



# Prolonged static sitting at work

Health effects and good practice advice

Report

Authors: Kees Peereboom and Nicolien de Langen (vhp human performance, the Netherlands) in cooperation with Alicja Bortkiewicz (Nofer Institute of Occupational Medicine, Łódź, Poland).

Sarah Copsey (EU-OSHA)

Reviewed by Jacqueline Snijders (Panteia, the Netherlands).

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Project management: Sarah Copsey (EU-OSHA)

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## Executive summary

### Introduction

As many jobs become more sedentary, there is mounting evidence linking ill health to a sedentary lifestyle, which has increased the importance of tackling prolonged static sitting in the workplace. This report explores the issue of prolonged sitting at work. This includes the extent of sitting at work, the health effects of prolonged sitting, recommendations for time limits for sitting, and good practical advice and examples on how to avoid and reduce prolonged sitting at work and make work more active and dynamic. It also includes conclusions and pointers for policy-makers. The report aims to take into account the needs of micro and small enterprises (MSEs), and looks at both office and non-office work, gender and ageing issues, and prolonged sitting and schools. The report defines prolonged sitting as being sedentary for more than 2 hours at a time.

A second report, linked to this one, covering prolonged standing <sup>(1)</sup> and three OSHwiki articles <sup>(2)</sup> <sup>(3)</sup> <sup>(4)</sup> provide further information on prolonged sitting, prolonged standing and promoting moving at work.

### Policy background

Although there is no specific occupational safety and health (OSH) policy on sitting at work in the European Union (EU), the general challenge of work-related musculoskeletal disorders (MSDs) has been recognised and prioritised in the EU OSH strategy <sup>(5)</sup>. There are also a number of EU directives on OSH, implemented by EU Member States, that are relevant to preventing risks from prolonged sitting. Linked to an increase in sedentary working, the EU has formulated policy recommendations on promoting physical activity, including at work <sup>(6)</sup>. These recommendations include indicators for Member State actions in the working environment, based on the EU's physical activity guideline <sup>(7)</sup>.

### What is prolonged sitting?

Prolonged sitting can be defined as being sedentary for 2 hours or longer at a time. It has three main characteristics:

- low energy expenditure;
  - a seated body posture;
  - static loading (physical exertion to maintain the same position).

### How much sitting do we do at work?

According to Eurobarometer data from 2013 <sup>(8)</sup>, in the EU 18 % of adults sit for more than 7.5 hours in total during the day, with higher levels typically seen in Scandinavian countries and lower levels in countries such as Italy, Portugal and Spain. A French survey found that adults, on average, sat for

<sup>(1)</sup> EU-OSHA (European Agency for Safety and Health at Work), *Prolonged constrained standing at work: Health effects and good practice advice*, 2021. Available at: <https://osha.europa.eu/en/themes/musculoskeletal-disorders/research-work-related-msds>

<sup>(2)</sup> [https://oshwiki.eu/wiki/Musculoskeletal\\_disorders\\_and\\_prolonged\\_static\\_sitting](https://oshwiki.eu/wiki/Musculoskeletal_disorders_and_prolonged_static_sitting)

<sup>(3)</sup> [https://oshwiki.eu/wiki/Musculoskeletal\\_disorders\\_and\\_prolonged\\_static\\_standing](https://oshwiki.eu/wiki/Musculoskeletal_disorders_and_prolonged_static_standing)

<sup>(4)</sup> [https://oshwiki.eu/wiki/Promoting\\_moving\\_and\\_exercise\\_at\\_work\\_to\\_avoid\\_prolonged\\_standing\\_and\\_sitting](https://oshwiki.eu/wiki/Promoting_moving_and_exercise_at_work_to_avoid_prolonged_standing_and_sitting)

<sup>(5)</sup> European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions — 'Safer and healthier work for all — Modernisation of the EU Occupational Safety and Health Legislation and Policy', COM(2017) 12 final, 10.1.2017, p. 9. Available at: <https://ec.europa.eu/social/BlobServlet?docId=16874&langId=en>

<sup>(6)</sup> EU (European Union), Council Recommendation (EC) No 2013/C 354/01 on promoting health-enhancing physical activity across sectors. Available at: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:354:0001:0005:EN:PDF>

<sup>(7)</sup> EU (European Union), *EU physical activity guidelines*, 2008. Available at: [https://ec.europa.eu/health/sites/health/files/nutrition\\_physical\\_activity/docs/2008\\_eu\\_physical\\_activity\\_guidelines\\_en.pdf](https://ec.europa.eu/health/sites/health/files/nutrition_physical_activity/docs/2008_eu_physical_activity_guidelines_en.pdf)

<sup>(8)</sup> Loyen, A., van der Ploeg, H.P., Bauman, A., Brug, J. and Lakerveld, J., 'European sitting championship: prevalence and correlates of self-reported sitting time in the 28 European Union Member States', *PLoS ONE*, Vol. 11, No 3, 2016, e0149320. Available at: <https://doi.org/10.1371/journal.pone.0149320>. Based on Eurobarometer data collected in 2013.

around 7.5 hours a day, of which 4 hours 10 minutes involved sitting at work <sup>(9)</sup> <sup>(10)</sup>. According to Eurostat data from 2017, 39 % of EU workers carry out their work while sitting down <sup>(11)</sup>. This includes office workers using computers, staff in call centres and vehicle drivers. According to the 2015 European Working Conditions Survey <sup>(12)</sup>, 28 % of workers report sitting almost all the time and 30 % report sitting a quarter to three-quarters of the time. In total, 31 % of women reported sitting almost all the time, compared with 25 % of men. The percentage of people working with computers, laptops or keyboards for all or almost all of the time increased from 17.6 % in 2000 to 30.3 % in 2015. In the 2019 European Survey of Enterprises on New and Emerging Risks, the third most frequently reported risk factor in the EU-27 (61 % of establishments) was prolonged sitting <sup>(13)</sup>.

## Workers at risk

### ▪ Types of work

Office workers are most at risk of prolonged sitting. However, other jobs and work areas involving prolonged sitting include drivers, pilots, crane operators, sewing machine operators, assembly line workers, and those working at service desks and in laboratories, call centres and control rooms. Those working from home may be tempted to work for longer without a break, in what may be poorer ergonomic conditions than those that they have in the office.

### ▪ Women

Women report sitting at work almost all the time more than men <sup>(14)</sup>. They are over-represented in a number of predominantly seated jobs, such as office work and micro-assembly, which are also of a low grade. This may mean that they have a lack of control over how they work, including when they can take breaks to get up and move around. Pregnant women need to avoid prolonged sitting by taking frequent breaks to stand and move around, especially as pregnancy advances.

### ▪ Older workers and workers with chronic musculoskeletal conditions

Prolonged sitting is a particular issue for workers who have developed chronic conditions such as back pain and rheumatic diseases, as long periods of sitting may provoke the pain associated with such conditions. As the workforce ages, there will be more workers with such conditions. In addition, because of the increased sedentary nature of work and a rise in the official retirement age, workers today may have an increased exposure to sedentary work across their life course compared with previous generations of workers. Avoiding prolonged sitting is an issue for sustainable working.

