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Short Communication

Time spent sitting during and outside working hours in bus drivers: A pilot study

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ABSTRACT

This cross-sectional pilot study objectively measured sedentary and non-sedentary time in a sample of bus drivers from the East Midlands, United Kingdom. Participants wore an activPAL3 inclinometer for 7 days and completed a daily diary. Driver's blood pressure, heart rate, waist circumference and body composition were measured objectively at the outset. The proportions of time spent sedentary and non-sedentary were calculated during waking hours on workdays and non-workdays and during working-hours and non-working-hours on workdays. 28 (85% of those enrolled into the study) provided valid objective monitoring data (89.3% male, [median ± IQR] age: 45.2 ± 12.8 years, BMI 28.1 ± 5.8 kg/m^2). A greater proportion of time was spent sitting on workdays than non-workdays (75% [724 ± 112 min/day] vs. 62% [528 ± 151 min/day]; $p < 0.001$), and during working-hours than non-working-hours (83% [417 ± 88 min/day] vs. 68% [307 ± 64 min/day]; $p < 0.001$) on workdays. Drivers spent less than 3% of their overall time stepping. Bus drivers accumulate high levels of sitting time during working-hours and outside working-hours. Interventions are urgently needed in this at-risk group, which should focus on reducing sitting and increasing movement during breaks and increasing physical activity during leisure time to improve cardiovascular health.

Introduction

Sedentary behaviour (SB), defined as "any waking behaviour characterised by an energy expenditure ≤1.5 METs while in a sitting or reclining posture" (Sedentary Behaviour Research Network, 2012), is prevalent amongst many working-aged adults. Prolonged time sitting has been linked to increased risk of cardiovascular disease, cardiovascular mortality, all-cause mortality and diabetes, independent of leisure-time physical activity (Wilmot et al., 2012). Adults typically spend between 50 and 60% of their waking hours in sedentary postures (Healy et al., 2011), with these figures increasing significantly amongst those with sedentary jobs. Studies carried out with office workers have shown they spend between 65% and 82% of their working hours sedentary (Clemes et al., 2014; Brown et al., 2013), with sitting at work accounting for over 60% of their total daily sitting time on workdays (Clemes et al., 2015). However, limited literature (Morris et al., 1953; Tse et al., 2006; French et al., 2007; Wong et al., 2014) has examined sedentary behaviour levels and patterns of individuals employed in occupations other than desk-based settings.

Driving as an occupation can best be described as a 'compulsory sedentary occupation' yet drivers have received limited attention in sedentary behaviour research (Wong et al., 2014), despite research by Morris and colleagues in the 1950s highlighting the higher rates of cardiovascular disease seen amongst bus drivers in comparison to bus conductors (individuals collecting fares and selling tickets on buses, up until the 1980s) (Morris et al., 1953). A higher prevalence of obesity amongst bus drivers in comparison to those employed within other occupations was also reported (Morris and Crawford, 1958). These studies provided early evidence for the potential harmful consequences associated with driving occupations. It is now established that workers from the transport industry face a greater risk of co-morbidities and mortality compared to the general population (Robinson and Burnett, 2005; Tse et al., 2006). Indeed, national statistics have shown that those in the transport sector have one of the lowest life expectancies in comparison with other sectors (Office for National Statistics, 2011).

Interventions are therefore urgently needed to promote the health and wellbeing of those in driving occupations. In order to successfully intervene, it is important to first understand the prevalence and patterns of habitual lifestyle health-related behaviours, including sedentary behaviour and non-sedentary behaviours, in this occupational group. To date there are no published studies that have objectively quantified time spent sitting and standing across occupational and leisure time within drivers in the transport industry.

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The aim of this pilot study was to ascertain the feasibility of using the activPAL inclinometer to directly measure drivers' sedentary and non-sedentary behaviours over the course of a week, and to quantify the prevalence of these behaviours during and outside working hours.

Methods

Study design and participants

This cross-sectional pilot study was undertaken at a local bus company within the East Midlands, UK. Data collection took place between November 2013 and February 2014. A volunteer sample of 33 drivers aged 18 years and over was recruited, representing 42% of the driving workforce. Participants were recruited in person by the researcher during their breaks at the companies' canteen and depot after obtaining the managers' permission. Ethical approval was obtained from the Loughborough University Ethical Advisory Committee and all participants provided written informed consent.

Measurements

Participants self-reported their age. Resting blood pressure and heart rate were measured using an Omron Intellisense M7 Upper Arm monitor. This assessment was taken 3 times after 10 min of participants being seated quietly with 5 min in between each reading, following the recommendations of the European Hypertension Society (O'Brien et al., 2005). Height was measured without shoes using a portable stadiometer (Seca 206). Waist circumference was assessed using anthropometric tape at the midpoint between the upper edge of the iliac crest and the inferior border of the last palpable rib. Body composition and weight were assessed using a Tanita BC-418 MA Segmental Body Composition Analyzer (Tanita UK Ltd). Body Mass Index (BMI) was calculated as kg/m^2 and participants were classified as healthy weight (BMI ≥ 18.5–25 kg/m^2), overweight (BMI ≥ 25 < 30 kg/m^2) or obese (BMI ≥ 30 kg/m^2). These assessments were taken for descriptive purposes.

