Feasibility of reducing older adults’ sedentary time

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ABSTRACT

Background: Sedentary time (too much sitting, as distinct from lack of exercise) is a prevalent risk to health among older adults.

Purpose: Examine the feasibility of an intervention to reduce and break up sedentary time in older adults.

Design: A pre-experimental (pre-post) study.

Setting/participants: 59 participants aged 60 years or older from Brisbane, Australia. Data were collected between May and December 2009, and analyzed in 2010.

Intervention: One face-to-face goal setting consultation and one individually-tailored mailing providing feedback on accelerometer-derived sedentary time, grounded in social cognitive theory and behavioral choice theory.

Main outcome measures: Program reach and retention; changes in accelerometer-derived sedentary time, light-intensity physical activity (LIPA), and moderate- to vigorous-intensity physical activity (MVPA) (assessed over six days in pre-and post-intervention periods); and participant satisfaction.

Results: Reach was 87.5% of those screened and eligible; retention was 100%. From pre- to post-intervention, participants decreased their sedentary time [-3.2% (95%CI: -4.18 to -2.14), p<0.001], increased their breaks in sedentary time per day [4.0 (1.48 to 6.52), p=0.003], and increased their LIPA [2.2% (1.40 to 2.99), p<0.001] and MVPA [1.0% (0.55 to 1.38), p<0.001]. Significantly greater reductions in sedentary time were made after 10am with significantly greater number of breaks occurring between 7pm and 9pm. Participants reported high satisfaction with the program (median 9/10).

Conclusions: Sedentary time in older adults can be reduced following a brief intervention and randomized trials are needed to build upon these findings.
INTRODUCTION

Cross-sectional and prospective studies have identified sedentary time (too much sitting, as distinct from lack of exercise) as a distinct health risk, and a potentially important health-behavior change target. To date, only one intervention trial, which focused on a particular sedentary behavior (television (TV) viewing), has been conducted with adults (aged 22-61 years). We examined the feasibility of a novel intervention to reduce overall sedentary time in older adults (aged ≥60 years) -- the population group with the highest levels of sedentary time and among whom high levels of TV viewing and overall sitting are associated with the metabolic syndrome. Outcomes included program reach and retention, effects of the intervention on light-intensity (LIPA) and moderate- to vigorous-intensity physical activity (MVPA), and participant satisfaction.

METHODS

Study design

Enrolment for this pre-experimental (pre-post) study occurred May-December 2009, with data analyzed in 2010. Participants underwent a 6-day baseline assessment, received a face-to-face intervention session, and completed a 6-day post-intervention assessment immediately following the intervention session (see Figure 1). The study was approved by The University of Queensland’s Behavioural Social Sciences Ethics Review Committee. Participants provided written informed consent and were not paid for their involvement.

Participants

Inclusion criteria were: age 60 years or older, self-reported TV viewing time of ≥2 hours/day, no paid employment, ambulatory, and residence within 50 km of the research centre. A target of 60 participants was set as this was estimated to provide 90% power (2-
tailed, p<0.05) to detect a 5.6% (SD 9.4%) decrease in sedentary time, allowing for 15% attrition.

**Intervention**

A key intervention message of the ‘Stand Up For Your Health’ program was to stand up and move after 30 minutes of uninterrupted sitting. Specific constructs (from Social Cognitive Theory and Behavioral Choice Theory) informed the intervention: self-efficacy via realistic and measurable goal setting; self-control via self-monitoring of sedentary time and goal setting; outcome expectancies via barriers and benefits of reducing sedentary time; reinforcement via rewarding behavior change; and, preference via identifying enjoyable non-sedentary pursuits.

