The sedentary office : a growing case for change towards better health and productivity Expert statement commissioned by Public Health England and Active Working C.I.C.

BUCKLEY, John P., HEDGE, Alan, YATES, Thomas, COPELAND, Robert J. <http://orcid.org/0000-0002-4147-5876>, LOOSEMORE, Michael, HAMER, Mark, BRADLEY, Gavin and DUNSTAN, David W.

The sedentary office: a growing case for change towards better health and productivity

Expert statement commissioned by Public Health England and the Active Working Community Interest Company (C.I.C.)

John P Buckley[1] **Corresponding author**

Alan Hedge[2]
Thomas Yates[3,4]
Robert J Copeland[5]
Michael Loosemore[6]
Mark Hamer[6]
Gavin Bradley[7]
David W Dunstan[8]

[1]Institute of Medicine, University Centre Shrewsbury and, The University of Chester, UK CH1 4BJ
[2]Department of Design and Environment Analysis, Cornell University, Ithaca, New York, USA 14853-4401
[3]NIHR Leicester-Loughborough Diet, Lifestyle and Physical Activity Biomedical Research Unit, Leicester Diabetes Centre, UK LE5 4PW
[4]Diabetes Research Centre, College of Medicine, Biological Sciences and Psychology, University of Leicester, Leicester, UK, LE1 7RH
[5] The National Centre for Sport & Exercise Medicine and, The Centre for Sport and Exercise Science, Sheffield Hallam University, Sheffield, UK S10 2BP
[6]The Institute of Sport, Exercise and Health, University College London, UK W1T 7HA
[7]Active Working CIC Teddington, London, UK TW11 9PE
[8]Baker IDI Heart and Diabetes Institute, Melbourne, Australia 3004

Running title: The sedentary office

Key words: *Sedentary behavior, cardiovascular disease, diabetes, active offices, standing up at work*

Word Count: 2912

Abstract

An international group of experts was invited by Public Health England and a UK community interest company (Active Working CIC) to provide guidelines for employers to assist office-based workers in ways to avoid prolonged periods of sedentary work. The set of recommendations was developed from the totality of the current evidence, including long-term epidemiological studies and interventional studies evaluating health mechanisms of getting workers to stand and/or move more frequently. The evidence was ranked in quality using the four levels of the American College of Sports Medicine. The derived guidance is as follows: for those occupations which are predominantly desk-based, workers should aim to initially progress towards accumulating two-hours per day of standing and light activity (light walking) during working hours, eventually progressing to a total accumulation of four hours per day (pro-rated to part-time hours). To achieve this, seated-based work should be regularly broken-up with standing-based work, the use of sit-stand desks or the taking of short active standing breaks. Along with other health promotion goals (improved nutrition, reducing alcohol, smoking and stress), companies should also promote to their staff that prolonged sitting, aggregated from work and in leisure-time, may significantly and independently increase the risk of cardio-metabolic diseases and premature mortality. It is appreciated that these recommendations should be interpreted in relation to the evidence from which they were derived, largely observational and retrospective studies or short-term interventional studies showing acute cardio-metabolic changes. While longer-term intervention studies are required, the level of consistent evidence accumulated to date and the public health context of rising chronic disease, suggest initial guidelines are justified.

We hope these guidelines stimulate future research and that greater precision will be possible within future iterations.

Background and general aims

The overall aim of this expert statement is to provide guidance for employers and staff working in office environments to combat the potential ills of long bouts of seated office work. In the past five years, an accelerated amount of evidence has been published on the links between sedentary living, including time at work, and the leading causes of morbidity and mortality (cardiovascular disease, diabetes and some cancers). Much of the evidence has been from cross-sectional and/or prospective observational studies, however, a number of more recent intervention studies have highlighted potential mechanisms in an attempt to demonstrate causality. These outcomes have captured much journalistic attention from news and documentaries on television, weekly articles in newspapers and features within the popular press on science, ergonomics and health. An expert panel was convened to evaluate the evidence and draw up some core recommendations (Box 1.) as an initial guide for employers, ergonomists, office furniture and equipment suppliers and occupational health promoters.

