



## Original research

# Past-day recall of sedentary time: Validity of a self-reported measure of sedentary time in a university population



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## ABSTRACT

**Objectives:** To assess the validity of the Past-day Adults' Sedentary Time-University (PAST-U) questionnaire, modified for a university population, compared with activPAL.

**Design:** Participants ( $n=57$ , age = 18–55 years, 47% female, 65% students) were recruited from the University of Queensland (students and staff).

**Methods:** Participants answered the PAST-U questionnaire, which asked about time spent sitting or lying down for work, study, travel, television viewing, leisure-time computer use, reading, eating, socialising and other purposes, during the previous day. Times reported for these questions were summed to provide a measure of total sedentary time. Participants also wore an activPAL device for the full day prior to completing the questionnaire and recorded their wake and sleep times in an activity log. Total waking sedentary time derived from the activPAL was used as the criterion measure. Correlation (intraclass correlation coefficient, ICC) and agreement (Bland–Altman plots) between PAST-U and activPAL sedentary time were examined.

**Results:** Participants were sedentary (activPAL-determined) for 66% of waking hours. The correlation between PAST-U and activPAL sedentary time for the whole sample was ICC = 0.64 [95% confidence interval (CI) = 0.45, 0.77]; and higher for non-students (ICC = 0.78, 95%CI 0.52, 0.91) than students (ICC = 0.59, 95%CI 0.33, 0.77). Bland–Altman plots revealed that the mean difference between the two measures was 5 min although limits of agreement were wide (95% limits of agreement: –3.9 to 4.1 h).

**Conclusions:** The PAST-U provides an acceptable measure of sedentary time in this population, which included students and adults with high workplace sitting time.

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## 1. Background

Time spent in sedentary behaviour (too much sitting as distinct from too little exercise) has been detrimentally associated with several health outcomes,<sup>1,2</sup> and with premature mortality.<sup>3–5</sup> Sedentary behaviours are defined as activities with an energy expenditure of less than 1.5 metabolic equivalents (METs) spent in a sitting or reclining position while awake.<sup>6</sup> Sitting time, in particular, has been the target for contemporary research as adults are spending increasing amounts of time sitting each day in work, transport and leisure activities.<sup>7–9</sup>

Methods used to measure sedentary behaviour include the use of device-based measures, such as accelerometers and inclinometers, and self-report measures, such as questionnaires and 24-h recalls.<sup>10</sup> While device-based measures provide a measure of posture and motion with good accuracy,<sup>10</sup> they do not provide

information on sedentary time in specific behaviours or contexts, and are often too expensive for large-scale studies. In contrast, self-report questionnaires provide a low-cost and easy to use alternative for measuring sedentary behaviours, and are able to capture the type (e.g. computer use) and context (e.g. at work) of behaviour.<sup>10</sup> These qualities make questionnaires a desirable tool for monitoring sedentary time in population health studies. However, self-report measures are susceptible to random error (i.e. inaccurate reporting) and systematic bias (e.g. social desirability).<sup>11,12</sup> Thus, it is necessary to use high quality self-report measures to complement the information from device-based measures, in order to provide a more robust estimate of sedentary time,<sup>10</sup> or to provide the best alternative when cost is an issue.

Most commonly used sedentary behaviour questionnaires employ recall of past week or usual behaviour; however, these generally show poor validity against device-based measures. Recall of the past day may improve the accuracy of these measures.<sup>10</sup> A recent study of the Past-day Adults' Sedentary Time (PAST) questionnaire found it to be a valid, reliable and easily administered self-report measure.<sup>13</sup> However, the study was conducted with a

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female population diagnosed with breast cancer, a very specific group who may already be aware of their health habits. University communities include a wide range of participants, including students, research and administrative staff, who engage in activities that involve prolonged sitting.<sup>14,15</sup> In view of the typically high sitting times in this population and specific concerns about weight gain in university students,<sup>16</sup> the development of a self-report sedentary time measure in a university setting would provide a useful tool for future studies. The aim of this study is, therefore, to modify the PAST questionnaire for use in a university population and assess the validity of the modified version.

## 2. Methods

The PAST questionnaire used in this study (see Appendix A) was a modification of the questionnaire used in the study by Clark and colleagues,<sup>13</sup> which asks about sitting and lying down while awake on the previous day. The previous version of the PAST demonstrated acceptable reliability (intraclass correlation coefficient: 0.50, 95% confidence interval [CI] 0.32–0.64) and good validity ( $r=0.57$ ; 95% CI = 0.39–0.71 against activPAL) for measurement of sedentary behaviour in a population of women with a history of breast cancer.<sup>13</sup> The modification process involved (1) discussion between the key researchers on the inclusion of new questions; and (2) interviews with university students and staff to give feedback on the questionnaire on two occasions. Students and staff who gave feedback on the questionnaire were recruited by word of mouth and were known to the research team; however, were not part of the team conducting this project.

