763	82	2,315	77	
single/separated/divorced/widow	1,435	18	628	21	
missing	-	-	59	2	
Caring for grandchildren					**<.001**
never	1,090	13	505	17	
occasionally	2,313	28	895	30	
daily or weekly	4,795	59	1,526	51	
missing	-	-	76	3	
Providing care for others					.28
no	6,142	75	2,281	76	
yes	2,056	25	721	24	
Time use					

Hours worked					**<.001**
not in labour force	1,709	21	833	28	
part-time	2,922	36	1,050	35	
full-time	3,567	43	1,041	35	
missing	-	-	78	3	
Home duties					**<.001**
no home duties	208	2	119	4	
part-time	6,690	82	1,943	65	
full-time	1,300	16	513	17	
missing	-	-	427	14	
Studying					**.002**
no	6,757	82	2,241	75	
yes	1,441	18	394	13	
missing	-	-	367	12	
Passive leisure					**<.001**
no passive leisure	171	2	144	5	
1-15 hours/week	5,529	67	1,855	62	
>15 hours/week	2,498	31	803	27	
missing	-	-	200	7	
Health					
BMI					**.005**
normal weight	3,691	45	1,101	37	
overweight	2,652	32	842	28	
obese	1.855	23	665	22	
missing	-	-	394	13	
Number of chronic conditions					**<.001**
none	3,950	48	1,321	44	
1	2,591	32	949	32	
2	1,119	14	465	16	
≥3	538	7	267	9	
Sleeping poorly					.37
no	4,447	54	1,434	48	
yes	3,751	46	1,259	42	
missing	-	-	309	10	
Stiff or painfull joints					**<.001**
no	4,303	53	1,347	45	
yes	3,746	47	1,428	48	
missing	-	-	227	8	
Health behaviors					
Physical activity [d]					**<.001**
none	1,382	17	549	18	
very low	1,561	19	497	17	
low	1,514	19	386	13	
moderate	1,688	21	477	16	
high	2,053	25	564	19	
missing	-	-	529	18	
Energy intake [e]					.095
very low	1,591	20	586	20	
low	1,547	20	524	18	
moderate	1,504	19	548	18	

high	1,697	22	532	18	
very high	1,534	20	561	19	
missing	-	-	251	8	
Smoking					**.044**
never smoked	4,434	54	1,567	52	
ex-smoker	2,633	32	920	31	
current smoker	1,131	14	462	15	
missing	-	-	53	2	
Alcohol intake					**<.001**
non-drinker	982	12	451	15	
low risk drinker	4,485	55	1,323	44	
rarely drinker	2,252	28	840	28	
risky drinker	479	6	136	5	
missing	-	-	252	8	

[a] Data collected in 2003, except country of birth (1996) and education (1996); [b] Percentage may not add up to 100% due to rounding; [c] P-values refer to differences in proportions between categories listed in the rows, using Pearson's chi square tests. [d] None (<40 MET.min/week), very low (40-300 MET.min/week), low (>300-<600 MET.min/week), moderate (600-<1,200 MET.min/week), high (≥1,200 MET.min/week); e Very low (≤4800 KJ), low (>4800-5800 KJ), moderate (>5800-6800 KJ), high (>6800-8300 KJ), and very high (>8300 KJ).