The growing interest in changing sedentary working environments has led to a proportionate acceleration in the production, marketing and sales of commercial and domestic furniture retailers with either sit-stand attachments for desks or fully adjustable sit-stand desk-tops. Marketing claims for such products have focused on the additional energy expenditure, with alleged benefits to weight

control/loss, relief and prevention of musculoskeletal conditions (acute and chronic), and improved cardio-metabolic health. Although these products do come with some guidance on their use, there is a paucity of guidance relating to affecting a number of factors that may best help realise the promoted health benefits, including: long-term behaviour change processes and daily doses (sustained versus fractions of time) of standing and active breaks required at work within the office environment.

This expert statement therefore aims to provide some primary guidance to support, as best as possible, those employers and staff who have invested or plan to invest in creating less sedentary and more active working environments. Market trends, which are adding momentum to such investments, may however be moving at a faster pace than the related and supporting evidence-base can be produced. The notion of an intervention which can improve employee well-being and performance has concomitantly attracted interest from arenas of occupational health and human resources. This guidance thus represents a summary and extrapolation of the evidence to date. Future refinements will be required as more evidence is published.

Rationale, evidence and objectives

In meeting the above aims, the two objectives of this expert statement are to highlight: (1). the effects of prolonged seated desk-work on the health and well-being of office-based workers and (2). how a less sedentary office environment potentially influences productivity, both intrinsically for the individual worker and extrinsically for the corporate achievements of an organization, including

economic savings and benefits from improved productivity, profitability, and reduced sickness and absenteeism. Overall, social-political theorists have captured these values under the term "Corporate Social Responsibility" (CSR)[1]. Historic examples of CSR date back to Victorian times (the 1870s), which includes examples such as the Cadbury chocolate company, who provided facilities and a living community designed for promoting a physically and socially healthy working, living and leisure environment for workers and their families.

Within the context of this current expert statement, sedentary behavior is defined in its truest sense (from its Latin roots "sedere") as meaning time spent sitting [2] . The simple act of postural changes, standing and movement/ambulation within an office space is considered to be *light intensity activity* [3], which can add 0.5 to 2.0 kcals per minute of energy expenditure compared to sitting still whilst performing computer work [4-6]. Although this added energy expenditure might intuitively be translated to potential weight-loss, the current evidence is equivocal on whether increased standing at work could have a significant impact on reducing obesity. Nevertheless, analyses by magnetic resonance imaging (MRI) does show that fat deposited around vital organs (heart, kidneys and liver) is much more strongly associated with objectively measured sedentary time compared to overall body mass index [7 8]. The most encouraging evidence thus far demonstrates that avoiding long bouts of sitting coupled with even short but frequent bouts of more light intensity movement improves glucose and insulin levels [5 9-12]. Such strategies have also been shown to reduce musculoskeletal (e.g. low back) discomfort and fatigue in office workers [13].

Sedentary behavior within the context of human physical activity

In the lead-up to the London 2012 Olympic and Paralympic Games, a special edition of the Lancet published a series of papers, based on national statistics from around the world, that globally ~40% of individuals with cardiovascular disease, diabetes or cancer failed to achieve the minimum recommendations for health of 150 minutes per week of moderate intensity physical activity [14]. In high-income countries in Europe and North America this figure rose to ~70%. More worryingly, if objective measures of physical activity are used, up to 95% of adults in the general population are classified as inactive [15 16]. As part of the World Health Organisation's (WHO) 25 x 25 initiative (reducing premature mortality by 25% from non-communicable diseases by the year 2025), a specific target has been set to decrease physical inactivity by 10%. In the UK this has been translated into a year on year decrease in the number of people performing less than 30 minutes of physical activity per week [17].

Reducing physical inactivity is as much (if not more) about reducing sedentary time spent at work, home and in leisure as it is about getting people to attain a weekly target energy expenditure of 1000+ kcals (e.g. 150 minutes of moderate intensity activity per week)[2]. In the UK, sedentary behavior now occupies around 60% of people's total waking hours in the general population and over 70% in those with a high risk of chronic disease [18 19]. For those working in offices, 65 to 75% of their working hours are spent sitting, of which more than 50% of this is accumulated in prolonged bouts of sustained sitting; on non-working days people sit less by up to 2.5 hours [20-25]. The evidence is clearly emerging that a

first “behavioural” step could be to simply get people standing and moving more frequently as part of their working day (Figure 1). Moreover, in the workplace this may potentially be more socially achievable that targeted exercise. The UK’s 2011 Chief Medical Officers’ report is consistent with such an approach, and it provides a clear graphic (Figure 2.) that demonstrates the greatest risk reduction involves increasing activity in the least active/least fit. Promoting more active office environments could be used as a first step in this process [2].

