Which older women could benefit from interventions to decrease sitting time and increase physical activity?

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Published in:
Journal of the American Geriatrics Society

DOI:
10.1111/j.1532-5415.2011.03792.x

Which Older Women Could Benefit from Interventions to Decrease Sitting Time and Increase Physical Activity?

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There is increasing evidence that lack of physical activity (PA) and high sitting time are independently associated with poor health.[1;2] Thus, regardless of the health benefits of PA participation, prolonged sitting is associated with health risks. such as metabolic and cardiovascular disease, and mortality.[1;2] Reducing sitting time therefore offers a novel intervention opportunity, along with increasing PA, particularly for older people for whom PA may be difficult. To identify older population subgroups that may benefit from interventions to both decrease sitting time and increase PA, we recently conducted a study to identify demographic, social and health-related factors associated with an undesirable pattern of high sitting time and low PA levels in a large cohort of older community-dwelling women.

Data were from 6,116 women born between 1921-1926, who participated in the Australian Longitudinal Study on Women's Health (www.alswh.org.au).[3] The study was approved by the Ethics Committees of The University of Queensland and the University of Newcastle. Data were collected with a mail survey in 2002, when the women were aged 76-81 years. Women who were chair-bound/bedridden or underweight were excluded.

PA was measured using adapted Active Australia survey questions, which assess time spent in the previous week walking briskly, and in moderate (MPA) and vigorous (VPA) leisure-time PA. A PA score was calculated by weighting time in each activity by its metabolic equivalent (MET) to account for its respective intensity: (walking×3.0METs) + (MPA×4.0METs) + (VPA×7.5METs). Women also reported the number of hours per weekday and weekend day they typically spent sitting while doing activities like visiting friends, driving, reading, watching television or working at a desk or computer. Details about the PA and sitting variables have been reported elsewhere.[4;5]

The association between sitting and PA was calculated using Pearson's correlation. The associations between possible explanatory factors and, separately, sitting and PA were initially examined in univariate linear regression models. Variables found to be significantly associated with at least one outcome were included in multivariable models for weekday sitting, weekend day sitting and PA. (Variables and categories are shown in Table 1). Analyses were done in Stata (Stata Corporation, Release 10.1), with statistical significance at $p \leq 0.05$.

The correlation between sitting time (hrs/day) and PA (MET.minutes/week) was -0.02 for weekday sitting and -0.03 for weekend day sitting, confirming that PA and sitting are unrelated. Differences were found in the demographic, social and health-related factors associated with sitting and PA (Table 1). Some factors were associated with more sitting and less PA (BMI, chronic conditions, anxiety/depression, caring duties, volunteering [weekday sitting only]); some were associated with more sitting and *more* PA (being from an English speaking country other than Australia, more social interaction); some were associated only with more sitting (experiencing dizziness/loss of balance, being single, living in an urban area, having post high-school education [weekday sitting only]); and others were associated only with less PA (experiencing stiff/painful joints, experiencing foot problems).

Of the five factors associated with high sitting time *and* low PA levels, three were health-related (obesity, having ≥3 chronic conditions, having more symptoms of anxiety and depression). For example, each additional point on the anxiety/depression scale was associated with an additional 2 minutes sitting per day and with 21 MET.minutes less PA per week (equivalent to 7 minutes of walking). This study expands on previous work showing associations between poor physical and mental health and low PA levels in older people,[6-8] by demonstrating that some physical and mental health problems are also associated with high sitting time.

The other two factors associated with high sitting time *and* low PA were social factors: women without caring duties and women not doing volunteer work sat more and did less PA than women involved in these activities. In contrast, previous research has indentified caring duties as a barrier to PA participation.[9] An explanation could be that our significant caring variable included caring for grandchildren, which could increase PA by engaging in active play, as well as for frail older adults.

