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Reliability and validity of self-reported sitting and breaks from sitting in the workplace

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ABSTRACT

Objectives: Prolonged sitting is a health risk factor which is ubiquitous to the workplace, and breaking up prolonged sitting is widely recommended. This study evaluated the test–retest reliability and concurrent validity of a self-report measure of duration of sitting and breaks from sitting in the workplace.
Design: Cross-sectional study.
Methods: Fifty-nine workers who reported spending most of their work time sitting wore an activPAL inclinometer and the ActiGraph accelerometer for eight consecutive days, and completed single-item measures of duration of sitting (min/work hour) and breaks from sitting (frequency/per work hour), twice, seven days apart.
Results: Participants reported sitting at work for a median of 420 min/day (Interquartile Range = 360–450 min/day) and taking one break (Interquartile Range = 1.0–2.0) from sitting per work hour. For reported duration of workplace sitting, test–retest reliability was adequate (Intra-Class Correlations = 0.78, 95% Confidence Intervals [CI] = 0.65, 0.86), and concurrent validity fair against the activPAL (Spearman's Rho = 0.24, CI-1.0,0.47) and the ActiGraph (Rho = 0.39, CI = 0.15, 0.68). For reported breaks from sitting (frequency/per work hour), test–retest reliability was adequate (Intra-Class Correlations = 0.65, CI = 0.48, 0.78) and concurrent validity fair against the activPAL (Spearman's Rho = 0.39, CI = 0.25, 0.74) and the ActiGraph (Spearman's Rho = 0.30, CI = 0.15, 0.69). Self-reported duration of sitting was biased toward over-reporting compared to the activPAL (median = 45.4 min) and under-reporting compared to the ActiGraph (median = 21.7 min).
Conclusions: This study found adequate reliability and fair validity for self-reported duration of sitting (min/work day) and breaks from sitting (frequency/per work hour). Further validity research is needed using the inclinometer.

1. Introduction

Sedentary behaviour (all waking behaviours performed in a sitting/lying posture and expending ≤1.5 metabolic equivalent units of rest [METs])[1] is an emerging chronic health risk factor independent of insufficient physical activity.[2–4] Sedentary time accumulation may impact on health, with unbroken bouts of sedentary time adversely associated with cardio-metabolic risk factors.[5,6]

Sitting is ubiquitous, particularly in the workplace. Up to 80% of the workday can be spent sitting, often with few breaks.[7–9] Although there is some evidence of adverse health effects from workplace sitting,[10] research is limited by the capacity to accurately and conveniently measure workplace sitting and breaks from sitting. While objective measures, such as accelerometers and inclinometers, are precise and unaffected by subjective biases, they are not always feasible or cost-effective in large-scale workplace research.[11] Psychometrically sound self-report measures of sitting duration and frequency of breaks from sitting in the workplace are needed.

While several self-report measures have been developed to assess sitting time in the workplace,[12–14] few also capture frequency of breaks from sitting.[13,15,16] These measures have demonstrated low-to-adequate-concurrent validity, but have been validated against hip-mounted ActiGraph (AG) accelerometers[12,13,15]

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which define sedentary time as a lack of movement (<100 counts per minute [cpm]).[17] As accelerometers are unable to distinguish between different postures (i.e. sitting/standing),[18,19] a more suitable concurrent measure of 'sitting' is needed. One such tool is the *activ*PAL (aP), which can capture postural changes and distinguish between sitting and standing.[18,19]

To date, only one study has evaluated the validity of self-reported workplace sitting duration and frequency of breaks from sitting using an inclinometer (aP)[16], reporting only adequate validity (Spearman's Rho [Rho] = 0.63) and reliability (Intra-Class Correlations [ICC] = 0.74) for sitting time and poor validity (Rho = 0.06) and reliability (ICC = 0.12) for sitting breaks. There is a need to further develop simple self-report measures that can be used in workplace studies to accurately assess sitting duration and frequency of breaks from sitting. The aim of this study was therefore to evaluate the test–retest reliability and concurrent validity of two simple single-item self-report questions designed to estimate duration of sitting time and the frequency of breaks from sitting at work.

2. Methods

Convenience sampling in workplaces across Melbourne (e.g. display of posters, snowball techniques) was used to recruit participants who were ≥18 years and reported working in an occupation where they spent most of their work time sitting. Overall, 59 participants were recruited, which is considered a 'good' sample size for a study of this type (54% females, mean age = 32.1 ± 9.9 years; Table 1).[20] COSMIN guidelines were used to report the study design and statistical methods.[20,21] Ethical approval was received from Deakin University's Human Research Ethics Committee.

Participants simultaneously wore an aP on the left thigh and an AG on the right hip for eight consecutive days, consistent with epidemiological assessment of sedentary time.[11] The two self-report items were completed on two occasions, seven days apart, corresponding to the first and last day that the aP and AG were worn.[11] A daily log book was also completed by participants each week to record workdays and hours, and any times they did not wear the aP or AG. Participants were shown how to wear the monitors by trained research assistants following a protocol and script, and were instructed to remove the devices only if engaging in water-based activities. The two survey administrations took place at the same location and by the same research assistant, there was no overlap in self-reported days.