Over the past five decades, the culprits of sedentary behaviour in both developed and developing nations have included: reduced frequent bouts of active human transport (walking, cycling), increased sedentary leisure pursuits at home (television viewing and computer-based activities) and less manual occupations with increased amounts of seated technical work or desk-based office work [26]. Since 1960 the estimated energy expenditure loss at work has been 175 kcals per day [27] coinciding with a 20% reduction in physical activity, which on current trends could be 35% by 2030 [28]. Coupled within these figures is a reduction of walking in the UK by 60 miles per year since 1975 [29], where the minimum total loss of energy expenditure in daily life for the average working person is ~200 kcals per day. Most of this reduced energy expenditure has therefore been in the form of displacing light physical activity into sedentary behaviour and not necessarily from decreased active leisure, exercise or sporting pursuits which has traditionally been the sole focus of many health, social and political campaigns [2 18 30]. In lower socioeconomic groups and ethnic minorities there has also been a decline in light daily movements and active leisure and sport [31].

In observational research, daily hours spent being sedentary (sitting), independent of levels of exercise or physical activity, are positively correlated with the risk of diabetes, cardiovascular disease, some cancers and premature mortality [32-35]. For example a comprehensive review of the data found that compared to those who sit the least, those who sit the most have over twice the risk of developing type 2 diabetes and cardiovascular disease [36] . Similarly, it has been found that every additional hour of TV viewing per day is linked to a 10% higher risk of developing type-2 diabetes and a 7.5% higher risk of developing cardiovascular disease [36 37]. Another study reported that the overall risk of premature mortality from sedentary behaviour suggests that for those sitting more than seven hours per day, there is a 5% increased risk with each additional hour of sitting [38]. These associations may, however, be attenuated in people that undertake regular moderate-to-vigorous physical activity [39]. Furthermore, those who spend more time sitting at work also spend more time sitting during leisure time [20]. A number of studies in relation to television viewing have shown adverse associations with mental health and wellbeing [40-42] and muscle strength [43 44]. Overall this demonstrates that strategies to incorporate reduced sitting within working hours could offer significant risk reduction.

Sedentary office environments

Policies for addressing concerns around inactive working environments have been well documented within national service frameworks for public health and medicine[17 45]. As previously noted, declines in energy expenditure at work over the past five decades have increasingly been the result of large proportions of the population moving from jobs in a standing or light activity mode to those at a

seated work-station. Morris et al. [46 47] were the first to scientifically demonstrate the link between physical inactivity and morbidity or premature mortality in sedentary occupations (bus drivers and office-based postal workers). Results were presented as a "relative risk" between active and sedentary occupations, and the rates of morbidity and mortality could either be equally or at least partially associated with sedentary work and not simply with the active occupations. Considering that developed countries will also be facing an aging workforce, where the age of retirement is set to rise [48], excessive sitting in the office environment could increase chronic exposure to sedentary behaviour throughout the lifecourse, with consequences for unhealthy ageing [49] and poorer bone health in later life[50].

Standing time at work has more recently demonstrated a dose-response type relationship, based on longer-term epidemiological data (>10 years), with cardio-metabolic, musculoskeletal, mental health risks and overall mortality[9 51]. In this same period a coinciding proliferation of sit-stand workstations has been widely marketed in Europe and North America. Data from the Furniture Industry Research Association (FIRA) estimate that 90% of office workers in Scandinavia now have access to sit-stand workstations, in the UK this figure is only 1%. Whilst the impact on health outcomes are yet to be demonstrated from such widespread initiatives in Scandinavia, it provides a welcome opportunity for health scientists to evaluate the reality of the intuitive/perceived benefits being promoted by both the furniture industry and employers wanting to engage in new approaches to improving wellbeing and performance.