Sedentary and non-sedentary behaviours were measured objectively during waking hours over 7 days, using an activPAL3 accelerometer. The activPAL3 is a small, lightweight device worn on the front of the thigh. It contains a tri-axial accelerometer which responds to signals related to gravitational forces and provides information on thigh inclination (Atkin et al., 2012). It has been shown to be a valid measure of time spent sitting, standing and walking in adults (Grant et al., 2006; Kozey-Keadle et al., 2011). The activPAL3 was attached to the leg using a hypoallergenic medical dressing (BSN Hypafix), enabling participants to wear the device continuously, except for water-based activities, over the 7 day period.

Participants were asked to complete a daily-log book where they recorded the time they went to bed and woke up. On workdays, the times they started and finished work, along with break times were also recorded. Information about any non-wear time was also recorded in the diary.

All activPAL data were downloaded using activPAL Professional v.7.2.29 software in 15-second epochs and processed manually using a customized Microsoft Excel macro. Participants were included in the analyses if they provided at least 4 valid days of activPAL data, including at least 3 workdays and 1 non-workday. For a day to be valid, participants were required to have worn the device for at least 10 h and provided complete diary data. For each participant, total minutes spent sitting, standing and stepping during working hours and outside of working hours on workdays were extracted based on times derived from participants' logs. On non-workdays, the total time spent sitting, standing and stepping during waking hours were obtained. Sleep time was interpreted as the time between the last transition from standing to sitting and the first transition from sitting to standing during night time. These sleep periods were cross-checked and confirmed with participants log books. Sleep time was excluded from the analysis. Proportions of time spent in each behaviour within each domain (i.e. working hours and non-working hours on workdays) were calculated to control for differences between wear times.

Statistical analyses

Statistical analyses were conducted using SPSS version 22. activPAL-determined sitting, standing and stepping time, along with the total time and the proportion of times spent in each behaviour, on non-workdays, workdays, working hours and non-working hours on workdays were checked for normality using the Shapiro–Wilk Test, which confirmed that all data were not normally distributed. Thus, non-parametric statistical tests were used throughout. Median and inter-quartile range (IQR) values were computed for all variables. Wilcoxon-signed rank tests were used to compare the proportions of time (accounting for wear time) and the actual time spent sitting, standing and stepping between workdays and non-workdays and between working hours and non-working hours on workdays.

Results

Participants and cardiovascular biomarkers

Of the 33 drivers enrolled in the study, 28 (34% of the overall workforce, 85% of those enrolled into the study) provided valid activPAL data on at least 3 workdays and 1 non-workday, and were included in the analyses. Table 1 displays the characteristics of the included participants, along with the recommended ranges for the markers of health measured. No significant differences were observed for age, BMI, waist circumference, blood pressure and heart rate between those who provided valid data and those who did not ($p > 0.05$). This sample of drivers displayed higher than the recommended ranges for BMI (74% were clustered as overweight or obese), % body fat, waist circumference and blood pressure, putting them at high risk of cardiovascular events.

activPAL-determined sitting, standing and stepping time

Median activPAL-determined waking hours were 1021 ± 106 min/day for workdays and 914 ± 198 min/day for non-workdays ($p < 0.01$). Given the significant difference in waking hours for both types of day, only proportions of time spent sitting, standing and stepping were used in the primary comparative analyses. The proportion of time spent sitting was significantly greater on workdays compared to non-workdays ($p < 0.001$). A greater proportion of time was spent standing ($p < 0.001$) and stepping ($p < 0.01$) on non-workdays than on workdays (Table 2).

During workdays, the proportion of time spent sitting was significantly higher during working-hours compared to non-working hours ($p < 0.001$). Significantly more time was accumulated standing ($p <$

Table 1
Median and IQR of the body measurements and blood pressure in a sample of bus drivers from the East Midlands, UK (N = 28).

	Total sample (median ± IQR)	Healthy ranges
Age (years)	44 ± 27	
BMI (kg/m^2)[a]	28.1 ± 5.8	18.4–24.9
% body fat[b]	26 ± 9	11–17
Waist circumference (cm)[c]	101.5 ± 21	<94
Systolic blood pressure (mm Hg)[d]	137 ± 14	120–90
Diastolic blood pressure (mm Hg)[d]	88 ± 11	80–60
Heart rate (beats/min)	72 ± 12	

[a] WHO, 1995, 2000, 2004.
[b] Jeukendrup and Gleeson, 2010.
[c] Lean et al., 1995.
[d] Blood Pressure Association, 2008.