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Office workers' objectively assessed total and prolonged sitting time: Individual-level correlates and worksite variations

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Sedentary behavior is highly prevalent in office-based workplaces; however, few studies have assessed the attributes associated with this health risk factor in the workplace setting. This study aimed to identify the correlates of office workers' objectively-assessed total and prolonged (≥30 min bouts) workplace sitting time. Participants were 231 Australian office workers recruited from 14 sites of a single government employer in 2012–13. Potential socio-demographic, work-related, health-related and cognitive-social correlates were measured through a self-administered survey and anthropometric measurements. Associations with total and prolonged workplace sitting time (measured with the activPAL3) were tested using linear mixed models. Worksites varied significantly in total workplace sitting time (overall mean [SD]: 79% [10%] of work hours) and prolonged workplace sitting time (42% [19%]), after adjusting for socio-demographic and work-related characteristics. Organisational tenure of 3–5 years (compared to tenure >5 years) was associated with more time spent in total and prolonged workplace sitting time, while having a BMI categorised as obese (compared to a healthy BMI) was associated with less time spent in total and prolonged workplace sitting time. Significant variations in sitting time were observed across different worksites of the same employer and the variation remained after adjusting for individual-level factors. Only BMI and organisational tenure were identified as correlates of total and prolonged workplace sitting time. Additional studies are needed to confirm the present findings across diverse organisations and occupations.

1. Introduction

Exposure to high levels of workplace sedentary (sitting) time has become common, particularly in office environments (Healy et al., 2012). Office-based workers have been reported to spend between two-thirds and three-quarters of their working hours sitting (Thorp et al., 2012; Parry and Straker, 2013; Clemes et al., 2014; Ryan et al., 2011), with a high proportion accrued in prolonged, unbroken bouts of 30 min or more (Parry and Straker, 2013; Ryan et al., 2011). Consistent evidence has linked high levels of sitting with chronic diseases and premature mortality (Biswas et al., 2015; de Rezende et al., 2014) and prolonged sitting with cardio-metabolic risk (Healy et al., 2008). Thus, exposure to excessive workplace sitting is an emerging workplace health and safety issue (Straker et al., 2014).

Despite a growing interest in workplace interventions (Neuhaus et al., 2014a), relatively little is known about factors influencing workplace sitting time; knowledge which could improve targeting of

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strategies. While factors relating to work have been identified as potential correlates (Hadgraft et al., 2015; Mummery et al., 2005; Wallmann-Sperlich et al., 2014; De Cocker et al., 2014), only two studies (Wallmann-Sperlich et al., 2014; De Cocker et al., 2014) have assessed cognitive-social factors that may influence sitting time. Both studies noted the need for confirmatory and additional research (Wallmann-Sperlich et al., 2014; De Cocker et al., 2014). Also, no previous studies have analysed potential correlates of prolonged sitting time (i.e. unbroken bouts) to assess whether these attributes differ from those associated with total workplace sitting time.

Existing studies have also used self-report questionnaires to measure sitting time (Hadgraft et al., 2015; Wallmann-Sperlich et al., 2014; De Cocker et al., 2014). Relative to self-report, objective-measurement devices—such as inclinometers—can determine the volumes and accumulation patterns of sitting time with better validity and accuracy (Clark et al., 2011). The use of objective-measures of workplace sitting in studies assessing correlates reduces the potential for measurement error.

The factors influencing workplace sitting are likely to operate at multiple levels – including individual, cognitive-social, environmental, and policy levels (Owen et al., 2011). The extent to which workplace sitting is influenced by factors acting at the individual-level, compared with at the organisational-level, is of interest when considering how interventions should be designed and targeted. This may include whether strategies should be individually-driven and targeted at "high risk" groups and/or aimed at influencing the organisational-level through policy and cultural change. Assessing the variation in sitting time between worksites, before and after accounting for individual-level factors, provides the opportunity to explore such issues.

The aim of this study was to examine the worksite-level variation, and the socio-demographic, health-related, work-related, and cognitive-social correlates of objectively-assessed total and prolonged workplace sitting time in Australian office-based workers. Given limited evidence relating to the correlates of workplace sitting time, including prolonged workplace sitting, this study employed an exploratory, data-driven approach.