## The health effects of prolonged sitting

Based on a short review of literature, the report presents the cause and health effects of prolonged static sitting in a graphic model. Health effects that have been linked to prolonged sitting include:

- low back pain;
- neck and shoulder complaints;
- type 2 diabetes and cardiovascular disease;
- obesity;
- certain types of cancers, in particular breast cancer and colon cancer;

<sup>(9)</sup> Saidj, M. et al., 'Descriptive study of sedentary behaviours in 35,444 French working adults: cross-sectional findings from the ACTI-Cités study', *BMC Public Health*, Vol. 15, No 379, 2015. Available at: <https://doi.org/10.1186/s12889-015-1711-8>

<sup>(10)</sup> Debrosses, K., 'Le Comportement sédentaire au travail: de quoi parle-t-on?', *Hygiène et sécurité du travail*, No 252, 2018. Available at: <http://www.inrs.fr/dms/inrs/CataloguePapier/HST/TI-DC-22/dc22.pdf>

<sup>(11)</sup> Eurostat, 'Persons performing physical activity when working by type of activity, most frequent activity status, quantile and degree of urbanization [ilc\_hch06]', last update: 24 February 2020. Available at: <https://data.europa.eu/euodp/en/data/dataset/rE6263Ct1IFXmwmOHizAA>

<sup>(12)</sup> Eurofound, *Sixth European Working Conditions Survey — Overview report (2017 update)*, Publications Office of the European Union, Luxembourg, 2017. Available at: <https://www.eurofound.europa.eu/surveys/european-working-conditions-surveys/sixth-european-working-conditions-survey-2015>

<sup>(13)</sup> EU-OSHA (European Agency for Safety and Health at Work), 'Third European Survey of Enterprises on New and Emerging Risks (ESENER 3)', 2019. Available at: <https://osha.europa.eu/en/publications/third-european-survey-enterprises-new-and-emerging-risks-esener-3/view>

<sup>(14)</sup> Eurofound, *Sixth European Working Conditions Survey — Overview report (2017 update)*, Publications Office of the European Union, Luxembourg, 2017. Available at: <https://www.eurofound.europa.eu/surveys/european-working-conditions-surveys/sixth-european-working-conditions-survey-2015>

- mental health issues;
- premature death.

Regarding diabetes and cardiovascular disease, when you sit you hardly use your leg muscles. However, muscle activity in the large leg muscles is important for getting your blood pumping.

#### ▪ **Sitting and MSDs**

Exposure to whole-body vibration when sitting, for example in vehicles, increases the risks of low back problems and other MSDs, especially if postures are constrained, awkward or poor.

In addition to low back pain, sitting work can result in upper limb disorders when combined with repetitive work, static muscle load, awkward postures and having to apply force or reaching.

## Regulations and guidelines

### ▪ **Regulations**

Although prolonged sitting is not specifically covered by any European safety and health regulations, in accordance with EU directives, all employers in the EU have general duties to carry out risk assessments and put in place preventive measures based on the assessments<sup>(15)</sup>. In selecting the measures, they should avoid risks if possible and adapt work to the worker. Any workers who habitually use display screen equipment as a significant part of their normal work are covered by regulations on display screen equipment<sup>(16)</sup>, which include providing them with a suitable workstation and chair, and periodic breaks or changes of activity to reduce time spent on display screen work. Directives on work equipment<sup>(17)</sup>, machinery<sup>(18)</sup>, vibration<sup>(19)</sup> and manual handling<sup>(20)</sup> may all be relevant to improving the health and ergonomics of seated work.

### ▪ **Guidelines for sitting at work**

Based on the guidelines reviewed in the report, the following is recommended:

At work:

- Spend 50 % or less of your working day sitting.
- Avoid sitting for any length of time — aim to get up at least every 20-30 minutes.
- Always get up for at least 10 minutes after 2 hours of sitting — sit less whenever possible.
- Do not exceed 5 hours of sitting at work each day.
- Work in an active manner and change position between sitting, standing and walking.

Always maintaining a posture that is ‘as upright as possible’ is no longer considered ideal and is being replaced by the concept of ‘dynamic sitting’, whereby sitting positions are continuously altered. In addition, the opposite of sitting is not standing — it is moving. So, although a sit-stand table to alternate between sitting and standing can be useful, it is not enough, as you are still alternating between two static postures.

## Prevention practice

It is important to change posture as much as possible. The general goal is to promote a dynamic, active workstyle: moving more and sitting less. Workers should be able to adopt a variety of positions when working and preferably be able to vary between sitting, standing and moving around.

### ▪ **Prevention strategy to avoid prolonged sitting**

As with all areas of risk management, actions to avoid prolonged sitting should be implemented within a strategy that takes a systematic approach, uses risk assessment and follows a hierarchy of prevention measures. The prevention strategy should ensure good workplace ergonomics and worker participation and include specific measures to limit prolonged sitting and promote movement at work. At the organisational level, supportive workplace policies and practices are needed. At the environmental level,

<sup>(15)</sup> <https://osha.europa.eu/en/legislation/directives/the-osh-framework-directive/1>

<sup>(16)</sup> <https://osha.europa.eu/en/legislation/directives/5>

<sup>(17)</sup> <https://osha.europa.eu/en/legislation/directives/3>

<sup>(18)</sup> <https://osha.europa.eu/en/legislation/directives/directive-2006-42-ec-of-the-european-parliament-and-of-the-council>

<sup>(19)</sup> <https://osha.europa.eu/en/legislation/directives/19>

<sup>(20)</sup> <https://osha.europa.eu/en/legislation/directives/6>



changes to the workspace can encourage less sitting and more movement. At the individual level, workers need to be encouraged to work more dynamically and move more, for example taking microbreaks to stretch and using the stairs. The report includes a graphic to assist in deciding whether work should be carried out sitting or standing.

The prevention strategy should include the following:

- Provide a **suitable ergonomic workstation** and suitable environmental conditions as a starting point, including an appropriate chair, stool, table and driver's seat. **Adjustability** is important to allow postural change and comfortable working, for example adjustable chairs that also facilitate postural change and 'dynamic sitting', adjustable workstation height, sit-stand workstations and cabins that can swivel.
- **Organise work to limit sitting and promote movement:** balance the tasks to be performed and provide possibilities for active work, task rotation, job enrichment, minibreaks and individual control options. Choose an approach directed at active/dynamic work. Give workers sufficient control over their work so that they can alter how they work and take a break when needed.
- **Organise the work environment and culture to promote movement**, for example putting bins and printers in a common area and scheduling time for stretching during meetings.
- Encourage consultation and **active worker involvement** — this is important for all aspects of the strategy. By working together, employers and workers can find practical ways to promote more active ways of working.
- **Promote healthy behaviour**, for example through raising awareness of and providing training on prolonged sitting. This measure will be ineffective unless implemented together with the other abovementioned elements.
- **Implement organisational policies and practices** to make sure it happens in practice.

It is important to assess the full range of risks factors, including prolonged sitting, poor ergonomic postures, repetitive movements, manual handling and exposure to whole-body vibration, and address them together in a comprehensive way.

#### ▪ **Tips and examples of workplace practice**

The report contains a number of tips for making workplaces more active, such as having walking meetings, using cordless phones so that workers can walk around while talking, motivating workers to take breaks, move and stretch, using computer apps that give break and stretching reminders. The report also includes tips for drivers (e.g. to vary posture as much as possible while driving) and for teleworkers (e.g. plan short exercise breaks, do a small household chore to interrupt sitting).