During the intervention session (45-minutes delivered face-to-face), participants were guided through four activities in a workbook (available on request): (1) review of accelerometer-assessed sedentary time from the previous day; (2) normative feedback on self-reported sedentary time, using graphs to compare to an average Australian of a similar age and gender; (3) goal setting to reduce sedentary time and increase the number of breaks in prolonged sedentary time; and, (4) formulation of a behaviorally-specific action plan. Self-monitoring of goals was encouraged using a tracker (available on request). Generic strategies to reduce and break up sedentary time were suggested, and participants identified strategies specific to their circumstances (see online Table).

Individually-tailored feedback from accelerometer-derived sedentary time in the previous week was mailed to the participants following the face-to-face session.
Measures

Reach: Calculated as [(participants enrolled / participants screened and eligible) * 100].

Retention: Calculated as [(participants completing post-intervention assessment / participants enrolled) * 100].

Sedentary time, breaks and physically-active time: Derived during waking hours from a uniaxial accelerometer (Actigraph GT1M). Days on which the researcher conducted home visits and when the accelerometer was worn for <10 hours were excluded, based on data from the accelerometer and wearing logs completed by participants. Data were summarized as the percentage of monitoring time spent sedentary (≤100 counts per minute (cpm)), in LIPA (100-1040 cpm), and in MVPA (≥1041 cpm), via a modified version of the National Cancer Institute’s program (http://riskfactor.cancer.gov/tools/nhanes_pam/) using SAS 9.1 (SAS Institute Inc., Cary, NC, USA). A break in sedentary time was considered as an interruption in sedentary time (≥100cpm, for ≥1 minute) and summed per day. Sedentary time (mins) and breaks in sedentary time (number) were also examined for each hour (e.g. 7:00am-7:59am) where the accelerometer was worn for the full hour.

Participant satisfaction with the program: Rated during the post-intervention assessment on a scale of 1-10, with 10 being extremely satisfied.

Statistical analyses

All analyses were conducted in SPSS 17.0 (SPSS Inc., Chicago IL, USA). Changes in sedentary time, LIPA, and MVPA (log transformed) were assessed using paired t-tests. Day-by-day variations in sedentary time were examined by repeated measures ANOVA; hour-by-
hour differences were assessed using Wilcoxon signed-rank tests. Statistical significance was set at \( p<0.05 \).

RESULTS
Reach was 87.5\% of people who were screened and determined to be eligible (10.5\% of all initial contacts, and 75.0\% of people who expressed interest). Data from one participant were excluded due to accelerometer malfunction, leaving a final sample of 59 (see online Figure). Program retention was 100\%. There were no adverse events.

The majority of participants were women (n=44, 74.6\%); had completed post-secondary level education (n=37, 62.7\%); and lived with others (n=32, 54.2\%). Mean age was 74.3 (SD ± 9.3; range 60 – 92) years; mean body mass index (BMI) was 27.1 (SD ±4.6) kg.m\(^{-2}\).

From pre- to post-intervention there was a significant reduction (baseline level [SD], mean change [95\%CI]) in sedentary time (71.1\% [8.9], -3.2\% [-4.18, -2.14], \( p<0.001 \)), and a significant increase in the number of breaks in sedentary time per day (87.8 [14.0], 4.0 [1.48, 6.58], \( p=0.003 \)) and the proportion of time spent in LIPA (24.3\% [6.6], 2.2\% [1.40, 2.99], \( p<0.001 \)), and MVPA (4.6\% [3.5], 1.0\% [0.55, 1.38], \( p<0.001 \)). Individually, change in sedentary time ranged from 13.6\% reduction to 8.0\% increase. Fifty participants (84.7\%) reduced their sedentary time, with thirteen (22\%) exceeding the target of 5.6\% reduction.

There were no significant differences in sedentary time within days of the pre- (F=0.498, \( p=0.778 \)) or post-intervention (F=1.737, \( p=0.081 \)) periods (Figure 1).
On average, participants significantly reduced their sedentary time in all but two of the hours between 10am and 9pm, and mostly increased breaks in sedentary time after 7pm (Figure 2). Ninety-seven percent rated the program eight or higher (median 9, range 7 to 10).

