



Small Steps: Preliminary effectiveness and feasibility of an incremental goal-setting intervention to reduce sitting time in older adults



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ABSTRACT

Objective: This study aimed to evaluate the preliminary effectiveness and feasibility of a theory-informed program to reduce sitting time in older adults.

Design: Pre-experimental (pre-post) study. Thirty non-working adult (≥ 60 years) participants attended a one hour face-to-face intervention session and were guided through: a review of their sitting time; normative feedback on sitting time; and setting goals to reduce total sitting time and bouts of prolonged sitting. Participants chose six goals and integrated one per week incrementally for six weeks. Participants received weekly phone calls.

Outcome measures: Sitting time and bouts of prolonged sitting (≥ 30 min) were measured objectively for seven days (activPAL3c inclinometer) pre- and post-intervention. During these periods, a 24-h time recall instrument was administered by computer-assisted telephone interview. Participants completed a post-intervention project evaluation questionnaire. Paired *t* tests with sequential Bonferroni corrections and Cohen's *d* effect sizes were calculated for all outcomes.

Results: Twenty-seven participants completed the assessments (71.7 ± 6.5 years). Post-intervention, objectively-measured total sitting time was significantly reduced by 51.5 min per day ($p = 0.006$; $d = -0.58$) and number of bouts of prolonged sitting by 0.8 per day ($p = 0.002$; $d = -0.70$). Objectively-measured standing increased by 39 min per day ($p = 0.006$; $d = 0.58$). Participants self-reported spending 96 min less per day sitting ($p < 0.001$; $d = -0.77$) and 32 min less per day watching television ($p = 0.005$; $d = -0.59$). Participants were highly satisfied with the program.

Conclusion: The 'Small Steps' program is a feasible and promising avenue for behavioral modification to reduce sitting time in older adults.

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1. Introduction

High levels of time spent in sedentary behavior (any waking behavior characterized by low rates of energy expenditure while in a sitting or reclining position) [1] have been shown to be associated with increased risk of developing cardiovascular disease, type 2 diabetes, obesity, breast and colon cancer, and premature mortality [2–4]. Accruing sedentary time in prolonged bouts may be particularly detrimental for cardio-metabolic health [5,6]. The deleterious impacts of high levels of sedentary time are also observed in older adults [7], who are the most sedentary age group of the

population [8], with an average sedentary time of 9.4 h per day. Reducing sedentary time is an emerging target for health behavior change interventions [9].

A recent meta-analysis of interventions reporting sedentary time outcomes in adults concluded that interventions targeting physical activity (alone or in combination with sedentary time) were not effective in reducing sedentary time [10]. Limited evidence exists on interventions to specifically reduce sedentary time in older adults. Three pre-post studies have implemented goal setting interventions which included individual feedback on sedentary time [11–13]. These studies reported decreases in objectively-measured sedentary time ranging from 24 [13] to 31 min per day [11]. Two of these studies included short-term interventions of one day [11] and two weeks [13] with immediate post-intervention follow up, and the third study targeted overweight and obese older adults, therefore possibly limiting the generalisability of the findings [12].

In order to increase reductions in sedentary time and assess changes beyond the short-term nature of previous interventions, a novel, incremental goal setting intervention ('Small Steps') was developed and evaluated for feasibility and preliminary effectiveness.

2. Materials and methods

2.1. Study design

The study employed a pre-experimental (pre-post) design and complies with the STROBE guidelines for the reporting of observational studies [14]. Data were collected in Adelaide, South Australia between April and December 2014. Ethical approval was gained from the University of South Australia Human Research Ethics Committee (protocol no. 0000032457). Participants provided written informed consent.

