A survey of sitting time among UK employees

ABSTRACT

Background: Sedentary behaviour is a known risk factor for a wide range of chronic diseases. This major health risk is likely to increase given the increasingly sedentary nature of work.

Aims: To investigate the prevalence of sedentary behaviour in a sample of United Kingdom (UK) working-aged adults, across a range of employment sectors.

Methods: A cross-sectional survey conducted with organisations throughout the UK in the education, government administration, retail, telecommunications and service industry sectors. The questionnaire examined employee and organisational information, self-reported domain-specific sitting time, sleep and physical activity.

Results: 1141 employees completed the questionnaire, of which 504 completed all aspects of the Domain-Specific Sitting Time Questionnaire for work day sitting. Work time sitting accounted for more than half of the total daily sitting time on a work day (54%). Significantly more time was reported sitting on a work day than time reported sleeping (p<0.001). Males spent more time sitting at work and using a personal computer at home compared to females. Workers in the telecommunications industry had the highest sitting times. There were significant positive associations between sitting time and body mass index.

Conclusions: There is a pressing need for future workplace health interventions to reduce employee sitting times.

Key words: physical activity, health workplaces, workplace health promotion, occupational health services, healthy lifestyles, sedentary behaviour.

INTRODUCTION

Economic advances and industrial innovation have resulted in large numbers of people being employed in sedentary occupations (1). Australian data suggests that half of total daily sitting time takes place at work (2), with similar findings reported from small samples of United Kingdom (UK) workers (3-5). Evidence suggesting that individuals who sit for long periods at work do not compensate by increasing their physical activity levels during leisure time (6) is a cause for concern.

Sedentary behaviour is an independent risk factor for many adverse health outcomes (7-8). It has been defined as any waking behaviour characterised by an energy expenditure of less than 1.5 of the standard metabolic equivalent, while in a sitting or reclining posture (9). Greater sitting time is associated with increased risk of obesity (10-11), cancer (12), type 2 diabetes (10,13) and mortality from cardiovascular disease and all causes (7,13).

There is a growing consensus that sedentary behaviour represents a unique aspect of human behaviour and that it should not be viewed as simply the absence of physical activity (14). Sedentary individuals are characterised by exhibiting high levels of 'sitting behaviour', and differ from insufficiently active individuals, or those who do not meet recommended physical activity guidelines (9,15). Our understanding of the prevalence of sitting time in UK workers is limited and has largely been restricted to the study of leisure time screen-based sedentary behaviours (16) or to specific occupational groups (17). Accelerometers have been used in population surveillance investigations to provide a measure of inactive behaviours (18), but they do not distinguish between lying down, sitting and standing still. Therefore, standing still may be incorrectly classified as sedentary behaviour. In addition, accelerometers do not provide investigators with the contexts in which these behaviours occur, such as at work or during transport. It is important to measure all types of sedentary behaviour, across a range of contexts, if we are to understand the determinants of sedentary behaviour and develop behaviour change interventions. The aim of the current study was to examine the prevalence of sitting time in a sample of UK workers from a range of employment sectors in order to provide some descriptive epidemiology in this under-investigated area.

METHODS

We contacted a variety of different organisations (employers, trade unions and employee representatives) with an invitation to participate in a cross-sectional survey, i.e. by opportunistic sampling. We provided organisations with an email invitation to forward to their employees and other contacts and the survey was accessed online via a secure external internet web-link. Other organisations who demonstrated an interest in participating but whose employees were unable to access the web-link were provided with a paper version of the questionnaire. The only stipulation for individuals to participate was that they must be currently employed. The survey assessed a range of work-related factors including for example general health, work ability, job satisfaction, organisational commitment and intention to quit. However, the focus of this paper is the descriptive epidemiological data on sitting times across different employment sectors. The study was approved by the Loughborough University Ethical Advisory Committee. All participants provided informed consent prior to beginning the survey, and all survey responses were anonymous.

