

# Chapter 18

## Workplace Programmes Aimed at Limiting Occupational Sitting

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**Abstract** On a typical working day, 50% of waking hours is spent in the workplace. This means that over the course of a lifetime, for most adults, a lot of time is spent at work. The workplace has a direct influence on the physical, social, economic, mental, and social well-being of workers and in turn the broader community. Moreover, many of the influences on behaviour, including sedentary behaviour, can be addressed within this setting. Given this, the workplace has been identified by the World Health Organization as a priority setting for health promotion. This chapter provides an overview on the workplace as a setting for addressing prolonged sitting time and programmes that have addressed this behaviour. Specifically, this chapter will: summarize evidence on how much workers sit; outline best practice approaches for addressing prolonged workplace sitting time; provide an overview of interventions that have targeted workplace sedentary time; and identify key gaps and opportunities in the field. The terms workplace sitting, occupational sitting, and occupational sedentary behaviour will be used interchangeably throughout the chapter to mean sedentary time accrued while undertaking work.

### 18.1 How Much Do Adults Sit at Work?

Since the 1960s, there has been a considerable increase (>40% for many countries) in time spent sedentary [1]. These changes are also reflected in the occupational domain, where increased computerization and modernization of work tasks has seen rapid changes in the activity profiles of workers, with the mean daily energy expenditure due to work-related activity estimated to have dropped by more than

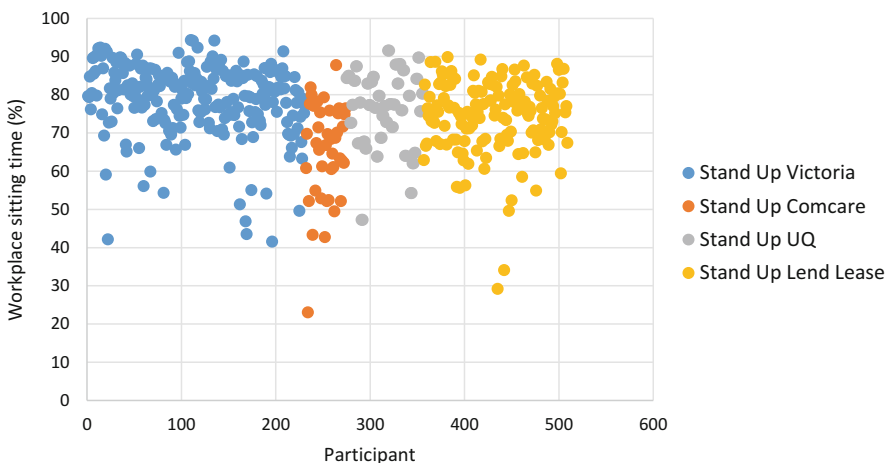
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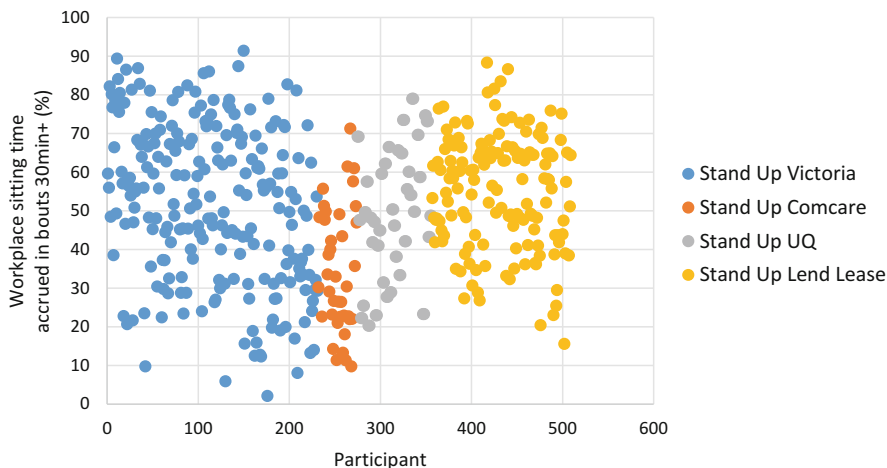
100 calories in this time [2]. This is of particular importance as workplace sitting time is a large contributor to overall sedentary exposure, with one study reporting that 48.5% of total weekly sedentary time was accrued at the workplace [3].