2.2. Participants

Older adults (≥ 60 years) were recruited in metropolitan Adelaide, South Australia. Flyers advertising the study were placed in local government community centres, seniors clubs and groups, older adult education providers, and libraries. Wherever possible, the principal investigator (LKL) talked to groups about the study and distributed flyers face-to-face. Adults were included if they: could communicate effectively in English, lived in the metropolitan area, and worked less than two days per week (paid or voluntary). People who are working, particularly in desk jobs have less discretion over their sedentary time, and have different environmental barriers to sitting less. People were excluded if they were unable to walk independently or had a significant cognitive impairment. No formal cognitive screening was applied but potential participants needed to understand the study aims, procedures and instruments.

We required a sample of 25 participants to detect a 90 min/day reduction in sitting time (80% power, alpha 0.05) which would result in an effect size of 0.53—based on older adults' (≥ 60 years) mean sedentary time of 618 ± 171 min per day (unpublished self-report use of time data from 2163 older adults). We aimed to recruit 30 participants to allow for attrition.

2.3. The 'Small Steps' program

The intervention has been reported according to the Template for Intervention Description and Replication (TIDieR) [15]. The intervention was administered by either the principal investigator (LKL) or a trained research assistant (EL) and consisted of a one hour, one on one, face-to-face session in participant's homes

followed by weekly supportive phone calls. Participants were guided through three activities:

- 1) *Review of assessed sedentary time.* Participants were provided with a workbook adapted from a previous study [11] which contained general information about sitting time and health, and individualized data (min/day) on total sitting time, and the time spent sitting while completing certain types of activities, e.g., watching TV, reading or transport. These data were derived from a use of time interview completed by participants.
- 2) *Normative feedback on sedentary time.* Participants were provided with a ranking (in quartiles) against the average older Australian ($n=2163$, unpublished data) for their total sitting time, and their sitting time according to 'types' of activities (e.g., TV, reading). This feedback informed the subsequent guided goal setting (i.e., it provided informational feedback to inform self-endorsed goal setting).
- 3) *Guided goal setting.* The goal setting involved a collaborative 'Small Steps' approach, whereby each participant chose six ways to decrease their sitting time and break up prolonged sitting from a list of pre-specified behavioral items combined with suggestions of their own. The aim was for one goal to be integrated incrementally each week for six weeks, so that in the final week of the intervention, participants would have integrated six goals into their day to reduce sedentary time (e.g., Week 1: "I am going to stand up during the TV ad breaks", Week 2: "I am going to stand up while I talk on the phone" + Week 1 goal). Each step was designed to be easily achievable and to reduce sitting time by about 15 min/day, leading to a cumulative reduction of 90 min/day at the end of the 6-week intervention. Individually tailored feedback and a summary of the goal setting plan were provided at the end of the session. Participants were required to self-monitor their goals with a simple daily checklist (e.g., "Today, did you achieve your goal of standing up during two TV ad breaks? Yes/No. If not, why not?"). Weekly phone calls provided support and resolved any issues. Intervention materials are available from the principal investigator.

Small Steps was informed by constructs from self-determination theory [16] which argues that enduring behavior change arises from the satisfying of universal and innate human needs for competence (the need to feel capable and effective within activities), autonomy (the need to experience behaviors as self-endorsed, volitional, and valued), and psychological relatedness (the need to experience close and caring connections with others). The program captured each of these needs, for example, competence because the goals were modest and achievable, autonomy because participants suggested and chose their own goals within the context of making comparisons with normative data (informational feedback), and relatedness with the integration of supportive phone calls.

2.4. Outcome measures

Sitting, standing and stepping time were measured with the activPAL3 device (PAL Technologies, Glasgow, UK) which was waterproofed, attached to the anterior mid-thigh, and worn for 24 h/day for seven days at pre- and post-intervention. The activPAL is a valid and reliable measure of sitting time compared with direct observation in older adults (correlation of 0.99) [17]. Data were processed using activPAL3 software (version 7.2.28). Sitting time during waking hours was obtained from a custom-built SAS program which matched self-report non-wear and sleep time (from logs and entered into a database) to activPAL data (from events files) [18].

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