The questionnaire comprised five sections: demographic characteristics; organisational information; sitting time, sleep and physical activity. Self-reported sitting time was assessed using the Domain-Specific Sitting Time Questionnaire, validated in Australian (19) and UK adults (5). This questionnaire asks participants to estimate the number of hours and minutes spent sitting on typical work and nonwork days in specific domains including at work, travelling to and from places, watching television, using a computer at home and during other leisure activities. Participants were also asked to estimate how much time they spent sleeping at night on a work day and non-work day. A cut-off point for total reported daily sitting time was 1,000 minutes per day (16 hours 40 minutes), with participants with reported sitting times above this value being excluded from the analysis. Participants were categorised into whether or not they met the UK physical activity guidelines at the time of data collection (at least 30 minutes of moderate intensity physical activity, on at least 5 days of the week) (18) by providing information on the frequency, duration and intensity of any regular physical activities.

Analyses were conducted using SPSS (19.0). Data were tested for normality using the Kolmogorov-Smirnov test which revealed that all sitting time data were not normally distributed, therefore non-parametric analyses were conducted on this data and the median and inter-quartile ranges were calculated throughout. Participants' self-reported height and weight were used to calculate their body mass index (BMI). Age and BMI were compared between participants providing valid sitting time data and those not providing valid data using independent samples t tests. Employees were divided into 5 age categories (29 or under, 30-39, 40-49, 50-59, and 60 and over) and a Kruskall-Wallis test was conducted to assess any differences between sitting time for these categories.

Descriptive statistics were calculated for the time reported sitting in each domain on a work day and non-work day for the sample as a whole, and for the following subgroups: males, females, normal weight (BMI<25 kg/m²), overweight (BMI=25–29.9 kg/m²) and obese (BMI≥30 kg/m²) participants. Total daily sitting time was calculated for work and non-work days for each participant by summing sitting times reported across domains.

Domain sitting times along with total sitting time and sleep time on a work day and a non-work day were compared between males and females using Mann-Whitney U tests. Similarly, sitting times were compared between the three BMI groups, and across different age groups using independent-samples Kruskal-Wallis tests, with Bonferonni-corrected post hoc comparisons where relevant. Spearman correlation coefficients (*r*) were calculated for the sitting time data to determine the relationship between sitting time at work and total sitting time on a work day.

The responses were categorised into 5 organisational sectors, which were based on the responses from participants identifying the type of organisation they worked for and their job role. Sitting times across the organisational sector groups for individual domains were also compared using independent-samples Kruskal-Wallis tests, with Bonferonni-corrected post hoc comparisons.

RESULTS

In total 1,141 employees from 145 UK organisations in the education (17%), local government (22%), retail (17%), telecommunications (34%) and service sector (10%) participated (see Table 1). 44% (544) of participants completed all aspects of the Domain-Specific Sitting Time questionnaire for work day sitting (52% male, mean age=38 years; mean BMI=25 kg/m²). Of this sample, 384 participants also provided valid sitting time data for non-work days. The analyses using the work day sitting data are based on the 504 participants who completed this aspect of the questionnaire. Analyses comparing work day and non-work day sitting are based on the 384 participants providing both sets of data. A Mann-Whitney U test was conducted to determine if there were differences in age and BMI between participants who completed the Domain Specific Sitting Time Questionnaire and those who did not. There were no statistically significantly differences in age and BMI between these two groups.

(Table 1)

The proportion of respondents included in the main analyses who met the physical activity guidelines at the time of data collection was 22% (n=111). Participants who met the guidelines had a significantly lower BMI in comparison to those who did not meet the guidelines (24.0 versus 25.6 kg/m², p<0.05).

The proportions of time reported sitting in each domain, along with total sitting and sleep time reported on a work day are shown in Table 2. More time was reported sitting at work than in any other domain, with work time sitting accounting for more than half (54%) of the total daily sitting time on a work day. Significantly more time was reported sitting on a work day than time reported sleeping (p<0.001). Males reported significantly higher sitting times compared to females in the following domains: at work (p<0.01), using a PC at home (p<0.01) and total work day sitting time (p<0.001).