Often workplace interventions are simple and low cost. Some measures used in the practical examples and sectoral guidance presented in the report include the following:

- Supermarket checkouts: allow operators to swap between sitting and standing when they need to.
- Casino croupiers: allow a maximum of 15 minutes sitting and 30 minutes standing and a rest of 15 minutes after 45 minutes at the gaming table.
- Petrol station till: allow workers to alternate between sitting and standing and provide an adjustable seat and screen.
- Factory production line: introduce microbreaks and task rotation.
- **School ergonomics and promoting movement in schools**  
Primary school pupils spend 30 hours per week sitting at their desks <sup>(21)</sup>. This is in addition to time spent sitting outside school, for example in front of screens at home. Low back pain has been associated with school furniture features, but schools are in a position to encourage pupils to move more. This includes using activity-based methods during classes, and facilities and school grounds that encourage physical activity and active school commutes.

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<sup>(21)</sup> BAuA (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin), *The ups and downs of sitting – Sitting at work and elsewhere*, BAuA, Dortmund, 2008. Available at: [https://www.baua.de/DE/Angebote/Publikationen/Praxis/A66.pdf?\\_\\_blob=publicationFile&v=2](https://www.baua.de/DE/Angebote/Publikationen/Praxis/A66.pdf?__blob=publicationFile&v=2)

## Conclusions for the workplace

Prolonged static sitting is related to various serious health problems, including cardiovascular problems, type 2 diabetes and low back pain. Our bodies need movement, and avoiding static postures is part of making work sustainable. Although many jobs in Europe involve prolonged static sitting, much can be done to organise work to limit prolonged sitting and facilitate more movement and physical activity at work, to ensure good ergonomics and to make sitting work more dynamic. Important factors identified in this report include the following:

- Overall, 2 hours is considered the maximum time for continuous sitting as health risks may occur, in particular, when this 2-hour limit is exceeded on a regular basis. Within this timeframe, getting up every 20-30 minutes is important.
- Our next posture is the best posture. This means changing position between sitting, standing and walking. It also means varying posture as much as you can when you are sitting — ‘dynamic sitting’ and doing occasional stretching exercises, either sitting or getting up.
- Prolonged sitting should not just be replaced with prolonged standing, as prolonged standing is also associated with serious health effects. The approach can be summed up as ‘sit when you need to, stand when you want to and walk or move when you can’<sup>(22)</sup>.
- The general approach to avoiding prolonged sitting at work should be through a prevention strategy that ensures good workplace ergonomics and worker participation and that includes specific measures to limit prolonged sitting and promote movement at work within the strategy.
- As with all MSDs, early reporting of problems related to prolonged sitting is important.

## Pointers for policy-makers

- **General**
  - Many workplace interventions are simple and low cost; however, employers must be provided with information to understand the basics.
  - Guidelines on workstations and active working are needed, preferably sector-specific guidelines. This includes simple, sector-specific resources for MSEs.
  - More attention needs to be given to preventing prolonged sitting in non-office work.
  - Improved research tools are needed, especially questionnaires, to assess and investigate prolonged sitting.
- **OSH and workplace health promotion policy**
  - Prolonged sitting should be included in any OSH risk assessment that is carried out.
  - Avoiding prolonged sitting should become part of all workplace health promotion campaigns.

### Gender and age

More women than men report that their work involves sitting almost all the time. Women are over-represented in a number of predominantly seated jobs (office work, micro-assembly), which are also of a low grade.

- More research and guidance are needed on the health effects and risk prevention of prolonged sitting in jobs carried out by women. This includes when prolonged sitting is combined with other musculoskeletal risks.
- More attention needs to be given to the types of sedentary work that women do.

With regard to age, studies show that the level of prevalence of MSDs increases with age; this is partly due to the length of cumulative exposure to MSD hazards over the work-life course.

- For workers aged over 65 years, there is a need to develop an understanding of the impact of the extended duration of exposure owing to their extended working lives.
- More research is needed on moving older workers to less demanding predominantly seated occupations without exposing them to prolonged sitting.

<sup>(22)</sup> IWH (Institute for Work and Health), ‘Sitting or standing? Which is best?’, 2018. Available at: <https://www.iwh.on.ca/videos-and-presentations/sitting-or-standing-which-is-best>

- **Public health policy**
  - A combined approach aimed at reducing seated time both at work and at home and being more active is needed. More collaboration between OSH and public health in this area is needed to achieve this.
  - Public health programmes should include advice for the workplace on making work more dynamic and limiting prolonged sitting, and healthcare professionals should be educated and informed so that they can provide appropriate advice.
  - The cause-effect relationship between sitting and health effects is not fully understood. More research is needed in this area.
- **Schools**
  - Education about prolonged sitting and actions to limit it should take place in schools.
  - More attention needs to be given to the ergonomics of classrooms.

## Overall conclusions

Tackling prolonged sitting at work is part of making work more sustainable as well as part of tackling sedentary lifestyles. Work should provide good ergonomic working conditions, facilitate postural change between sitting, standing and walking and 'dynamic sitting', whereby sitting positions are continuously altered, and promote more physical movement at work. This should be part of a combined prevention and health promotion strategy. There are many simple and low-cost steps that MSEs can easily take to reduce prolonged sitting at work and increase movement.

### **Remember:**

Our next posture is the best posture! Sit when you need to, stand when you want to, and walk or move when you can.

# 1 Introduction

Prolonged sitting occurs in many types of working situations, including among workers carrying out industrial types of work at assembly lines, cashiers in supermarkets and control room and visual display unit (VDU) workers. As many jobs become more sedentary, there is mounting evidence linking ill health to a sedentary lifestyle. The health effects include both musculoskeletal disorders (MSDs) and non-MSD complaints, diseases, such as diabetes and coronary heart disease, obesity, depression and even premature death. This increases the importance of tackling prolonged static sitting in the workplace.

This report explores the issue of prolonged sitting at work. Prolonged sitting is a type of sedentary behaviour and the report defines prolonged sitting as being sedentary for more than 2 hours at a time.

The report explores the extent of sitting at work, the health effects of prolonged sitting, recommendations for time limits for sitting, and good practice advice and examples on how to avoid and reduce prolonged sitting at work and make work more active and dynamic. It explores the cause-effect relationships between sitting and both MSDs and non-MSD health effects, as understanding these will inform correct prevention practice. It also includes conclusions and pointers for policy-makers. The report aims to take into account the needs of micro and small enterprises (MSEs), and looks at both office and non-office work, gender and age issues, and prolonged sitting in schools. The report aims to help support the successful avoidance of prolonged static sitting and explains why 'Our next posture is the best posture'.

Although the report primarily focuses on MSDs associated with prolonged static sitting (see Box 1), given the increase in evidence concerning the importance of non-MSD health effects, it is important to take account of all the health effects together.

This report is part of a larger project on MSDs, static postures and work that includes a second report on prolonged constrained standing (EU-OSHA, 2021a), three OSHwiki articles — on prolonged static sitting (de Langen and Peereboom, 2020a), promoting exercise at work (de Langen and Peereboom, 2020b) and prolonged static standing (de Langen and Peereboom, 2020c) — and an information sheet on making work more active (EU-OSHA, 2021b) together with an infographic <sup>(23)</sup> and a PowerPoint presentation <sup>(24)</sup>. The two reports, in turn, are part of a larger research activity on MSDs <sup>(25)</sup>.

## Box 1 Sitting and MSDs

All of our postures and movements are dependent on the functioning of the musculoskeletal system, which is complex and made up of muscles, joints, tendons, ligaments, nerves, cartilage, bones and blood vessels. Impairments to the system are known as musculoskeletal disorders (MSDs). Work-related MSDs are mostly cumulative, resulting from repeated exposure to loads at work over a period of time, such as awkward or fixed postures, repetitive work or handling heavy loads. Sitting is an activity that we perform using our musculoskeletal system, and prolonged sitting requires the muscles to hold the trunk, neck and shoulders in a fixed position (EU-OSHA, 2007).