Our results suggest that older women with a high health risk profile (obesity, having ≥3 chronic conditions, having more symptoms of anxiety/depression) and social risk profile (no volunteer or caring duties) may particularly benefit from interventions to promote both reducing sitting time and increasing PA. In addition, for women who find it difficult to engage in PA, interventions could focus on the substitution of sitting with light activities, which has been associated with improved physical health.[10]

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Table 1: Factors Associated with Sitting Time and Physical Activity (Multivariable models, n=6,116)

	Weekday sitting (hrs/day)			**Weekend day sitting (hrs/day)**			**Physical Activity (MET.minutes/week)***		
	Mean	95% CI	*p*	Mean	95% CI	*p*	Mean	95% CI	*p*
Factors associated with more sitting and less PA (compared to reference category)									
BMI									
normal weight	4.8	(4.7 - 4.8)	-	5.1	(5.1 - 5.2)	-	773	(733 - 813)	-
overweight	**5.0**	**(4.9 - 5.1)**	***0.00***	**5.4**	**(5.3 - 5.5)**	***0.00***	712	(661 - 762)	*0.06*
obese	**5.4**	**(5.2 - 5.5)**	***0.00***	**6.0**	**(5.8 - 6.1)**	***0.00***	**542**	**(477 - 606)**	***0.00***
Chronic conditions[§]									
none	4.7	(4.6 - 4.9)	-	5.2	(5.0 - 5.3)	-	860	(781 - 939)	-
1	**5.0**	**(4.9 - 5.1)**	***0.01***	**5.4**	**(5.3 - 5.5)**	***0.04***	780	(728 - 831)	*0.09*
2	4.9	(4.8 - 5.0)	*0.10*	5.3	(5.2 - 5.4)	*0.22*	**681**	**(626 - 736)**	***0.00***
≥3	**5.1**	**(5.0 - 5.3)**	***0.00***	**5.6**	**(5.4 - 5.7)**	***0.00***	**582**	**(530 - 635)**	***0.00***
Symptoms of anxiety/depression: GADS score									
constant	3.8	(3.4 - 4.2)	*0.00*	3.8	(3.4 - 4.3)	*0.00*	477	(291 - 662)	*0.00*
coefficient	**0.03**	**(0.01 - 0.04)**	***0.00***	**0.03**	**(0.02 - 0.05)**	***0.00***	**-21**	**(-29; -13)**	***0.00***
Caring duties									
not providing care	5.0	(5.0 - 5.1)	-	5.5	(5.4 - 5.6)	-	678	(635 - 721)	-
for grandchild or frail adult	**4.9**	**(4.8 - 5.0)**	***0.02***	5.4	(5.3 - 5.5)	*0.16*	731	(688 - 775)	*0.09*
for grandchild and frail adult	**4.7**	**(4.5 - 4.9)**	***0.00***	**5.0**	**(4.8 - 5.2)**	***0.00***	**833**	**(750 - 916)**	***0.00***
Volunteering									

no	5.0	(4.9-5.1)	-	5.4	(5.3-5.5)	-	685	(644-726)	-
yes	**4.9**	**(4.8-5.0)**	***0.02***	5.3	(5.2-5.4)	*0.47*	**757**	**(713-800)**	***0.02***
Factors associated with more sitting and more PA (compared to reference category)									
Country of birth									
Australia	4.9	(4.8-4.9)	-	5.3	(5.2-5.3)	-	689	(657-721)	-
other English speaking	**5.4**	**(5.2-5.5)**	***0.00***	**5.9**	**(5.7-6.1)**	***0.00***	**825**	**(740-911)**	***0.00***
non-English speaking	4.9	(4.7-5.1)	*0.47*	5.5	(5.2-5.7)	*0.08*	**801**	**(696-906)**	***0.04***
Social interaction: DSSI score									
constant	3.8	(3.4-4.2)	*0.00*	3.8	(3.4-4.3)	*0.00*	477	(291-662)	*0.00*
coefficient	**0.10**	**(0.06-0.14)**	***0.00***	**0.13**	**(0.08-0.17)**	***0.00***	**57**	**(38-76)**	***0.00***
Factors associated with sitting only									
Dizziness/loss of balance									
no	4.9	(4.9 -5.0)	-	5.3	(5.3-5.4)	-	717	(688-746)	-
yes	**5.3**	**(5.0 -5.6)**	***0.02***	**5.8**	**(5.5-6.1)**	***0.01***	756	(627-886)	*0.56*
Marital status									
single†	5.1	(5.1-5.2)	-	5.5	(5.4-5.6)	-	724	(685-762)	-
married/partnered	**4.7**	**(4.6-4.8)**	***0.00***	**5.2**	**(5.1-5.3)**	**0.00**	714	(668-759)	0.75
Area of residence									
urban	5.1	(5.0-5.1)	-	5.5	(5.4-5.6)	-	751	(707-795)	-
large town	4.9	(4.7-5.1)	*0.11*	5.4	(5.2-5.6)	*0.48*	662	(583-741)	*0.06*
small town/remote	**4.9**	**(4.8-4.9)**	***0.00***	**5.3**	**(5.2-5.4)**	***0.01***	704	(660-748)	*0.14*