Traditionally, occupational activity has been broadly classified by job role or other relatively crude categorical measures [4]. This has limited our understanding of individual-level variations in workplace activity and associated impacts on health [5] and work outcomes. This was highlighted in a 2010 systematic review of occupational sitting and health risks, where wide heterogeneity in study designs and measures was found [5]. The review recommended the use of measures with demonstrated reliability and validity to enable understanding of dose–response relationships [5]. This gap is, at least in part, being addressed through the recent advances in measurement technology. Affordable devices are now available that can measure not only time spent in different activities and postures, but also when the activities are occurring. Coupled with context-specific data (such as diaries of work times), this has provided valuable insights into workers’ activity both in and out of the workplace.

Much of the activity monitor evidence to date has been from office workers. Using postural-based monitors, it has been observed that, on average, over two-thirds of the office work day is spent sitting, with the remainder of time primarily spent standing or in light intensity activities [6–9]. However, there are large individual variations in levels. This is demonstrated in Fig. 18.1, which shows the percentage of worktime spent sitting, measured objectively using the activPAL activity monitor, in 496 participants (all office-based workers) from four organizations who were participating in the Stand Up Australia programme of research [7, 8, 10, 11]. Although there is relatively little variation by organization (overall mean



**Fig. 18.1** Variations in total workplace sitting time (% of total worktime) in 496 participants from four organizations who participated in the Stand Up Australia programme [7, 8, 10, 11]



**Fig. 18.2** Variations in prolonged workplace sitting time accrued in bouts of 30+ minutes (% of total workplace sitting time) in the Stand Up Australia programme [7, 8, 10, 11]

76%, standard deviation 10.6%), there are large individual differences, with some individuals sitting less than 25% of their working day and others sitting over 90%. Activity monitors have also provided insights into how workplace sitting time is accumulated, which is particularly important given the increasing evidence on the links between prolonged, unbroken sedentary time and poor cardiometabolic [12] and musculoskeletal health [13]. In office workers, it has been observed that a considerable proportion of workplace sitting time is accrued in prolonged, unbroken bouts of at least 30 min [6, 14]. However, similar to what was observed for total sitting time, there is large individual variability in this, as highlighted in Fig. 18.2. Here, on average, 50.5% (SD 19.2%) of workplace sitting time was accrued in prolonged, unbroken bouts of at least 30 min in the 496 participants. However, some participants accrued <10% of their workplace sitting time in this form, whereas for others, more the 85% was accrued this way. When considered across all working hours, 40% of work hours on average (SD 18%) was spent in sitting bouts 30 min or greater in this group of participants ( $n = 496$ ).

Activity monitor data has also been used to compare sedentary time of various occupational categories. Using hip-worn accelerometer data from the U.S. 2003–2004 National Health and Nutrition Examination Survey (NHANES), occupational categories with the highest proportion of time spent sedentary during an average day (i.e. including both work and non-work time) were engineers, architects, and scientists (65.0%) and management-related occupations (60.3%), while those with the lowest average daily sedentary time were waiters and waitresses (39.8%) and cleaners, hand packagers, labourers, and other helpers (42.4%) [15]. Examining work hours specifically, a study in 15 male bus drivers observed that 44% of work time was spent sedentary compared to 59.5% in non-work time [16]. In 191 blue-collar workers (including assembly workers, cleaners,