In the event that the evidence continues to demonstrate the health risks of prolonged seated work, then a strong case for changing the ergonomic design of offices and work stations along with movement behaviours during the working day should be supported [25 52-55]. There are, however, strong indications that simply changing the office environment might not be enough to invoke long-term change in behaviour. Strategies and programmes for implementing change will need careful organisational and behavioural support and public education to prevent current interests in active office environments from simply being a passing fad [52 56 57]. Similar to the risks of prolonged static seated positions, so too should prolonged static standing postures be avoided[58]; movement does need to be checked and corrected on a regular basis especially in the presence of any musculoskeletal sensations[59]. Occupational standing with seated breaks and walking have however not shown to be causally linked to low back and neck pain and can provide relief[54 60]

Evidence evaluation and the recommended guidelines

The evidence-base for drafting this initial set of guidelines has been evaluated using an adapted version of the four-level criteria of the American College of Sports Medicine (Table 1.) [61]

Table 1. Categories of research evidence used for this report, adapted from ACSM criteria [61] (applied in Box 1.)

Category	Descriptor

A. Randomised, controlled trials (overwhelming data)	Provides a consistent pattern of findings with substantial studies
B. Randomized, controlled trials (limited data) and high quality observational data	Few randomized trials exist, which are small in size, and results are inconsistent or observation studies supported by evidence of causality from acute or experimental studies
C. Nonrandomised trials, observational studies	Outcomes are from uncontrolled, nonrandomized, and/or observational studies
D. Panel consensus judgment	Panel's expert opinion when the evidence is insufficient to place it in categories A–C

From the observational and experimental evidence cited thus far, the amount of time office workers should avoid sitting equates to a minimum accumulation of standing and/or moving within the office space for at least two hours per day but ideally four hours per day. On this basis the core recommendations are summarised in Box 1. The key evidence that underpins these recommendations comes from two key sets of studies:

i. Data collected as part of a longer-term retrospective national health and fitness survey[51 62], where independent of physical activity and controlled for other confounding factors, there was a threshold for significant risk reduction in individuals who performed work that involved (at least) standing on one's feet (or some movement) for more than two hours per day; and where the greatest risk reduction was demonstrated in those standing for at least half their day to a full day (4+ hours)

ii. Data presented from a number of observational or acute interventional studies where there were pronounced changes in cardio-metabolic and ergonomic risk factors (e.g. energy expenditure, blood glucose, insulin, muscle function and joint sensations), when the total accumulated time would be greater than two-hours per day[5 7 10-13 20 27 33 44 53 57 63]

Box 1. ***Core recommendations (evidence level from Table 1 in brackets)***

For those occupations, which are predominantly desk-based, workers should aim to follow these recommendations:

- ***Initially progress towards accumulating at least two-hours per day of standing and light activity (light walking) during working hours, eventually progressing to a total accumulation of four hours per day (pro-rated to part-time hours) (B-C)**

- **Seated-based work should be regularly broken up with standing-based work and vice versa and thus sit-stand adjustable desk stations are highly recommended (B)**

- **Similar to the risks of prolonged static seated positions, so too should prolonged static standing postures be avoided; movement does need to be checked and corrected on a regular basis especially in the presence of any musculoskeletal sensations[59]. Occupational standing and walking have however not shown to be causally linked to low back and neck pain and can provide relief [54 60] (C-D)**

- **Those individuals new to adopting more standing-based work could expect some musculoskeletal sensations and some fatigue as part of the positive adaptive process. If such sensations cannot be relieved either by an altered posture or walking for a few minutes, then the worker should rest, including sitting, with a posture that relieves the sensations. If discomfort does persist, then seeking appropriate medical advice is recommended (D)**

- **Along with other health promotion goals (improved nutrition, reducing alcohol, smoking and stress), employers should also promote to their staff that prolonged sitting, aggregated from work and leisure-time, may significantly increase one's risk of cardio-metabolic diseases and premature mortality (D)**

**Whilst more evidence is required to add greater certainty to this set of recommendations, or evolve and/or change them, the key elements remain to highlight the potential ills of sitting for prolonged periods and emerging benefits of changing office environments that promote standing and movement. Employers need to evaluate the best ways to achieve this, whether it be changes to how and when people can take breaks which involve standing and movement or desk designs and technologies that allow people to perform their work more easily either at their desk location or from other locations within the office space in a standing-up position. On the basis that there are a large number of occupations which involve people standing and moving for considerably more than four hours per day (e.g. hospital staff, teachers, factory workers, retail and catering staff), it is expected*

that for office-based workers in general this should not pose too many significant physical or cognitive challenges.