DISCUSSION

This intervention, using a single-session goal setting consultation with one tailored mailing, was followed by a significant reduction in sedentary time in older adults and was acceptable to participants. The reduction (3.2%) was comparable to the only previously reported intervention targeting reducing sedentary time in adults (3.8% reduction achieved by using a lock-out device to reduce TV viewing time), and the changes occurred across most of the day.

As this was the first phase of research in a new area, a decision was made to conduct this feasibility study without a control group. While this precludes ruling out the possibility that reductions in sedentary time may have occurred through factors unrelated to the intervention; there was a significant reduction in sedentary time on the three days immediately following the intervention session.

Strengths include the focus on older adults (who are an under-studied population group), grounding the intervention in well established health behavior theories, and objective
measures of sedentary and active time; although the GT1M accelerometer does not directly measure posture. More research in the objective measurement of sedentary time is needed, including the establishment of appropriate cut-points and the use of inclinometer-assessed postural changes.

Randomized trials of longer-term interventions are needed to evaluate intervention efficacy. Such trials should incorporate cardio-metabolic measures to assess clinical outcomes. Our small, non-random sample was more highly educated with more living alone than the general population of older Australians. Trials are needed with population representative samples to demonstrate clinically-meaningful changes in sedentary time.
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REFERENCES

FIGURE LEGENDS

Online Figure – Flow diagram of participants in study

Figure 1 - Accelerometer-derived sedentary time for each day of the study period

Data are presented as means (95%CI) from participants with valid days (wear time of ≥ 10 hours) in both pre- (●) and post-intervention (■) assessment periods.

aSedentary time on Days 9 and 10 are significantly lower (p<0.05) than on Days 2-7, e.g. difference (mean [95%CI] between Days 7 and 9: -4.6% [-6.96 to -2.36], p=0.001; bSedentary time on Day 11 is significantly lower (p<0.05) than on Days 2, 4-7 as assessed by repeated measures ANOVA.

Figure 2 - Accelerometer-derived sedentary time and number of breaks in sedentary time across hours of the day

Data are presented as means (95%CI) from participants with valid data (wear time = 60 mins for each individual hour) in both pre- and post-intervention assessment periods. Sedentary time in the pre (●) and post-intervention (■) assessment periods; number of breaks in the pre (△) and post-intervention (◇) assessment periods. *Significant differences (p < 0.05) in variables as assessed by Wilcoxon signed rank tests.
### Online Table - Strategies used to reduce and break up sedentary time by participants