## 1.1 Background

### 1.1.1 Policy context

Although there is no specific occupational safety and health (OSH) policy on sitting at work in the European Union (EU), the general challenge of work-related MSDs was recognised and prioritised in the EU's Strategic Framework on Health and Safety at Work 2014-2020 (EC, 2014a). The framework defines MSDs as one of the main challenges to address. It recommends that 'specific attention should be given to addressing the impact of changes in work organisation in terms of physical and mental health'. It also underlines the need to improve the 'prevention of work-related diseases by tackling existing, new and emerging risks'.

<sup>(23)</sup> <https://osha.europa.eu/en/tools-and-publications/infographics/get-moving-work>

<sup>(24)</sup> <https://osha.europa.eu/en/publications/move-msds-and-avoiding-prolonged-static-sitting-work/view>

<sup>(25)</sup> <https://osha.europa.eu/en/research-work-related-msds>

In response to an increase in sedentary behaviour, in 2008 the EU produced guidelines recommending policy actions to support physical activity, including at work (EU, 2008). In 2013, the Council of the European Union produced a recommendation for Member States on promoting health-enhancing physical activity, which also included the workplace (EU, 2013). These recommendations include indicators for Member State actions in the working environment. In support of these policy actions, a study published by the European Commission provides examples and advice on physical activity programmes at work (EC, 2017). In 2020, the World Health Organisation's (WHO's) evidence-based guidelines on physical activity were expanded to become guidelines on physical activity and sedentary behaviour (WHO, 2020).

Tackling prolonged sedentary work to help keep workers healthy throughout their working life will contribute to allowing them to work for longer. This in turn contributes to addressing the long-term effects of demographic ageing, in line with the Europe 2020 strategy's objectives for smart, sustainable and inclusive growth (EC, 2010).

There are also a number of EU directives on OSH, implemented by EU Member States, that are relevant to preventing risks from prolonged sitting. These are described in Chapter 6.

### **1.1.2 Background to this report**

This report builds on previous European Agency for Safety and Health at Work (EU-OSHA) reports on MSDs and on OSH for an ageing workforce. EU-OSHA (2010) concluded that 'prevention also needs to address the trend towards sedentary work, more static work postures including prolonged standing and sitting and lack of variety of tasks. Besides the provision of ergonomic workstations and equipment, particular attention should be paid to work organisational measures: For example, more emphasis should be given to ensuring variation in tasks especially where repetitive and monotonous tasks are being carried out and where workers have a low influence on the pace of work and how their work is organised. Effective examples of prevention should be screened to identify successful work organisational measures.' EU-OSHA (2016a) research also stressed the importance of preventing exposure to risks and promoting well-being throughout the working life in order to make work sustainable. Tackling prolonged sedentary work is part of this.

## **1.2 Aim and methodology**

### **1.2.1 Aim**

The aim of this report is to increase understanding of the health effects of prolonged sitting at work and provide advice on practical measures that can be taken to tackle prolonged sitting at work. By examining practice, guidance and recommendations, and providing practical information it aims to inform workplace interventions, including what MSEs can do, but also to inform policy-makers and the research community. The outcome should improve understanding of what the issues are and what employers and other stakeholders can do in practice.

The report explores the following:

- the extent of prolonged sitting at work;
- health effects and the cause-effect relationship between prolonged sitting and ill health;
- guidelines on prolonged static sitting, to inform the prevention of health problems;
- preventing prolonged static sitting, introducing a dynamic work style and the essential aspects of good workplace design, providing simple suggestions for employers and practical examples;
- prolonged sitting in both office and non-office work, associated gender and age issues, and prolonged sitting in schools.

### **1.2.2 Methodology**

To explore the relationship between ill health conditions and prolonged sitting, maximum 'safe' sitting times and successful measures to limit prolonged sitting and reduce the associated health effects, a study was performed on 107 selected sources of information (see Appendix 2). The results were

incorporated into a model of the cause-effect relationship between prolonged sitting and both MSD and non-MSD health effects. Regarding prevention practice and guidelines, reference was also made to grey literature and campaigns.

An overview of good practice recommendations in relation to avoiding prolonged sedentary work and promoting dynamic sitting while working was made, and examples of prevention practice were selected for inclusion in the report based on their relevance to MSEs and with the aim of covering a range of different types of work.

Further details of the methodology, including the search strategy, are given in Appendix 1.

## 2 Definitions of sedentary behaviour and prolonged sitting

Prolonged sitting can be defined as being sedentary for 2 hours or longer at a time. It has three main characteristics:

1. low energy expenditure;
2. a seated body posture;
3. static loading (physical exertion to maintain the same position).

### Sedentary behaviour

Sitting is a type of sedentary behaviour: sedentary behaviour is characterised by activities that involve low energy consumption in combination with a sitting or lying position (Kroemer and Grandjean, 1997). Based on consensus in both the scientific and grey literature, prolonged sitting can be defined as being sedentary for 2 hours or longer at a time.

The WHO (2020) defines sedentary behaviour as follows:

- Any waking behaviour characterised by an energy expenditure of 1.5 metabolic equivalents (metabolic equivalent of task — MET) or lower while sitting, reclining or lying. Most desk-based office work, driving a car and watching television are examples of sedentary behaviours; these can also apply to those unable to stand, such as wheelchair users.

Table 1 provides an indication of different types of physical behaviour and the associated energy expenditure (MET) levels.

**Table 1 Physical behaviour and associated energy expenditure level**

Physical activity	MET*
Sitting and writing, desk work, using a computer	1.5
Light-intensity activities	< 3
Moderate-intensity activities	3 to 6
Walking 3.0 mph (4.8 km/h)	3.3
Sweeping or mopping floors, vacuuming carpets	3 to 3.5
Playing a game of tennis doubles	5.0
Vigorous-intensity activities	≥ 6
Bicycling, on a flat surface, 11 mph (18 km/h), light effort	6.0
Swimming of moderate to hard intensity	8 to 11
Jogging, 5.6 mph (9.0 km/h)	8.8

Source: Ainsworth et al., 1993, 2011

\*MET: a physiological measure expressing the intensity of physical activities. One MET is equivalent to the energy expended by an individual while seated at rest.

There are various lay terms in use to refer to sedentary behaviour (see Box 2).

## Box 2 Lay terms used to refer to sedentary behaviour

A lay person's terms for referring to sedentary behaviour include:

1. physical inactivity;
2. stationary behaviour;
3. sedentary behaviour;
4. screen time;
5. non-screen-based sedentary time;
6. sitting;
7. reclining;
8. lying;
9. sedentary behaviour pattern;
10. sitting for long bouts/without breaks/without interruptions, etc.

## 2.1 Prolonged sitting

According to studies in the area, prolonged sitting has three main characteristics of importance:

1. low energy expenditure;
2. a seated body posture;
3. a static type of load.

The types of sitting covered by such studies include:

- sitting while using a chair or any other kind of furniture (bench, school furniture);
- sitting on any type of surface;
- sitting while using a saddle seat/stool; in this case, more than 50 % of the weight is taken off the legs (or a minimum of 50 % of weight rests on the buttocks);
- sitting in or on any kind of vehicle while operating or driving the vehicle.