Education									
junior high school certificate or less	4.9	(4.8-5.0)	-	5.3	(5.3-5.4)	-	701	(668-735)	-
high school or leaving certificate	5.0	(4.9-5.2)	*0.10*	5.5	(5.3-5.7)	*0.11*	772	(686-858)	*0.13*
trade, certificate, or diploma	**5.2**	**(4.9-5.5)**	***0.04***	5.3	(5.2-5.5)	*0.91*	741	(654-828)	*0.41*
university degree	**5.1**	**(4.9-5.2)**	***0.04***	5.4	(5.1-5.7)	*0.81*	775	(634-917)	*0.32*
Factors associated with physical activity only									
Stiff/painful joints									
no	4.9	(4.8-5.0)	-	5.3	(5.3-5.4)	-	742	(708-775)	-
yes	5.0	(4.9-5.2)	*0.11*	5.4	(5.3-5.6)	*0.18*	**656**	**(605-708)**	***0.01***
Foot problems									
no	4.9	(4.9-5.0)	-	5.4	(5.3-5.4)	-	740	(708-772)	-
yes	5.0	(4.9-5.2)	*0.38*	5.4	(5.3-5.6)	*0.43*	**608**	**(547-668)**	***0.00***

* Means and 95% CIs for physical activity are bootstrapped estimates given the non-normality of the data; † single/separated/divorced/widow; § From a list of health conditions, including diabetes, cancer, and heart disease, reported as diagnosed by a doctor, or treated for, in the previous 3 years; DSSI = Duke Social Support Index, range 4-12 points, higher score indicates more interaction; GADS = Goldberg Anxiety and Depression Scale, range 0-18 points, higher score indicates more symptoms; MET = metabolic equivalent; PA = physical activity; **boldface** indicates significant difference compared with the reference category; underlined indicates reference category.

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, Ms. Van Gellecum and Dr. Burton were supported by a NHMRC program grant (Owen, Bauman and Brown; #569663) at The University of Queensland, School of Human Movement Studies. NB was also supported by a Heart Foundation of Australia Postdoctoral Fellowship (PH 08B 3904).

Conflict of Interest Checklist:

Elements of Financial/Personal Conflicts	*Author 1 JGZ van Uffelen		Author 2 KC Heesch		Author 3 YR van Gellecum		Author 4 NW Burton		Author 5 WJ Brown	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Employment or Affiliation		X		X		X		X		X
Grants/Funds		X		X		X		X		X
Honoraria		X		X		X		X		X
Speaker Forum		X		X		X		X		X
Consultant		X		X		X		X		X
Stocks		X		X		X		X		X

Royalties		X		X		X		X		X
Expert Testimony		X		X		X		X		X
Board Member		X		X		X		X		X
Patents		X		X		X		X		X
Personal Relationship		X		X		X		X		X

***Authors can be listed by abbreviations of their names**

For "yes", provide a brief explanation: _NA

Author contributions: WB was involved with the initiation and development of the ALSWH surveys, including the sitting time and PA measures. JvU and KH conceived the study described in this manuscript. JvU, KH and YvG developed the analysis plan, and YvG conducted the analyses. All authors participated in the interpretation of the data. JvU drafted the letter and all authors were involved in critically revising the letter for important intellectual content. All authors read and approved the final letter.

Sponsor's role: The Australian Longitudinal Study on Women's Health is funded by the Australian Government Department of Health and Ageing. The funding sources had no involvement in the research presented in this paper.