construction workers, garbage collectors), the observed proportion of worktime spent sitting was 39.4% (SD 19.2%), with 7.0% (SD 9.3%) of total work accrued in bouts greater than 30 min [17]. In comparison, 65.3% (SD 11.8%) of leisure time was spent sedentary, with 31.9% (SD 15.3%) of this total time accrued in prolonged bouts [17]. Collectively, this evidence suggests that exposure to sedentary time is high across multiple occupations, including both traditional white and blue collar fields. Indeed, it has been argued that the modern office may be failing to provide a safe system of work [18]. In response to the rapidly accruing evidence base and increasing public awareness on the health impacts of too much sitting, an expert statement was published in 2015 reviewing the evidence on occupational sitting and providing initial broad recommendations for employers and staff [19]. The recommendations highlight the importance of regular changes in posture, including the avoidance of prolonged standing [19]. They also set a specific initial target of 25% of the workday (2 h per 8 h workday) to be spent in standing and light ambulatory activity during working hours, with this progressing to 50% of the workday [19]. Of key importance to note is that the evidence informing these recommendations is in most cases very preliminary, and further high quality evidence is required.

## **18.2 Best Practice Approaches to Address Prolonged Workplace Sitting**

The ultimate aim of a workplace sitting reduction programme is for the dynamic workplace to become the norm. That is, for regular postural change to be a habitual, subconscious behaviour enabled by good workplace design, relevant organizational policies, high levels of knowledge, and a supportive organizational culture are required. To achieve this, interventions should be designed with consideration to successful buy-in, delivery, and sustainability. Achieving effective buy-in and implementation is likely to rely heavily on the perceived value of the intervention, the capacity to deliver the programme (including resources and job demands), and situational/organizational factors—all of which can be changeable and non-static [20]. Programme design factors to support buy-in, implementation and sustainability include allowing flexibility to adapt the programme to best suit organizational needs, the context, and the level of organizational readiness for change [20]. For example, information seminars to raise awareness on the health impacts of too much sitting may be critical for workplaces which are in the early stages of readiness, whereas team coaching for championing change may be more appropriate for workplaces which already have high levels of awareness and strong leadership support that needs to be mobilized. The programme should also have processes and mechanisms to be able to rapidly incorporate and implement new knowledge as the evidence base advances [21]. Examples to achieve this include through communication tools such as a web page and/or ongoing collaboration with researchers in the field [22].

Workplace health promotion models [23–25] provide an important framework for designing, implementing, and evaluating programmes to address prolonged sitting in the workplace. The World Health Organizations’ Healthy Workplace model details the five keys to healthy workplaces: leadership commitment and engagement, involving workers and their representatives, ensuring legal and ethical compliance, instilling a process of continuous improvement, and developing a plan for sustainability and integration [25]. Table 18.1 provides examples of how a sedentary behaviour intervention could address these five areas. Of note is that there are multiple influences on an employees’ activity level at work in addition to individual-level factors such as fitness, fatigue, and age. These include job tasks, the physical environment, the social environment, and organizational norms and policies [27, 28]. Some influences are more modifiable than others, and some are likely to have a greater impact on activity than others. Any programme targeting sustained changes in workplace sitting needs to acknowledge and address these multiple influences, taking into consideration that the key levers for change are likely to vary amongst organizations and individuals.

### **18.3 Interventions Targeting Prolonged Sitting: What Has Been Tried?**

Until recently, much of the research on occupational sitting has been from the ergonomic field, with a focus on reducing musculoskeletal symptoms through addressing time spent in prolonged, static postures including prolonged sitting [29]. The increased interest in the public health impacts of too much sitting has seen a surge in workplace interventions specifically examining the impact of interventions on behaviourally based outcomes, as well as indicators of health. The aim of these interventions is to decrease sitting time or specifically prolonged sitting time (i.e. through increasing regular breaks or interruptions in sitting). Strategies to achieve this aim have included raising awareness/knowledge, creating a supportive environment (both the physical and social environment), and/or building culture.