The following statements apply to the basic mechanisms of the underlying physiological processes that occur while performing light-intensity activities while being subject to prolonged sitting:

- Prolonged sitting in a static position leads to higher muscle tension — especially when combined with computer work or repetitive work — and this leads to poorer circulation.
- Because of poorer circulation, 'waste material' (acid) gathers within muscles; it is more difficult to remove this waste material and this leads to discomfort being experienced.
- Poor circulation may lead to swelling in the legs, especially around the ankles.
- Brain function slows down because less oxygen is supplied to the brain owing to poorer circulation.
- The key mechanisms for burning off fat shut off the moment we sit. So, over time, weight gain may occur.
- Muscles that are not used actively lose strength and mass, and the fibre composition changes.
- Every 2 hours spent sitting raises blood sugar levels and reduces 'good' cholesterol levels by 20 %.

Although occasionally sitting for slightly too long is unlikely to have a serious impact, the above processes will take place if *every* (working) day is spent *mostly* sitting. Many studies reviewed for this report (see Appendix 2) describe negative health effects occurring, in particular, from a daily level of 2 hours' continuous sitting upwards. Consequently, many guidelines use the 2-hour mark as a maximum for continuous sitting. It is important to note that negative health effects may also occur when an individual sits for fewer than 2 hours at a time. Therefore, the prevention practices described in this report should be applied particularly when workers sit for more than 2 hours a day at work, but they can also be applied for those who sit for fewer than 2 hours. The health effects of prolonged sitting are covered further in Chapter 4 and guidelines for maximum sitting are covered further in Chapter 6.



### 3 The extent of sitting

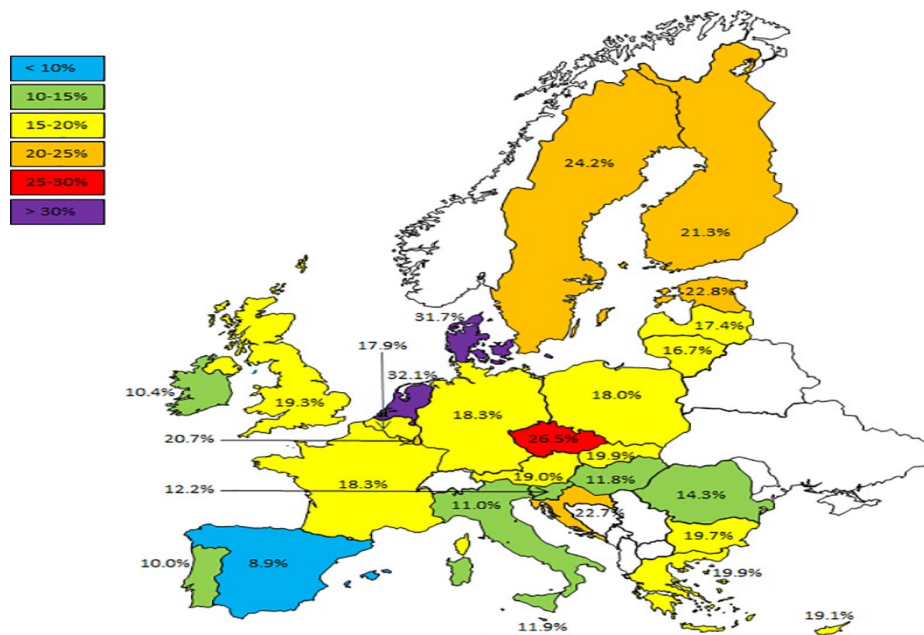
This chapter examines how much sitting is done both in general and at work and examines trends in sitting, including among schoolchildren.

#### 3.1 How much sitting do we do on a daily basis?

A Eurobarometer survey from 2013 on sport and physical activity (EC, 2014b; Lakerveld et al., 2017) asked respondents about the amount of time they spent sitting on a usual day. A little over 4 in every 10 respondents (43 %) said they sat for between 2 hours 31 minutes and 5 hours 30 minutes, nearly 39 % reported sitting for more than 5 hours 30 minutes, 18.5 % for more than 7.5 hours and 12 % for more than 8.5 hours on a usual day.

In their study on prolonged sitting, Loyen et al. (2016) further analysed the 2013 Eurobarometer data of respondents sitting for more than 7.5 hours a day. The highest levels of prolonged sitting were seen in adults from the Netherlands, Denmark and Czechia, whereas respondents in Spain and Portugal were least likely to report sitting for more than 7.5 hours a day (Figure 1). In terms of employment, levels of sitting were highest among white-collar workers with a high educational background.

Figure 1 The distribution of the proportion of adults reporting sitting for more than 7.5 hours per day across the European Union Member States (EU-28)



Source: © Loyen et al., 2016

In a previous study using data on sitting from the 2005 Eurobarometer survey, which covered 32 European countries, the average self-reported weekday sitting was 5-6 hours daily (Bennie et al., 2013). Self-reported daily sitting times varied extensively between countries. The lowest daily sitting times were reported in the south (Malta and Portugal: mean averages of 3-4 hours a day) and parts of eastern Europe (Romania and Hungary: mean averages of 3-4.5 hours a day). The highest daily sitting times were reported in the northern European countries (Germany, Benelux and Scandinavia: mean averages of 5.5-6.5 hours a day). According to the 2005 data, high self-reported sitting times were most prevalent among men, those with bad health, younger age groups, adults with low physical activity levels and those with higher levels of education (Bennie et al., 2013).

Although self-reported sitting times may not be accurate, other sources show the same levels of magnitude for sitting times as the Eurobarometer study:

- Adults in the United States: 26 % sit for more than 8 hours per day (Ussery et al., 2018);
- in the United Kingdom, people sit for 8.9 hours each day (work and non-work combined) <sup>(26)</sup>;
- Canadians sit for almost 10 hours a day on average <sup>(27)</sup>;
- Dutch workers sit, on average, more than 8 hours a day (TNO, 2016).

### 3.2 How much sitting do we do at work?

According to Eurostat data from 2017, 39 % of EU workers carry out their work while sitting down (Eurostat, 2021). This includes office workers using computers, staff in call centres and vehicle drivers. Within these EU averages, there are variations in the different Member States. For example, the majority of people employed in the Netherlands (55 %), Germany (54 %) and Luxembourg (52 %) spent their working time mostly sitting down. According to the 2015 European Working Conditions Survey (EWCS) (Eurofound, 2017), 28 % of workers report sitting almost all of the time and 30 % report sitting a quarter to three quarters of the time.



A French survey of 35,000 adults found that, on a normal workday, they were seated on average for 7 hours 28 minutes, of which 4 hours 10 minutes (56 %) was spent sitting at work. A further 1 hour 6 minutes (15 %) was spent sitting while travelling and 2 hours and 11 minutes (29 %) was spent sitting during leisure time (Saidj et al., 2015; Debrosses, 2018). In Australia, 81 % of workers report exposure to prolonged sitting at work and 50 % report sitting often or all of the time at work (Straker et al., 2016).

It appears that women are more likely to sit at work than men in the EU. In total, 31 % of women reported sitting almost all of the time, compared with 25 % of men (Eurofound, 2017). Table 2, based on data from the EWCS (Eurofound, 2015), shows a correlation between workers reporting MSDs and also reporting exposure to certain types of work, such as sitting, standing and VDU work. A gender difference is seen, with more women reporting MSDs being exposed to sitting and VDU work than men. The reverse is true for standing work. Risks caused by prolonged sitting are often combined with risks from repetitive work and VDU work.