<table>
<thead>
<tr>
<th>Situation</th>
<th>Strategy</th>
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| Watching television | ● Put the remote control next to the TV<sup>a</sup>  
● Stand up during advertisement breaks<sup>a</sup>  
● Do some household chores such as folding the laundry, doing some ironing, sorting files etc<sup>a</sup>  
● Break up your nightly routine, e.g. brush teeth, watch TV, wash face, watch TV, put on pyjamas, watch TV, go to bed<sup>b</sup>  
● Don’t turn on during the day; wait until family come home in the evening<sup>b</sup>  
● Instead of doing things to return to watching TV, try and do things to break up TV time<sup>b</sup>  
● Be more selective about what to watch<sup>b</sup> |
| Computer use     | ● Set an alarm to remind you to move after a specified period of time<sup>a</sup>  
● Start a load of washing so that you have to hang it out rather than ‘losing time’ when on the computer<sup>b</sup>  
● Don’t play games on computer<sup>b</sup> |
| Reading          | ● Stand up after you have finished a chapter, or a section of the newspaper<sup>a</sup>  
● Stand up to read the mail<sup>b</sup> |
| Transport        | ● Stand up when waiting for the bus to arrive<sup>b</sup>  
● Park car further away from entrance to shopping center<sup>a</sup> |
| Hobbies          | ● Stand up after completing the across clues when doing a crossword puzzle<sup>b</sup>  
● Stand up after each hand of bridge<sup>b</sup>  
● Stand up to play games such as patience<sup>b</sup>  
● Stand up when cutting fabric for quilting<sup>b</sup>  
● Stand at easel to paint<sup>b</sup>  
● Walk around / dance when listening to music<sup>b</sup> |
| Socialising      | ● Get refreshments for other members of friendship group instead of waiting for them to serve you<sup>b</sup>  
● Tell friends and family about the study so they can remind you to get up and move<sup>b</sup>  
● Stand during interval at the theatre / concerts / opera<sup>b</sup>  
● Stand up while talking on the telephone<sup>a</sup>  
● Walk to visit neighbour instead of calling them on the telephone<sup>b</sup>  
● Stand up to get a glass of water during social gatherings / meetings<sup>b</sup>  
● Play with grandchildren / pets more often<sup>b</sup> |
<table>
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<tr>
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| Domestic activities | • Instead of minimising the time to perform your household chores, extend the time it takes to complete each task, e.g. put away each item of ironing after completion, make multiple trips to the line to hang out the washing<sup>b</sup>  
• Split up chores, e.g. make separate trips to the letter box and to put the rubbish out<sup>b</sup>  
• When doing the gardening or when out shopping, try to pace your activity so that you avoid the “afternoon slump”. This may mean taking extra time (or even spread the activities over a number of days) to complete these activities, or planning a rest period during these activities.<sup>b</sup>  
• When each bottle is empty take it outside to the large recycling bin, rather than putting it in the small bin inside<sup>b</sup>  
• Use the stairs when shopping, rather than standing on the escalator<sup>b</sup>  
• Walk around more before entering stores and more when inside store<sup>b</sup>  
• Do some exercises while waiting for meal to cook<sup>b</sup>  
• Use the free time to do the chores that you have been avoiding, e.g. sorting through clothes to donate to charity<sup>b</sup>  
• Incorporate some extra walking into your daily routine, e.g. when going to the letterbox walk down to the end of the street and back<sup>b</sup>  
| General           | • It may be easier to get up and do something, rather than for the sake of getting up<sup>b</sup>  
• Break up sitting time with little jobs, instead of ‘working’ straight for longer periods, then sitting for longer periods<sup>b</sup>  
• Put commonly used items (e.g. reading glasses) out of reach so you need to get off the couch to retrieve them<sup>b</sup>  
• Walk to the movies to compensate for the extra sitting time<sup>b</sup>  
• Stood up to shave and brush teeth<sup>b</sup>  
• Drink more water so you have to get up to go to toilet more often<sup>b</sup>  
• Drink from a smaller glass so you have to get up more often to refill it<sup>b</sup>  
• Try to move more at the end of the day (5-6pm) before settling in for the evening<sup>b</sup>  
• Go for more walks, both for transport and recreation<sup>b</sup> |

<sup>a</sup> generic strategy suggested as part of the face-to-face consultation session; <sup>b</sup> personally-relevant strategy identified by participants.
Online Figure

Approximate numbers approached (n=569)
- Via postcards / flyers (n=350)
- Face-to-face conversations (n=200)
- Referral from other participants (n=19)

Expressed interest and screened for eligibility (n=80); 14.1%

Not eligible (n=10); 12.5%
- Location (n=6)
- Illness / not ambulatory (n=4)

Refusals (n=10); 12.5%
- No longer interested (n=6)
- Too busy (n=4)

Eligible and enrolled (n=60); 87.5%

Received intervention (n=60); 100%

Accelerometer malfunction (n=1); 1.7%

Completed assessments (n=59); 98.3%
Figure 1

- Pre (71.1±8.9%)
- Post (67.9±10.3%)

Visit 1: Accelerometer distributed
Visit 2: Intervention session
Visit 3: Accelerometer collected
Figure 2

[Graph showing the comparison of sedentary time and number of breaks pre-intervention and post-intervention throughout the day.]