Public health guidelines and recommendations regarding sedentary behaviour are only recently emerging [30, 31]. Hence, public health awareness and knowledge of the health impacts of too much sitting is likely to be lower than that regarding the benefits of regular participation in physical activity. Preliminary evidence suggests that providing information and tailored advice is acceptable and can result in behaviour change for some participants [32]. Prompts delivered via the computer [33, 34] or through the chair [35] can also be used to raise awareness and have been shown to elicit reductions in prolonged, unbroken workplace sitting time [33, 35]. Wearable technologies [11] and smartphone applications [36] also offer potential for real-time behaviour prompts and use as an intervention tool. Notably,

**Table 18.1** Examples of how a sedentary behaviour programme can address the five keys to a healthy workplace as outlined by the World Health Organization (adapted from [25])

Keys to a healthy workplace	Possible application to a workplace programme targeting reductions in sedentary behaviour
Key 1: Leadership commitment and engagement	<ul style="list-style-type: none"> <li>● Present a business case for the introduction of a programme to gain upper management support</li> <li>● Establish the resources available to be committed to the programme (e.g. sit–stand desks; headphones to enable standing telephone calls)</li> <li>● Evaluate, and where appropriate, adapt current policies and practices to support the programme (e.g. standing meetings; accessible stairwells)</li> <li>● Secure and formalize management and stakeholders’s commitment to initiatives in writing and ensure staff are aware of support (e.g. via email/internal memo/newsletter from CEO)</li> <li>● Identify role models and spokespersons to advocate the programme across multiple levels of the organization</li> </ul>
Key 2: Involve workers and their representatives	<ul style="list-style-type: none"> <li>● Actively involve workers in all stages of the programme including planning, delivery and evaluation</li> <li>● Allow flexibility and tailoring to enable workers/employees to choose strategies most appropriate for their workplace/team</li> <li>● Explore perceived barriers and concerns of staff and facilitate problem solving and solution generation</li> <li>● Ensure representation across multiple levels (e.g. general staff, team leader, senior management) on programme committees</li> <li>● Create both informal and formal opportunities for staff to share experiences and provide feedback on the programme (e.g. monthly morning teas where staff can share successes and challenges)</li> </ul>
Key 3: Business ethics and legality	<ul style="list-style-type: none"> <li>● Educate on the potential benefits and harms of standing up, sitting less, and moving more. This includes raising awareness of the potential harms of static postures (either sitting or standing) and the importance of “listening to your body”. Allow the broader community to participate in information and awareness raising seminars and workshops as appropriate</li> <li>● Allow flexibility in choice of working environments to facilitate regular postural transitions. This can include environmental support (e.g. sit–stand workstations) and/or allowing for unstructured (rather than structured) breaks. Follow available guidelines on the choice and use of sit–stand workstations [26]</li> <li>● Recommend gradual changes to sitting time</li> </ul>
Key 4: Use a systematic, comprehensive process to ensure effectiveness and continual improvement	<ul style="list-style-type: none"> <li>● Regularly (at least annually) evaluate organizational policies and practices related to the programme and employee knowledge and use of programme strategies</li> <li>● Regularly evaluate the impact of the programme on economic (e.g. productivity), health and well-being (e.g. stress), and social (e.g. collaborations) factors, as well as activity levels</li> <li>● Establish future goals for the programme, including project action plans. Ensure that there is input from representatives across multiple levels within the organization</li> <li>● Ensure programme approaches are evidence-based. Consult industry experts in programme design and evaluation as appropriate and enable mechanisms for the integration of new evidence</li> </ul>

(continued)

**Table 18.1** (continued)

Keys to a healthy workplace	Possible application to a workplace programme targeting reductions in sedentary behaviour
	<ul style="list-style-type: none"> <li>● Provide publically accessible reports on the impact of the programme</li> <li>● Collaborate and consult with other workplaces to discuss how they are delivering and evaluating programmes to address prolonged sitting</li> </ul>
Key 5: Sustainability and integration	<ul style="list-style-type: none"> <li>● Maintain and enhance knowledge through incorporating evidence-based findings into scheduled staff training (e.g. annual OHS training) and staff induction manuals</li> <li>● Integrate the programme into organization-wide health and well-being initiatives</li> <li>● Set programme-specific targets as part of annual reviews</li> <li>● Review and modify the programme to suit the level of organizational readiness and existing culture</li> </ul>

interventions that target the individual should be undertaken with consideration to the multiple influences on behaviour, as highlighted above.