<sup>(26)</sup> <http://www.getbritainstanding.org/>

<sup>(27)</sup> <http://getcanadastanding.org/>

**Table 2 Type of exposure reported by workers with MSDs at least 25 % of the working time**

	Female workers	Male workers
Sitting	60 %	56 %
Standing	69 %	75 %
VDU work	59 %	52 %
Repetitive work	68 %	68 %

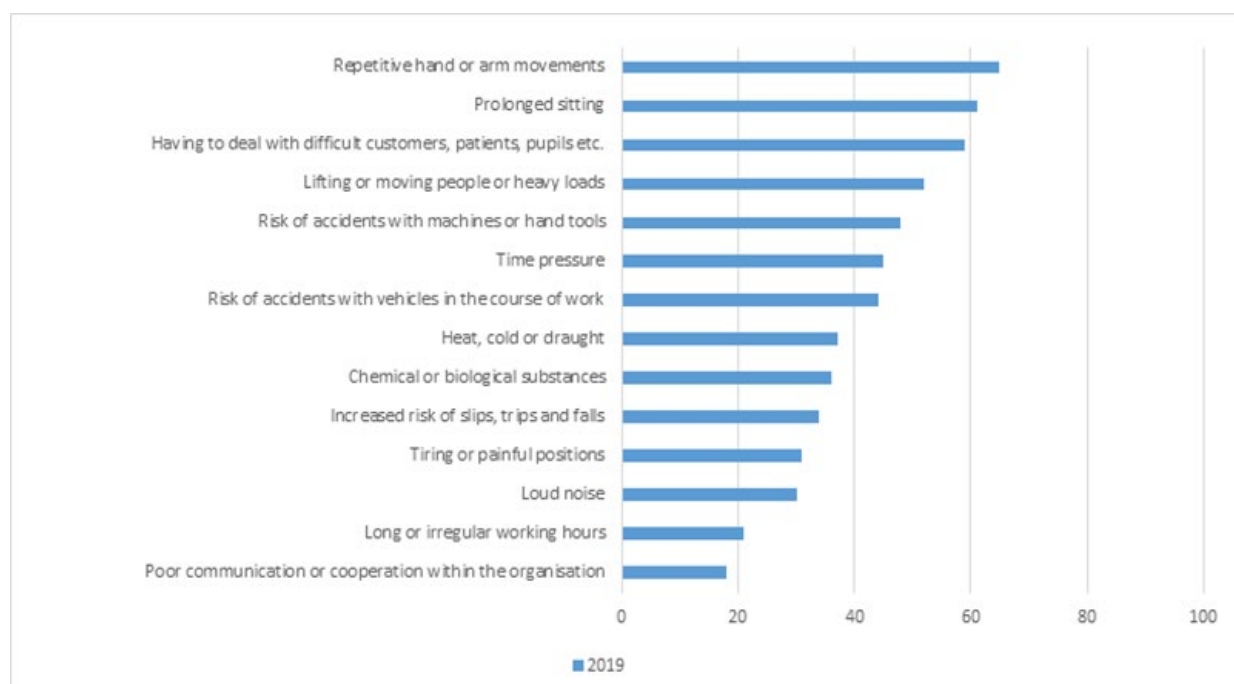
Source: Sixth European Working Conditions Survey (Eurofound, 2015).

Unsurprisingly, the French study found that sitting times at work varied by type of occupation. Average sitting time in sedentary occupations was 6 hours 13 minutes at work, whereas for heavy manual work average sitting time at work was 43 minutes (Saidj et al., 2015; Debrosses, 2018). Similarly, the analysis of the 2013 Eurobarometer data found that white-collar workers and managers were significantly more likely to report sitting for more than 7.5 hours a day than manual workers (Loyen et al., 2016). The German Federal Institute for Occupational Safety and Health (Bundesanstalt für Arbeitsschutz und Arbeitsmedizin — BAuA) estimates that an average office worker spends 80,000 hours of their working life seated (BAuA, 2008a).

Enterprises also report that prolonged sitting is a concern. EU-OSHA’s European Survey of Enterprises on New and Emerging Risks (ESENER) asks establishments about their current management of OSH. In the 2019 survey, the second most frequently reported risk factor in the 27 Member States of the EU (EU-27) (61 % of establishments) was prolonged sitting (EU-OSHA, 2019a) (Figure 2). This varies by country (Figure 3). By sector, it was reported most frequently by establishments in financial and insurance activities (93 % of establishments in the sector in the EU-27), information and communication (92 %) and public administration (91 %) (EU-OSHA, 2019a).

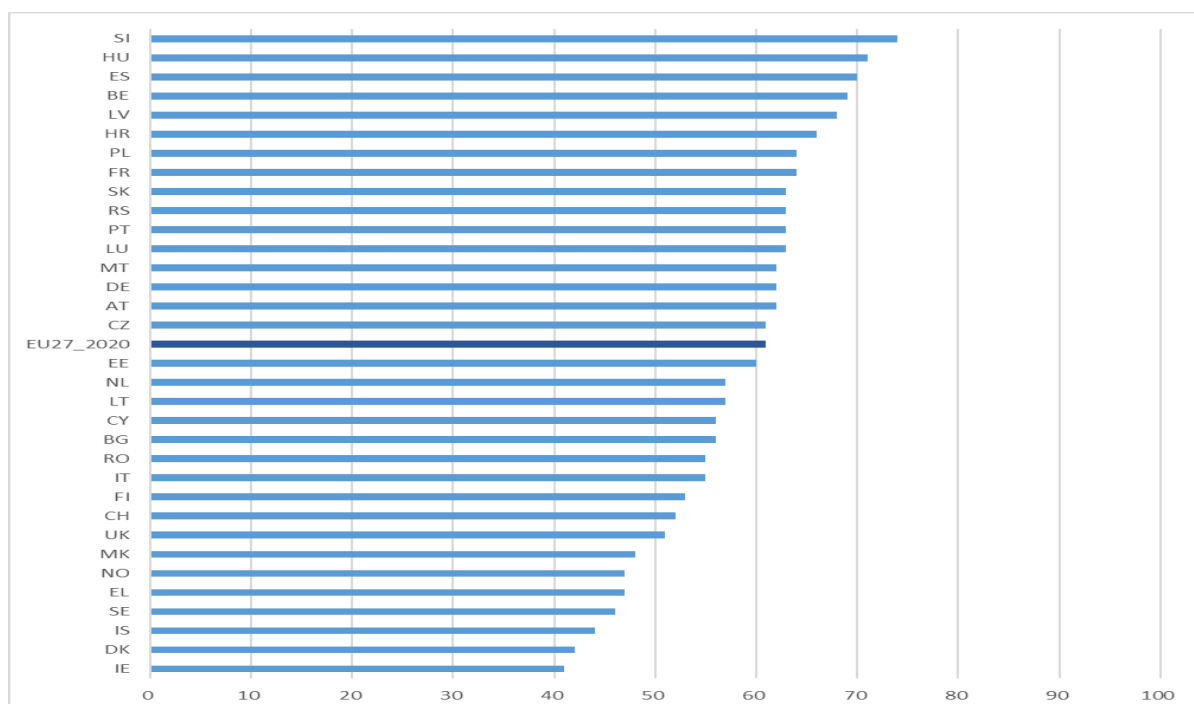
The data from these studies and reports underline the need to address prolonged sitting at work for the health and well-being of the workforce.