2. Methods

2.1. Study design and participants

Participants were recruited for a cluster randomized controlled trial of a multi-component workplace intervention aimed at reducing workplace sitting (the Stand Up Victoria [SUV] trial). They were informed that the study aimed to "investigate the effectiveness of an intervention to increase overall physical activity levels at the workplace". The intervention, detailed elsewhere (Dunstan et al., 2013; Neuhaus et al., 2014b; Healy et al., 2016), comprised organisational-, environmental- (sit-stand workstation), and individual-level strategies. Here, we report findings derived from baseline measurements. In brief, recruitment and randomization occurred at the worksite-level. Fourteen geographically separate worksites were recruited from a single government department (Victoria, Australia). At each site, a work team (i.e., a distinct group with dedicated team leader(s) and regular group meetings) was selected (if team size was <10, two teams were combined). Eligibility criteria included: aged 18–65 years, English-speaking, worked ≥0.6 full time equivalent (FTE) and had designated access to a telephone, internet, and desk within the workplace. Participants did not have height-adjustable desks at baseline. Participants' roles mostly involved telephone-based and clerical/administrative tasks.

Of the 278 who originally expressed interest, 33 were ineligible and 14 were no longer eligible and/or willing to participate at the intervention commencement, leaving 231 participants. Ethics approval was granted by Alfred Health Human Ethics Committee (Melbourne, Australia). The SUV trial was prospectively registered with the Australian New Zealand Clinical Trials Registry (ACTRN12611000742976).

2.2. Data collection

At baseline, trained staff conducted onsite assessments to collect anthropometric measurements, provide participants with activity monitors and logbooks, and give instructions on activity monitor use (see below). Thereafter, participants completed a self-administered online questionnaire (LimeService), containing questions relating to socio-demographic, work, health-related and cognitive-social characteristics.

2.3. Measures

2.3.1. Objectively measured sitting time and moderate-vigorous physical activity (MVPA)

Sitting time was measured objectively using the activPAL3 activity monitor (PAL Technologies Limited, Glasgow, UK) which provides highly accurate measures of sitting time and sitting accumulation (Lyden et al., 2012). Participants were asked to wear the activPAL for seven consecutive days (24 h/day) following the onsite assessment. The monitor was waterproofed and secured to the anterior mid-line of the right thigh, about one third down from the hip, using hypoallergenic adhesive material. During waking hours (apart from water-based activities) participants also wore the tri-axial Actigraph GT3X+ activity monitor (ActiGraph, Pensacola, Florida) on an elastic belt over their right hip. Participants were asked to record sleep and waking times, work hours and any device removals >15 min in a logbook.

Activity monitor data were processed in SAS 9.3 (SAS Institute Inc., Cary NC), with reference to participant logbooks. Quality controls were conducted before (e.g. diary entry errors) and after processing (visual checking). For activPAL data, events were coded as: awake, non-wear, or at work when they were mostly (≥50%) within these periods. Non-wear time and sleep were excluded. Workplace time was taken as all work hours for this employer from any location. Days were considered valid for workplace time when the device was worn for ≥80% of work hours (see Edwardson et al., 2016 for details of compliance). Times spent sitting, sitting for ≥30 min continuously (prolonged sitting), standing and stepping during work hours were averaged from the totals for valid days and standardised to an 8-h day. Time, rather than the number of prolonged bouts, was used as the outcome as it provides a more informative measure of the extent or duration of exposure to this potential health risk.

The GT3X+ data (extracted as 60-s epochs) were used to identify MVPA(Harrington et al., 2011) based on all minutes with ≥1952 vertical acceleration counts (Freedson et al., 1998) on valid days (≥10 h waking wear time). The activPAL estimation of MVPA, using a cadence-based equation, does not have high agreement with referent methods (Harrington et al., 2011). Non-wear time (≥60 min of 0 counts, allowing for up to 2 min with 1–49 counts) (Winkler et al., 2012) was excluded, as was sleep (McVeigh et al., 2015). Non-work time excluded work for any employer, and days the participant reported working but did not indicate work times. Non-work MVPA (min/day) was calculated using a weighted daily average (average non-work day MVPA × 2/7 + non-work time MVPA on work days × 5/7) to account for differences in non-work time on such days and the number of work and non-work days during the monitoring period.

2.3.2. Socio-demographic and health-related variables

Participants reported their age, gender, ethnicity (Caucasian; Asian; other), marital status (married/de facto; separated/divorced/widowed; never married), educational attainment (high school or lower; trade/vocational; university level) and smoking status at work (yes; no). Non-work MVPA was calculated as above. Body mass index (BMI) was calculated from height, measured using a portable stadiometer (average of two measures; third if the difference was ≥0.5 cm), and mass,