The revised version of the PAST had nine questions (Appendix A) about sedentary time for work, study, travelling, eating and drinking, watching television, using the computer, socialising and other daily activities. As it was modified for a university population it was named PAST-U. Times reported for each of the domains/behaviours were summed to create a total of self-reported time spent sitting and lying down (termed PAST-U sedentary time).

Participants were recruited from the University of Queensland by convenience sampling, including word of mouth and an online university newsletter. Those who showed interest received an information sheet explaining the study and the eligibility criteria; and an invitation to join the study via email. To be eligible for the study participants had to be over the age of 18 years, healthy and ambulatory. Eligible participants provided written informed consent prior to enrolling in the study and in return for their participation received a \$20 cash gratuity. Ethical clearance was obtained from the Medical Research Ethics Committee of the University of Queensland.

The protocol took place over three consecutive days from August to October 2013. The majority of data collection was completed during term time with regular lecture scheduling, although 11 participants provided data during mid-semester break (no regular lectures but continuing study and assignment commitments). Day 1 involved a visit to the Human Movement Studies department. At that session, participants self-completed a questionnaire to provide demographic information including age, gender, marital status and education. Instruction on activPAL inclinometer use was then provided before the device was attached. Participants were instructed to wear the activPAL continuously until the next visit on Day 3, allowing complete 24 h wear on Day 2. Participants were also provided with an activity log to record their waking and sleeping times for Day 2 and any periods the activPAL device was removed.

The second visit took place on Day 3. The activPAL and the completed activity log were collected and the participants completed the modified PAST questionnaire, which was interviewer administered. As Day 3 was scheduled for either Wednesday or Friday, the recall of the previous day was always a weekday.

The activPAL device (Version 3, Pal Technologies Ltd, Glasgow, UK) is a thigh-worn inclinometer accelerometer, which continuously records posture and movement (time spent sitting/lying, standing or stepping). The device was sealed with a nitrile finger cot and a layer of Opsite and attached to the skin with a transparent film (Tegaderm™ Roll, 3M™) in order to provide a waterproof barrier. The attachment was made to the right thigh (midline on the anterior aspect), which was prepared with an alcohol swab and a patch of hypafix to minimise skin irritation. The activPALs were initialized (default settings used) and data were downloaded using activPAL™ Professional Software, v6.1.2 Research Edition (Pal Technologies Ltd, 2010). Estimates for time spent sitting/lying were derived from the event file, which includes time intervals per day in seconds. Wake and sleep times recorded in the activity log were used to extract activPAL data for the times participants were awake on Day 2 and continuing to bed time if past midnight on Day 2. Participants' activPAL data were considered valid if they reported wearing the device for all waking hours with less than 30 min removal. The time spent sitting or lying down recorded by the device while awake was termed PAL sedentary time. While not strictly a gold standard measure of sitting time, the activPAL has shown good agreement with direct observation of sitting time (99% agreement<sup>17</sup>; and mean bias of 7.7 min per day<sup>18</sup> and 0.19%<sup>19</sup>) and so was used as the criterion measure for assessing the validity of the PAST questionnaire.

Data were analysed using SPSS version 21 (IBM Corporation) with statistical significance set at  $p < 0.05$ . Findings are presented for the overall sample; and for students and non-students separately to provide information for researchers undertaking research in solely student or non-student working populations. Descriptive statistics ( $N$ , mean, standard deviation [SD], median and interquartile range [IQR]) were used to describe the characteristics of the sample. Intraclass correlation coefficients (ICC) with 95% confidence intervals (CI) were used to determine the correlation between PAST-U sedentary time and PAL sedentary time; with the addition of Pearson's correlation coefficients ( $r$ ) so as to compare to existing validity studies for sedentary behaviour questionnaires. Bland-Altman plots<sup>20</sup> were used to examine differences between PAST-U–PAL sedentary time and the average of the two measures, with mean difference (MD) and 95% limits of agreement (LoA;  $\pm 1.96$  SD) reported. Statistical difference between sedentary times from the PAST-U and the activPAL were examined using Student's  $t$ -tests.

## 3. Results

Modifications made for the university version of the PAST questionnaire were the addition of questions on sitting time for study, for socialising and for meals and the incorporation of sitting for hobbies into the 'all other sitting' question. These modifications were based on consultation with the research team (addition of a question on sitting for study); and two sets of interviews with students and staff. At the first set of interviews, seven university students provided critical feedback. The main recommendations were to have 'time spent sitting while socialising' as a standalone question and to have 'time spent on hobbies' combined into the 'all other activities' question. On the second occasion, feedback from six university students and two members of staff was received. An additional suggestion was to have 'time spent sitting for meal times' as a standalone question, and to have examples for each question so as to be clear on the definition of activities in the various questions (e.g. paid work would include activities such as babysitting, administrative/clerical work; use of computer for leisure would include activities such as Facebook, YouTube, Skype or online shopping).

Fifty-eight participants consented to take part in the study (38 students and 20 staff). All 58 participants wore the activPAL device

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