(Table 2)

The Kruskal-Wallis test revealed sedentary time varied significantly between the three BMI groups in terms of sitting time spent watching TV (p<0.01) and using a PC at home (p<0.05), total sitting time reported on a work day (p<0.001) and time spent sleeping (p<0.05). Post hoc analyses demonstrated sitting and sedentary times reported by individuals in the obese group was significantly higher compared to the normal weight group in the following domains: watching TV (p<0.01), total sitting time (p<0.001) and sleep time (p<0.01). The obese group also reported significantly higher total sitting times than the overweight group in the following domains: using a PC at home (p<0.01) and total sitting time (p<0.001).

For the sample as a whole, Spearman correlations revealed significant, positive, associations between BMI and sitting for transport (p<0.05), at work (p<0.05), watching TV (p<0.01) and total sitting time reported on a work day (p<0.01). There was also a significant positive correlation between sitting time at work and total

sitting time on a workday (p<0.001).

A Kruskall-Wallis test showed that on a work day, sitting time varied significantly between the 5 age groups in two specific domains of sitting; at work (p<0.01) and during leisure time (p<0.001). Median sitting times (in minutes) whilst at work were 360 for 29 years or under, 410 for 30-39, 423 for 40-49, 398 for 50-59 and 300 for the 60 and over group. During leisure time, median sitting times (in minutes) were 60 for 29 years or under, 30-39 and 50-59 groups, 30 for 40-49 and 51 for the 60 and over group. Post hoc analyses revealed sitting time at work reported by individuals aged 60 and over were significantly lower than all other age groups, including those aged 29 or under (p<0.05), 30-39 (p<0.01), 40-49 (p<0.001) and 50-59 years (p<0.01). Sitting during leisure time reported by individuals aged 40-49 was significantly lower than in those aged 29 or under (p<0.001) and 30-39 (p<0.01). There were no significant differences between the age groups in the domains of transport, watching TV, using a PC at home, total work day sitting or sleeping time.

The median work day sitting time results for each domain and across each organisational sector are displayed in Figure 1. There were no significant differences between the proportions of individuals meeting physical activity guidelines across the organisational sectors. A Kruskall-Wallis test showed sitting time varied significantly between sectors, in the domains of work (p<0.001) and leisure time (p<0.001). Post hoc analyses revealed sitting time at work reported by employees in the retail sector were significantly lower in comparison to employees in education (p<0.001), telecoms (p<0.001) and service industry sectors (p<0.001). Local government workers reported significantly lower sitting times at work

compared to the telecoms (p<0.001) and service industry (p<0.001) sectors. Moreover, leisure time sitting reported by retail workers was significantly lower than those in the local government (p<0.01) and service industry (p<0.01) sectors.

(Figure 1)

Time reported sitting in each domain, along with total sitting time and sleeping time is shown in Table 3. A Wilcoxon Signed Rank Test with the participants who provided sitting time data for both work days and non-work days (n=384) showed statistically significant differences between the sitting behaviours on both types of day. Individuals reported significantly higher total sitting times on a work day compared to a non-work day (p<0.001). Participants reported higher sitting and sedentary times on a non-work day for: watching TV (p<0.001), during leisure (p<0.01) and while sleeping (p<0.001). The only domain that had significantly higher sitting times (p<0.001).

(Table 3)

DISCUSSION

Among this sample of employees, over half of the time spent sitting on a work day was accumulated at work. The results are consistent with sitting time prevalence in previous UK and Australian data (4-5). Chronic energy imbalance from individuals who are sedentary for longer contributes to fat accumulation and weight gain (11). The results for individuals in the obese category showed significantly higher total work day sitting and sleeping times compared to individuals in the normal or overweight categories. There is growing evidence that total sitting time is more closely related to BMI than total time spent in physical activity behaviours (21-22). Total sitting time on a non-work day was, overall, less than total sitting time reported on a work day. However, results indicated individuals sat for significantly longer whilst watching TV and during leisure activities on a non-work day was significantly longer than on a work day. Therefore, even though individuals accumulated less total sitting time on non-work days, they may still spend time in other sitting or sedentary behaviours that result in a similar amount of time spent being sedentary. The results support previous research showing that individuals with higher sitting times at work do not spend less time sitting in activities outside work (6).