The physical environment can have a strong impact on activity levels. Increasingly, workplaces are shifting towards “activity-permissive” or dynamic work environments that allow for more movement, more often. Features of these designs include visible, easily accessible and appealing stairwells, and amenities such as showers and bike storage racks [37]. Findings from natural experiments have shown that moving to these more activity-permissive buildings may have beneficial impacts on activity [38–40]. Notably, studies that have evaluated these moves have recommended that they be accompanied with education campaigns to increase awareness of the potential benefits of moving more and sitting less, as well as prompts (e.g. posters, computer prompts) [38, 39]. Changes to the physical environment can also be made on a smaller scale. For example, centralizing printers and wastepaper baskets or providing access to stairwells.

One physical environment intervention rapidly gaining attention is the activity-permissive workstation: i.e. a workstation that enables the worker to sit, stand, walk, and/or pedal while at their usual computer and other desk-based job tasks. Several systematic reviews have now concluded activity-permissive workstations can significantly reduce sitting time [41–44]. For example, in the meta-analysis by Neuhaus and colleagues [41], the pooled effect size for the reduction in workplace sitting time following installation of an activity-permissive workstation was 77 min per 8-h workday. These reviews also suggest that overall, the impact of the interventions involving activity-permissive workstations on health outcomes is generally beneficial, with no detrimental impact on work performance [41, 43].

The majority of interventions evaluating an activity-permissive workstation have examined the impact of sit–stand workstations: that is, workstations that allow the user to easily and quickly change between a sitting and standing posture. Designs can include full desk models (electronic or manual), as well as retrofitted

models that sit on top of existing desks. The increasing affordability of these workstations (models are now available <US\$300), accompanied by the increased media attention on the health impacts of too much sitting, have seen rapid uptake in their use. However, it is important to note that any potential benefits of sit–stand workstations are likely to be considerably greater when their installation is accompanied by strategies targeting other influences on sitting time (i.e. knowledge, organizational policies and workplace norms). This was highlighted in an intervention study which compared changes in sitting time across three groups: one who received a multicomponent intervention incorporating strategies targeting influences at the organizational, environmental (including sit–stand workstations), and individual level; one who received the sit–stand workstations only; and, a control group [8]. At 3 months, the multicomponent group had a nearly threefold greater reduction in workplace sitting time (–89 min per 8 h workday) compared to the workstation only group (–33 min per 8 h workday), with differences maintained at the 12-month assessment [45]. It is important to ensure that choice and installation of an activity-permissive workstation is done with the appropriate consideration to factors such as job design, existing office layout, privacy (e.g. noise, visibility), and equity. Guidelines are now available to support choice and use of sit–stand workstations [26].

Although less tangible than the physical environment, creating a supportive social environment is likely to be key for programme uptake and sustained change. Strategies for addressing the social environment include ensuring a participative approach, where employees are engaged in the changes, enlisting programme champions to role model the strategies and promote the programme, and demonstrated upper management support such as through participation in the programme, and relevant modifications to policies and practices (e.g. modifying dress codes to support the wearing of more “activity-friendly” footwear).

Increased computerization has meant that time spent in job tasks that required some activity (e.g. walking to the printer, filing papers) has substantially decreased [46]. Rather than postural changes occurring naturally through work tasks, it may be that additional support is needed to promote and maintain such changes. Unstructured breaks, that are chosen or planned by the individual, are preferable to structured breaks (e.g. set time for the breaks); structured breaks may interrupt work tasks and don’t allow for individual variability in posture preferences. Activity substitution is also commonly adopted as a strategy [7]. For example, walking to see a colleague rather than emailing or having standing or walking (rather than sitting) meetings. In addition to potentially increasing levels of incidental activity [47], promotion and visible use of such strategies are likely to be an important component of generating and sustaining a dynamic workplace culture. Potential barriers to implementing these strategies [16, 48, 49] should be identified and, where possible, addressed.