Future evidence requires longer-term prospective and randomized controlled trials assessing standing and light activity interventions in real office environments, and their effect on long-term health outcomes. These studies should include assessing the impact of creating "movement friendly" spaces for both purposeful and non-purposeful movement [64], including: computer-based prompts, alarmed or vibrating personal motion assessment devices, placement of toilets, kitchens, meeting places on different floors, stair-use promotions, standing meetings and messages delivered in person verbally or by hand. Much of the current evidence is based on epidemiological data, with proposed mechanisms measured from shorter-term bouts of standing or light activity often performed within highly controlled settings. Behavioural perceptions and long-term adherence to standing-based office work, or work that includes regular bouts of standing and/or light activity around the office, requires greater attention.

The financial case for change

Research is still needed to clearly demonstrate the potential financial reasons for reducing the average daily sitting time in the population below 9.0 hours (~60% of waking hours; 6 to 7 hours at work and 3 hours at home), including: reduced healthcare costs, and cost-savings-benefits from improved workforce productivity, engagement and reduced absenteeism.

The significant healthcare costs to the nation in relation to physical inactivity and

sedentary behavior have been widely reported, especially in relation to cardiovascular disease, cancer and the increasing incidence and prevalence of diabetes and obesity [2 18 30 65]. The most recent figures from the UK's Office for National Statistics (2014) highlight that of the 131 million working days lost to sickness, the largest contributing factor (~25%; 31 million days) is back, neck and muscle pain. Stress, anxiety and depression are also large contributors (~12%; 15 million days). Manual occupations have the largest proportion of total hours of sickness (2.4 - 3.2%) but the next highest are office-based administrative/secretarial/sales or customer service occupations (2.1 – 2.2%). In this latter group, the role of strategies to avoid sedentary behaviour at work is therefore required as a potential mediating factor. However, this evidence must be evaluated in controlling for the rate of sickness-absences being influenced by such factors as the size of the organization (negative correlate) and the level of professional skill or qualifications and pay (positive correlation).

Key studies from Australia have demonstrated a potential ameliorating influence of workplace interventions, which promote standing breaks and or the ongoing use of sit-stand adjustable work-stations. Not only did these interventions lead to improvements in markers of health risk but also improved work productivity, quality, efficiency and a greater sense of collaboration amongst groups of employees [13 53 66]. Furthermore these studies revealed that "healthy workers rate their work performance greater than less healthy workers; those or who are experiencing injury or illness are more likely to be absent from work and reduced sedentary practices can reduce the risk of musculoskeletal disorders". All of these examples provide cost savings to both the health service and the

employer, along with any knock-on costs to illness or injury that affects the productive lives of significant others (e.g. one's family or close friends needing time to assist or care).

Conclusion

While more evidence is required to add greater certainty and precision to this set of recommendations, or evolve and/or change them, the key elements remain to highlight the potential ills of sitting for prolonged periods and emerging benefits of changing office environments to promote standing and movement. Employers need to evaluate the best ways to achieve this, whether through changing how and when people can take breaks which involve standing and movement or through workstation (e.g. desk) designs and technologies that allow people to perform their work more easily either at their desk location or from other locations within the office space in a standing-up position. On the basis that there are a large number of occupations which involve people standing and moving for considerably more than four hours per day (e.g. hospital staff, teachers, factory workers, retail and catering staff), it is expected that for office-based workers in general this should not pose too many significant physical or cognitive challenges.

Acknowledgements
The authors are grateful to the expert "sounding-board" advice of: Justin Varney & Michael Brannan (Public Health England), Stuart Biddle (Victoria University, Melbourne), Nanette Mutrie (Edinburgh University), Philippa Dall & Sebastien Chastin (Glasgow Caledonian University).