**Figure 2 Risk factors present in workplaces (% of establishments), EU-27, 2019**



Source: ESENER 2019 (EU-OSHA, 2019a)

**Figure 3 Percentage of establishments (per country, EU-27) reporting the presence of prolonged sitting as a risk factor in their workplace**



Source: ESENER 2019 (EU-OSHA, 2019a)

### 3.3 Trends related to prolonged sitting

Physical demands in the workplace have undergone far-reaching changes during the last century, and this process is still in progress. In general, much physical labour has been eliminated in the industrialised part of the world; this is strongly related to the increase in sedentary work.

EU-OSHA concluded in 2010 that prolonged standing and sitting are a significant and underestimated risk and that there is a trend towards static work postures (EU-OSHA, 2010, p. 22). The report found that: 'Static work and prolonged standing and sitting are on the increase. New working methods, but also increased use of new technologies, have given rise to an increased exposure to prolonged sitting and standing, with a trend to more static work. This goes hand in hand with an increase in specific occupational diseases, for example neurological diseases linked to the use of computers' (EU-OSHA, 2010, p. 159).

Mainly due to increased computer use and other technical developments (robotics, cobotics<sup>(28)</sup>, internet of things, and an increase in the use of screen-based devices such as tablets and smartphones), many workers find themselves sat at their desks and workstations for prolonged periods of time. For example, previously it was still necessary to move around in the office to file and retrieve documents, now this just requires a click of the mouse. In recent decades, there has been a shift in the activity profile of workers from physical activity to cognitive work. For example, automation has changed many physical tasks to monitoring work.

Sedentary-orientated jobs have increased by 83 % since 1950 (Gremaud et al., 2018). In particular, in recent decades the amount of screen work has increased, and this increase will continue. According to the EWCS, the percentage of people working with computers for most of their working day increased from 17.6 % in 2000 to 28.8 % in 2010, with a further increase to 30.3 % in 2015 (proportion working all or almost all of the time with computers, laptops, smartphones, etc.) (Eurofound, 2017). At the same

<sup>(28)</sup> Cobotics comes from combining the words cooperation and robotics and refers to robots and people working together so that the robot increases human ability instead of replacing it.

time, looking at the 28 EU countries at the time, Eurostat (2020) reported an increase in the percentage of workers working with computers employed in companies with 10 or more employees between 2010 and 2018. Some examples of this trend are given in Table 3. (More information on this can be found in the OSHwiki article on MSDs and VDU tasks by Petreanu et al., 2020.)

**Table 3 Percentage of workers working with computers employed in companies with 10 or more employees in 2010 and 2018 in EU-28**

	2010	2018
<b>28 EU Member States</b>	<b>52 %</b>	<b>56 %</b>
Examples of Member States		
Belgium	68 %	64 %
Bulgaria	24 %	31 %
Estonia	46 %	50 %
Finland	71 %	77 %
Greece	40 %	42 %
Hungary	39 %	49 %
Italy	43 %	54 %
Netherlands	64 %	73 %

Source: Eurostat, 2020

Following these developments in the nature of work, the majority of today's occupations in the EU are associated with a low overall energy demand and, when work is demanding, a local, often monotonous load in specific muscles tends to constitute the strain. Therefore, on one hand, the energy demand of the work is well below that recommended for a healthy lifestyle, but, on the other hand, certain physically demanding tasks may create an enhanced risk of developing MSDs.

Prolonged sitting at work is now an occupational health risk that is on the increase, and new technologies, digitalisation and automation are likely to make it possible for more work to be carried out seated. It is therefore increasingly important that work is organised in a way that avoids prolonged sitting in constrained postures.

### 3.4 Sitting and schoolchildren

School pupils and students are the future workforce, and schools are in a position to provide risk education and promote health and physical activity among pupils; however, evidence suggests that more needs to be done to address sedentary behaviour in schools.

A review of over 230 research studies examined the relationship between sedentary behaviour and health indicators in school-aged children and young people aged 5-17 years (the health indicators included body composition, fitness, metabolic syndrome and cardiovascular disease, self-esteem, pro-social behaviour and academic achievement). The findings included the following (Tremblay et al., 2011):

- Television (TV) watching was the most common measure of sedentary behaviour.
- There is a relationship between increased sedentary behaviour and unfavourable health outcomes.
- Watching TV for more than 2 hours a day was associated with unfavourable body composition (percentage of body weight that is fat compared with other body tissue), decreased fitness, lower scores for self-esteem and pro-social behaviour, and decreased academic achievement.

- Lowering sedentary time leads to reductions in body mass index.
- A large body of evidence from these studies indicates that decreasing any type of sedentary time is associated with decreasing health risks in children and young people aged 5-17 years.
- The evidence suggests that daily TV viewing in excess of 2 hours is associated with reduced physical and psychosocial health.

Over a decade ago there were already reports of extended sitting and musculoskeletal pains among school children. Regarding schoolchildren, according to the BAuA in a report from 2008, primary school pupils were spending roughly 30 hours a week sitting at desks in the classroom. This was in addition to time spent sitting outside school, for example in front of screens at home. Children at nursery school could stay seated for 5-6 hours, and this could be as high as 8-9 hours for schoolchildren. One in three primary school pupils occasionally complained about pains in the small of the back, and the number of cases of posture-related damage among nursery school children had doubled since 1945, from 20 % to 40 %.

Murphy et al. (2007) found associations between ergonomics and other factors and back and neck pain among schoolchildren. In a survey of schoolchildren aged 11-14 years, 27 % reported having neck pain, 18 % reported having upper back pain and 22 % reported having low back pain. Neck pain was significantly associated with school furniture features. Upper back pain was associated with school bag weight (3.4-4.45 kg) and school furniture features. Low back pain was also associated with school furniture features. Emotional problems, family history of MSDs and previous injury or accident also had an influence.

In addition, there is an upwards trend in childhood obesity with increasing numbers of children going on to suffer from adult-onset diabetes. Although it is not only a lot of sitting that is responsible for this development, it is certainly a contributory factor.

Research cited by the Finnish schools 'On the Move' programme suggests that physical activity has a positive effect on learning and cognition among schoolchildren (Syväoja, 2015). BAuA (2008a) points out that, if children have to sit still most of the time, their attention flags. If children can run around during breaks, their concentration remains constant; however, if pupils have the benefit of lively and mobile lessons, they may even improve their grades (BAuA, 2008a).

## 4 Health effects of prolonged sitting

This chapter explores the cause-effect relationship between sitting and both MSD and non-MSD health effects. The chapter draws on information found on the specific health effects of prolonged sitting from a short review of 107 sources of scientific and grey information (Appendix 2).

The negative health effects from prolonged sitting are due to:

- insufficient movement and muscle activity (not moving enough, not changing posture enough);
- low energy expenditure.

### 4.1 Sitting and MSDs

There are some challenges to investigating the relationship between working conditions and MSDs. For example, statistics on back pain frequently do not differentiate between back pain arising from poor posture (e.g. sitting) and that associated with excessive external loads (e.g. manual handling) or other causes. Survey data rely on self-estimates of sitting time, which may be inaccurate, and do not take into account the 'quality' of the sitting (Holtermann et al., 2017; EU-OSHA, 2019b). For example, sitting for 4 hours at work with frequent breaks is very different from sitting continuously for 4 hours without a break, and the ergonomics of the sitting and the task will have an effect. Increasing sitting time for manual workers may have a protective effect from the risks of MSDs if it reduces exposure to heavy physical work and provides more breaks (Hallman et al., 2016). In addition, prolonged sitting at work may not be the cause of a back problem, but it can aggravate existing conditions resulting in pain. Back pain sufferers are consistently advised against prolonged sitting and about the ergonomics of sitting (for example, BackCare, 2020a).