A 2015 review compared the impact of these different strategies and approaches to addressing workplace sitting time, concluding that there was preliminary evidence that sit–stand desks can reduce sitting time at work, but the impacts of information and counselling and policy changes were inconsistent [44]. The review



noted the low quality evidence informing the field to date and highlighted the need for high quality cluster-randomized controlled trials testing the effect of different interventions on sitting time. Such trials are emerging [10] and will provide key guidance for policy and practice in this field.

## 18.4 Key Gaps and Opportunities for Workplace Programmes Addressing Prolonged Sitting

The rapidly accruing evidence base and increasing public awareness of the health impacts of too much sitting has seen strong industry interest in addressing this issue. For example, the Global CMO network identified addressing prolonged sitting through the creation of dynamic workplaces as one of the key recommendations for sustainably improving workplace health [50]. There is an ideal opportunity to capitalize on this strong industry interest to rapidly generate evidence to address the several gaps that remain in this rapidly emerging field. These gaps include:

- Obtaining more detailed understanding of the activity profiles of workers and how they vary across and within occupational sectors as well as across time through the use of objective, postural-based activity monitors
- Gaining clearer understanding of existing policies and practices regarding addressing prolonged sitting across various occupational sectors
- Rigorous, high quality cluster-randomized controlled trial evidence on effectiveness, acceptability, and sustainability across a range of different intervention approaches, including those with low resource implications
- Understanding organizational- and individual-level differences in how programmes are taken up, implemented, and sustained to inform what works best and for whom
- Evidence on the impact of programmes on a range of factors in addition to activity, including knowledge and awareness, organizational culture, policies and practice, health outcomes, and work outcomes to support the business case for uptake into practice
- Evaluation of the cost-effectiveness of interventions and determination of the relative cost-benefits of various strategies
- Understanding the impact of intervention programmes on activity outside of the work setting in relation to compensation and generalization [51]

Addressing these gaps is critical for building the business case for change and providing evidence on return on investment for workplaces. There are several opportunities available to achieve this. For example, the increasing availability, affordability, and sophistication of wearable monitors provide an opportunity to rapidly advance our understanding of activity profiles of individuals and how they vary within and across organizations. Wearable technologies also provide opportunities as an intervention and/or self-monitoring tool and could be utilized as an

affordable adjunct to support intervention messages. Models such as the dynamic sustainability framework [52] provide a foundation to evaluate how interventions are translated into practice and adapted over time to suit the context and the broader ecological system within which they exist. Use of such models will be integral for interpreting the success (or not) of programmes to reduce workplace sitting. As noted above, there are also now cluster-randomized controlled trials underway that will provide rigorous evidence on the effectiveness, acceptability, and sustainability of intervention changes [10, 53, 54]. Finally, a multidisciplinary approach will be needed to maximize change. For example, physical activity researchers could work with architects and town planners to ensure building design codes enable active choices to be the easy choices [55]. It will be critical that the messages to reduce prolonged sitting are consistent across these multiple stakeholders.

## 18.5 Summary

The workplace has been identified as a key setting in which to address prolonged sitting. Exposure to sitting is high across many occupational sectors, and workplace sitting is a major contributor to daily sitting time. Intervention trials targeting prolonged sitting have achieved substantial reductions in sitting time, particularly when the individual physical environment supports regular postural changes such as through the provision of sit–stand workstations. However, several questions and evidence gaps remain to be addressed, including those regarding the sustainability of these changes. With the strong industry interest in this area, there are key opportunities to address the identified gaps, translate research into practice, and generate practice-based evidence. Utilizing a multidisciplinary approach, incorporating a best practice framework, will be critical for achieving sustainable success.

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