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Figure 1.
Proportion of weekly waking hours spent in activity modes, ranging from time spent sitting through to vigorous physical activity (adapted from Townsend et al., 2012)

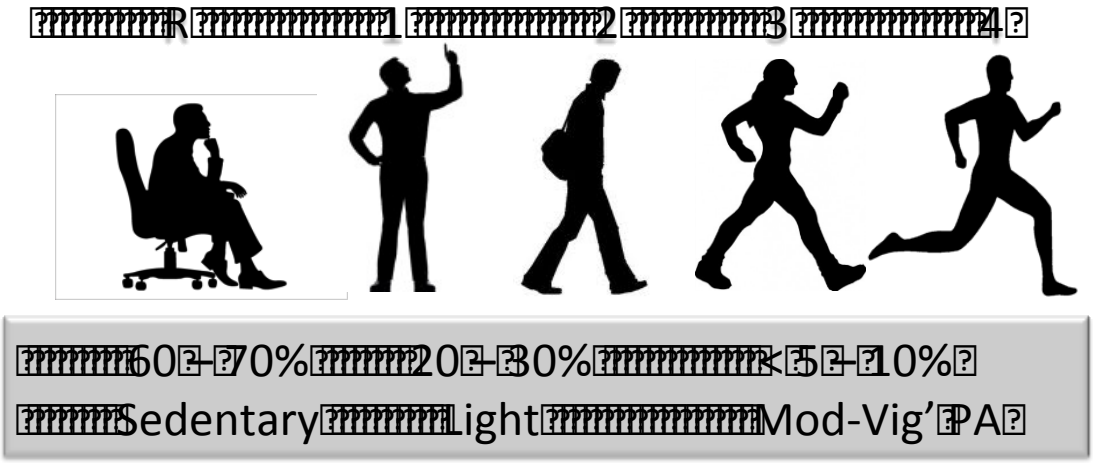

Figure 1.
Proportion of weekly waking hours spent in activity modes, ranging from time spent sitting through to vigorous physical activity (adapted from Townsend et al., 2012)

Values R, 1, 2, 3, and 4, represent behavioural "gears" synonymous to a car, where R = "reverse", 1 and 2 = light activities within daily living, 3 and 4 are moderate to vigorous activities either in daily life or as part of leisure-time pursuits, exercise and sport. Many health promotion and physical activity interventions aim to change people's behaviour by attempting to go from R to 3rd gear, missing targeted interventions in 1st and 2nd gear and thus resulting in behavioural "stalling" (relapse), as would occur in a car if one attempted to go from Reverse into 3rd or 4th gear.

Figure 2.
UK CMOs' Schematic representation of the dose-response relationship between physical activity level and risk of disease

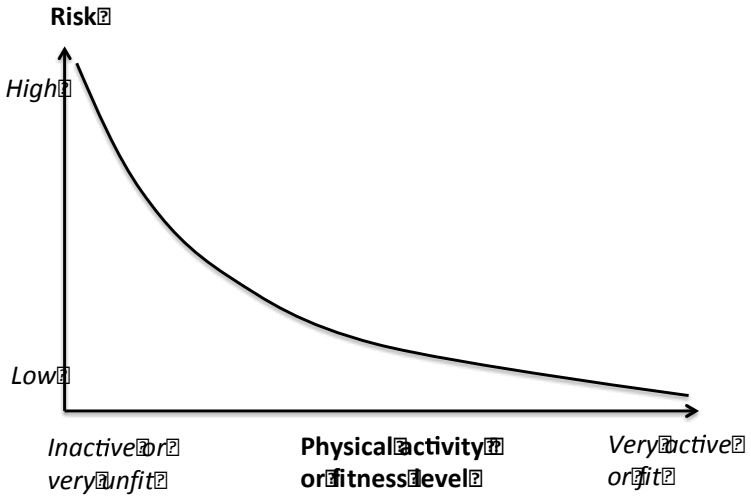

Figure 2. The dose-response relationship between level of physical activity and the risk of disease (primarily from cardiovascular disease and diabetes evidence). Adapted from the UK Chief Medical Officers' reports (2004, 2011)[19] The greatest risk reduction involve increasing activity in the least active/least fit and promoting more active office environments could be used as a first step in this process.