A survey of sitting time among UK employees

A. Kazi¹, M. Duncan², S. Clemes³ and C. Haslam³

¹NIHR Leicester-Loughborough Diet, Lifestyle and Physical Activity Biomedical Research Unit, Leicester Diabetes Centre, Leicester General Hospital, Leicester LE5 4PW, UK, ²Centre for Applied Resilience in Healthcare, Florence Nightingale School of Nursing and Midwifery, King’s College London, London SE1 8WA, UK, ³Work and Health Research Centre, School of Sport, Exercise and Health Sciences, Loughborough University, Leicestershire LE11 3TU, UK.

Correspondence to: A. Kazi, NIHR Leicester-Loughborough Diet, Lifestyle and Physical Activity Biomedical Research Unit, Leicester Diabetes Centre, Leicester General Hospital, Leicester, LE5 4PW, UK. Tel: +44 (0)116 258 4389; fax: +44 (0)116 258 4499; e-mail: Aadil.Kazi@uhl-tr.nhs.uk

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 UK working-aged adults, across a range of employment sectors.

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

Results A total of 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 with 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 Healthy lifestyles; health workplaces; occupational health services; physical activity; sedentary behaviour; workplace health promotion.

Introduction Economic advances and industrial innovation have resulted in large numbers of people being employed in sedentary occupations [1]. Australian data suggest that half of total daily sitting time takes place at work [2], with similar findings reported from small samples of 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 characterized by an energy expenditure of $<1.5$ 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 characterized 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**

A variety of organizations (employers, trade unions and employee representatives) were contacted with an invitation to participate in a cross-sectional survey. These organizations were provided with an email invitation to forward to their employees and contacts and the survey was accessed online via a secure external internet web-link. Additional organizations 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 also assessed a range of work-related factors including, for example, general health, work ability, job satisfaction, organizational 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; organizational 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 non-work 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 1000 minutes per day (16 hours 40 minutes), with participants who reported sitting times above this value being excluded from the analysis. Participants were categorized 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 [20]) 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 interquartile 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 five age categories (29 or younger, 30–39, 40–49, 50–59 and 60 and older) and a Kruskal–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 sub-groups: 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 Bonferroni-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 categorized into five organizational sectors, which were based on the responses from participants identifying the type of organization they worked for and their job role. Sitting times across the organizational sector groups for individual domains were also compared using independent-samples Kruskal–Wallis tests, with Bonferroni-corrected post hoc comparisons.

**Results**

In total, 1141 employees from 145 UK organizations in the education (17%), local government (22%), retail (17%), telecommunications (34%) and service sector (10%) participated (see Table 1). About 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 significant differences in age and BMI between these two groups.

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 with 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 than 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).

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 with 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 Kruskal–Wallis test showed that on a work day, sitting time varied significantly between the five 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 younger, 410 for 30–39, 423 for 40–49, 398 for 50–59 and 300 for the 60 and older group. During leisure time, median sitting times (in minutes) were 60 for 29 years or younger, 30–39 and 50–59 groups, 30 for 40–49 and 51 for the 60 and older group. Post hoc analyses revealed sitting time

### Table 1. Demographic profile of the sample by organizational sector, gender, age and BMI

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

SD, standard deviation.

### Table 2. Median (interquartile 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

<table>
<thead>
<tr>
<th></th>
<th>Minutes per day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Whole sample (n = 504)</td>
</tr>
<tr>
<td>Transport</td>
<td>60 (68)</td>
</tr>
<tr>
<td>Work</td>
<td>390 (240)</td>
</tr>
<tr>
<td>TV</td>
<td>120 (90)</td>
</tr>
<tr>
<td>PC at home</td>
<td>60 (75)</td>
</tr>
<tr>
<td>Other leisure</td>
<td>60 (90)</td>
</tr>
<tr>
<td>Total</td>
<td>680 (290)</td>
</tr>
<tr>
<td>Sleep</td>
<td>420 (90)</td>
</tr>
</tbody>
</table>
at work reported by individuals aged 60 and older were significantly lower than all other age groups, including those aged 29 or younger \((P < 0.05)\), 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 younger \((P < 0.001)\) 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 organizational sector are displayed in Figure 1. There were no significant differences between the proportions of individuals meeting physical activity guidelines across the organizational sectors. A Kruskal–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 with 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 with 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.

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 with 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 reported on a work day compared with a non-work day was the domain of work \((P < 0.001)\).

**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 with 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 compared with a work day. Moreover, the amount of time spent sleeping 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 overall. 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 >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 characterized 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 with periods 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. Self-reported 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 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.

Another 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

### Table 3. Median (interquartile 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

<table>
<thead>
<tr>
<th>Minutes per day</th>
<th>Whole sample</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Work day</td>
<td>Non-work day</td>
<td>Work day</td>
</tr>
<tr>
<td>Transport</td>
<td>60 (93)</td>
<td>60 (45)</td>
<td>60 (95)</td>
</tr>
<tr>
<td>Work</td>
<td>405 (240)</td>
<td>60 (120)</td>
<td>420 (180)</td>
</tr>
<tr>
<td>TV</td>
<td>120 (90)</td>
<td>177.50 (120)</td>
<td>120 (90)</td>
</tr>
<tr>
<td>PC</td>
<td>60 (64)</td>
<td>60 (79)</td>
<td>60 (70)</td>
</tr>
<tr>
<td>Leisure</td>
<td>30 (60)</td>
<td>172.50 (180)</td>
<td>35 (60)</td>
</tr>
<tr>
<td>Total</td>
<td>673 (294)</td>
<td>570 (360)</td>
<td>720 (265)</td>
</tr>
<tr>
<td>Sleeping</td>
<td>420 (90)</td>
<td>480 (90)</td>
<td>420 (90)</td>
</tr>
</tbody>
</table>
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.

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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Conflicts of interest
None declared.

References