From the findings identified there was a significant difference in reported sitting times between males and females, with the results suggesting that males spent more time sitting whilst at work and using a PC at home. This gender difference requires further investigation as it could have an impact on the types of health messages delivered to individuals. Older workers (aged over 60) reported lower overall sitting times at work than all other age groups. These findings contradict research that suggests physical activity declines as age increases (23-24). However, the findings were not replicated for sitting time accumulated outside work and may indicate older employees were in job roles that were less sedentary.

Employees working in retail or local government reported significantly lower sitting times than those employed in the telecoms or service industry sectors. The latter were characterised by office type workers. Research has demonstrated that occupational physical activity is associated with reduced risks of developing chronic illnesses independent of leisure-time physical activity levels (25). Reducing sitting time at work is vital as the effects of high amounts of sitting at work cannot be compensated for by leisure time physical activity, even if levels exceed activity guidelines (7). Therefore, specific interventions that target both reductions in sitting time and increases in physical activity should be implemented among office workers.

Given recent evidence suggesting that light intensity physical activity (such as slow walking) is beneficial to health (18), future worksite interventions targeting sedentary behaviour may benefit from promoting light intensity physical activity, where feasible. This could be done by encouraging the use of pooled printers/copiers, having centrally placed water coolers and restricting email and telephone contact for employees in the same building, for example. Emerging experimental evidence has shown that breaking up sedentary behaviour every 20 minutes with 2 minutes of light walking significantly improves glucose and insulin regulation (26). Therefore, a strategy such as this could be implemented in future workplace interventions.

Several limitations must be considered when evaluating the findings of this study. Participants were self-selecting, which introduces the potential for self-selection bias in the response sample. The fact that less than half of the sample provided complete sitting time data indicates the difficulty respondents have in estimating this behaviour. However, participants providing complete sitting time data did not differ significantly in terms of age and BMI from participants who did not provide complete data. Selfreported sitting time data may have been subject to estimation errors but research has shown that time spent in habitual activities such as travelling to and from work and at work is more accurately recalled than time spent in less structured leisure activities (19).

The low compliance rate, with only 44% of the sample completing all aspects of the Domain-Specific Sitting Time questionnaire, is a further limitation of the study. The questionnaire, in its entirety, was very long, including sections not only on sitting time and physical activity, but also on a range of other measures which are beyond the remit of this paper, and this may go some way to explaining the low response rate.

A final limitation of the study lies in its cross-sectional nature, which prevents conclusions about causality. Specifically, it is not possible to determine whether being sedentary at work leads to an individual being more sedentary outside working hours, for example. Longitudinal research is required to understand long-term relationships between sedentary behaviour accumulated during and outside working hours.

In conclusion, this study has provided a descriptive epidemiology of sitting times across multiple domains in UK workers. The research has identified that sitting is a major element of our working lives and this is a major public health issue, as sedentary behaviour is an independent risk factor for a wide range of chronic diseases. The research suggests that workers are accumulating the majority of their sitting at work. Therefore it seems clear that future workplace health interventions should focus not just on increasing physical activity levels but also on reducing the time employees spend sitting at work.

Key Points

- Sitting is a major requirement of our working lives and greater sitting time is associated with an increased risk of many adverse health conditions.
- Among this sample of UK employees, over half of the time spent sitting on a work day was accumulated at work. Significantly more time was reported sitting on a work day than time reported sleeping.
- Future occupational health interventions should focus on reducing the amount of time employees spend sitting at work.