Participants reported the duration of sitting time at work using a single item that has been previously validated against AG data: *"During the last 7 days, how much time did you usually spend sitting at work on a weekday"*.[14] Open ended numerical responses in hours and/or minutes were provided. For duration of workplace sitting, values were deemed admissible if sitting time did not exceed work hours recorded in the log book, and if sitting time was at least half the amount of time participants recorded working in the log book. Only one participant was excluded based on these criteria.

Breaks from sitting (frequency/per work hour) was assessed by a single item modified from previously validated items. The modifications included the addition of an open-ended response scale[13,15] and wording modification to reflect 'breaks from sitting' rather than 'short physical activity breaks'[13,15] in recognition of the health benefits associated with postural changes.[6] *"In the last 7 days, how many breaks from sitting did you take per hour, while at work? This could include* standing, stretching, taking a short walk. Please do not count lunch breaks or tea breaks". Frequency of breaks from sitting per work hour was truncated at six breaks/hour to negate extreme outliers and be consistent with capped scales used in past research.[15] None of the self-reported sitting or break items had missing data.

The hip-mounted AG GT3X (Pensacola, FL, USA) accelerometer and the thigh-mounted aP activPAL3™ (PAL Technologies, Glasgow, UK) inclinometer were used as concurrent measures. Data were collected in 15 s epochs. Both devices have demonstrated acceptable reliability and validity for assessing sedentary and sitting time, respectively.[18] For the aP, the sitting posture (based on the angle of the thigh relative to gravity) was used to determine the duration of workplace sitting, and transitions from a sitting posture to an upright posture was used as the concurrent for frequency of breaks from workplace sitting. For the AG, sedentary time was defined as <100 cpm,[7] and breaks from sedentary time were defined as the frequency of occasions that the accelerometer counts transitioned from sedentary (<100 cpm) to active (≥100 cpm).[22] Non-wear time was defined as ≥60 min of consecutive zeros.[23] Using information recorded in the log books, aP and AG data were extracted for each participant's work hours. To be included, participants needed to have worn the monitors for 75% of reported work hours[24] on at least three weekdays days for full-time workers and on two weekdays for part-time workers.[25] Data were averaged across valid days for inclusion in the analyses. Overall, 52 participants (88%) had valid aP data (proportion of wear time = 0.98 ± 0.02) and 49 (83%) had valid AG data (proportion of wear time = 0.99 ± 0.02). Those with missing data for the AG (12%) and the aP (17%) did not have a single day valid data, these participants were excluded in the final analyses. To compute frequency of breaks from sitting per work hour, the frequency of transitions from sitting to an upright position (aP) and breaks from sitting (<100 cpm; AG) that occurred during work hours was divided by wear time and then multiplied by 60. For duration of sitting/sedentary time error variables (monitor data–self-report estimates) were used to screen for multivariate outliers. One case was removed from the analytic sample as it approximated classification as a multivariate outlier.[26]

On the first day of monitoring, participants reported their height and weight, which was used to calculate body mass index (BMI: kg/m^2) and classify participants as healthy weight (<25 kg/m^2) or overweight or obese (≥25 kg/m^2).[27] The highest level of education reported was collapsed into four categories: <12 years, >12 years, trade/diploma, and university. Work status was dichotomised into full-time or part-time. The Active Australia Survey [AAS][28] was used to assess time spent in moderate-to-vigorous-intensity physical activity (MVPA); this survey has been found to have adequate reliability and validity properties.[28,29] The data were scored using established methods described in the guide for implementation of the AAS[28] and participants were dichotomised as sufficiently (≥150 min/week) or insufficiently (<150 min/week) active.[29]

Data were analysed using the Statistical Package for the Social Sciences (SPSS; version 22; IBM Corp, 2012) and STATA (version 13; StataCorp LP, 2012). Statistical significance was set at $p < 0.05$. Chi-square analyses were conducted to examine if socio-demographic characteristics differed between the full sample of participants and those with valid (i) AG and (ii) Ap data (Table 1). To quantify sitting (min/work day) and breaks from sitting (frequency/per work hour), medians and Interquartile Ranges (IQR) were calculated for self-report and monitor data. Test-rest reliability of the self-reported of sitting (min/work day) and breaks from sitting (frequency/per work hour) was examined using ICCs. A two-way mixed model based on absolute agreement was used, with ICC < 0.40 indicating poor agreement, 0.40–0.74 indicating fair to good agreement, and ≥0.75 excellent agreement.[30] Spearman's Rho was used to assess concurrent validity between self-reported sitting (min/work day) and breaks from sitting (frequency/per work hour), and each of the monitors. Rho estimates were interpreted as: 0.00 indicating poor; 0.00–0.20 slight; 0.21–0.40 fair; 0.41–0.60 moderate; 0.61–0.80 substantial; and 0.81–1.0 almost perfect.[31] To further examine differences between reported duration of sitting and mon-

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