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Organisational sector	Sample n (%)	Male n (%)	Female n (%)	Age years (SD)	BMI kg/m2 (SD)
Education	106 (21)	32 (30)	74 (70)	41.1 (12.6)	25.4 (5.0)
Local Government	72 (14)	29 (40)	43 (60)	40.2 (12.8)	26.0 (5.7)
Retail	48 (10)	15 (30)	33 (70)	41.7 (14.1)	25.7 (4.0)
Telecoms	242 (48)	169 (70)	73 (30)	46.3 (8.6)	27.0 (4.6)
Service Industry	36 (7)	22 (61)	14 (39)	32.7 (9.4)	25.6 (4.5)

 Table 1: Demographic profile of the sample by organisational sector, gender, age and BMI

Table 2. Median (inter-quartile range) reported sitting times (minutes) on a work day across each domain, along with total sitting time and self-reported sleep time for the sample as a whole and for males, females, normal weight, overweight and obese participants.

	Minutes per day						
	Whole sample (n = 504)	Males	Females	Normal weight	Overweight	Obese	
Transport	60 (68)	60 (90)	60 (60)	60 (70)	60 (60)	60 (99)	
Work	390 (240)	420 (180)	360 (300)	390 (300)	390 (240)	420 (180)	
TV	120 (90)	120 (90)	120 (60)	90 (60)	120 (70)	120 (120)	
PC at home	60 (75)	60 (90)	57.50 (60)	60 (75)	60 (50)	60 (90)	
Other leisure	60 (90)	60 (90)	60 (120)	60 (90)	60 (65)	60 (120)	
Total	680 (290)	720 (285)	643 (334)	660 (288)	660 (315)	753 (273)	
Sleep	420 (90)	420 (60)	420 (60)	420 (60)	420 (90)	420 (116)	

Table 3. Median (inter-quartile range) reported sitting times (minutes) of individuals who provided valid responses to the domain-specific sitting time questionnaire on both work days and non-work days across each domain (n=384), along with total sitting time and self-reported sleep time for the sample as a whole, and for male and female participants.

	Minutes per day							
	Whole sample		Males		Females			
	Work day	Non-work day	Work day	Non-work day	Work day	Non-work day		
Transport	60 (93)	60 (45)	60 (95)	60 (90)	60 (60)	60 (40)		
Work	405 (240)	60 (120)	420 (180)	60 (120)	360 (300)	35 (120)		
τν	120 (90)	177.50 (120)	120 (90)	180 (120)	120 (60)	125 (60)		
PC	60 (64)	60 (79)	60 (70)	90 (120)	30 (60)	60 (90)		
Leisure	30 (60)	172.50 (180)	35 (60)	195 (150)	30 (60)	180 (153)		
Total	673 (294)	570 (360)	720 (265)	600 (345)	640 (310)	540 (350)		
Sleeping	420 (90)	480 (90)	420 (90)	480 (60)	420 (68)	480 (120)		

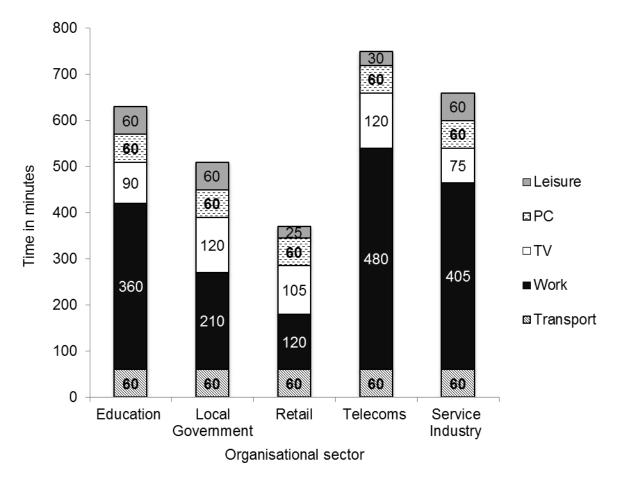


Figure 1. Bar chart displaying median sitting times (minutes) reported on a work day in each domain across each organisational sector.