#### 4.1.1 Low back pain



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Many factors may contribute to the development of low back pain; it often develops over time and can come and go. Given this, and that 'sitting' is a variable activity taking place in variable conditions, it is difficult to establish the role that sitting may play in the incidence of low back pain. Nevertheless, there is some research evidence linking prolonged static sitting to back pain. In one study, subjects who registered back pain within the last 24 hours showed a clear trend towards a more static sitting behaviour (Zemp et al., 2016). Another study showed a possible trend towards more static sitting behaviour among call centre workers with chronic low back pain, although it was thought that this may have been because participants were restricting movement to try and avoid triggering pain (Bontrupa et al., 2019). In a literature review, sitting for more than half a workday, in combination with whole-body vibration (WBV) and/or awkward postures, was found to increase the likelihood of having low back pain and/or sciatica, and it was the combination of those risk factors that led to the greatest increase in the risk of low back pain (Lis et al., 2007).

Sitting influences intervertebral spacing within the spine. Low back intervertebral disc pressure increases significantly when seated compared with standing or walking and, depending on how a person sits, the level of intervertebral disc pressure will vary. When sitting upright with no back support, the low back intervertebral disc pressure is 140 % compared with standing disc pressure (taken as 100%), while sitting with a forward trunk lean, the low back intervertebral disc pressure is 190 % of standing disc pressure (Kroemer and Grandjean, 1997). In addition to an increase in disc pressure, sitting increases ligament strain and places higher loads on muscles and tendons. This increases the risk of pain, discomfort, strains and injuries associated with postural stress disorders, joint compression and soft tissue injuries (Perry, 2012).

Sitting can also weaken back muscles. Those who sit for long periods of time tend to hunch their shoulders and head forwards, causing tight chest muscles and weaker upper back muscles (leading to muscular imbalance). The abdominal muscles and muscles of the lower back are also prone to muscular imbalances. The abdominal muscles are typically weak, as a result the lower back muscles are put under considerable stress from sitting. If the hamstrings are also tight, the lower back will start weaken, protruding the stomach. This all can lead to painful conditions.

In addition, the more general picture is that sitting comes with a monotonous, low overall energy consumption. This may lead to a situation where the body's energy demand for the back region is well below recommendations for a healthy lifestyle. The resulting combination of a low metabolic level and lowered blood circulation can eventually lead to muscle degeneration and osteoporosis. At the same time, not moving can lead to stiffness in joints.

The long-standing doctrine of the ideal sitting position, which is to maintain a posture that is 'as upright as possible' has been questioned and has been slowly replaced by the concept of 'dynamic sitting', where sitting positions are continuously altered. By using a dynamic sitting behaviour, one is able to vary the loading conditions of spinal segments, which induces an effective pump mechanism in the vertebral discs. This mechanism is thought to be critically important for intervertebral disc nutrition and for resistance against degenerative changes. This is important considering that official retirement ages are increasing and we are required to work longer. In particular, sitting in an upright and a forward inclined sitting position, combined with few breaks and no change in sitting posture, is believed to be connected to back pain (Zemp et al., 2016). Dynamic sitting is explored later on in this report.

#### 4.1.2 Neck, shoulder and upper limb complaints



Sitting time at work, combined with awkward postures, is associated with neck-shoulder pain. The neck-shoulder area and the lower back are the most common sites for musculoskeletal pain among office workers (Janwantanakul et al., 2008; Andersen et al., 2011). An unfavourable working posture can lead to increased muscle tension in the neck and shoulders. When neck and shoulder muscles are 'overstrained', the pressure on the blood vessels will increase and the blood vessels towards the arm can become partially pinched. The result can be a painful neck, pain in the shoulder muscles and cold hands, or a combination of these, due to the reduced blood flow. An intervention to reduce sitting time among office workers led to neck-shoulder pain being lower after the 3-month intervention period (Danquah et al., 2017).

EU-OSHA (2019b) reported that work-related upper limb MSDs were associated with repetitive work, awkward postures and prolonged computer work. The way that sitting is performed influences upper limb functioning during work, especially when sitting is combined with awkward postures and tiring positions, static muscle load in the neck-shoulder region, unfavourable viewing angles, applying force or having to overreach (EU-OSHA, 2019b).



In Spain, neck complaints are reported more in sectors related to financial and insurance activities, information and communications, professional activities, real estate activities, public administration and education than in other sectors.

Source: EU-OSHA, 2019b

### 4.1.3 Lower limb disorders

Although prolonged standing is a risk factor for developing lower limb (ankle, knee, hip) disorders (EU-OSHA, 2010, p.31; Halim and Omar, 2011; Waters and Dick, 2014), an analysis of self-reported complaints among EU workers found no such relationship between sitting and MSD complaints in lower limbs (EU-OSHA, 2019b). Sitting breaks will contribute to protection from lower limb disorders from standing work. However, long periods of sitting in the same postures may result in muscle discomfort and joint stiffness in the lower limbs on standing up, and prolonged sitting can result in a build-up of fluid in the leg veins, which can cause discomfort and pain in the lower limbs (Eifell et al., 2006). The risks of lower limb disorders associated with prolonged standing underline the importance of not just replacing working while seated with working while standing.

### 4.1.4 Driving and back pain

The incidence of back pain among drivers has long been recognised (Troup, 1978; Sakakibara et al., 2006) and drivers have been found to be among the occupational groups that most frequently report lower back pain (EU-OSHA, 2010, p. 90). In addition to postural stress from sitting, driving involves muscle exertion and exposure to WBV, and the combination of WBV and postural stress may contribute to an increased risk of low back pain disorders. Several epidemiological studies of, for instance, bus drivers and tractor drivers show vibration-related low back pain disorders; these disorders were found to be associated with age, accidents affecting the back, cumulative WBV exposure and postural overload (Bovenzi, 1996). When working seated while driving mobile machinery or vehicles of any kind, it is important to take into account occupational exposure to WBV. See section 8.13 for more information on preventing WBV.

### 4.1.5 Summary of evidence of links between MSDs and prolonged sitting

The first section of Table 4, which is based on a short review of 107 sources of information (see Appendix 2), summarises the evidence found relating different MSD health effects to prolonged sitting.

**Table 4 Evidence concerning health effects of prolonged sitting**

Health complaint	Evidence of link to prolonged sitting
<b>Mainly musculoskeletal</b>	
Gluteal muscle disorders	No
Lower extremities disorders (hips, legs, knees, feet)	Yes
Building up general muscular fatigue	No
Immobilisation of the joints	Yes
Low back pain	Yes
Body part discomfort	Yes
Muscle overload resulting in neck pain	Yes
Losing muscle strength	Yes
Osteoarthritis of the hip or knee	No
Stiffness in the neck and shoulders	Yes
Upper limb disorders	Yes

Health complaint	Evidence of link to prolonged sitting
<b>Other health risks</b>	
Cancer	Yes
<b>Non-musculoskeletal</b>	
Cardiovascular disease	Yes
Chronic venous insufficiency	Yes
Diabetes mellitus	Yes
Embolism	Yes
Inflammation of the veins	Yes
Metabolic syndrome	Yes
Mortality	Yes
Obesity	Yes
Osteoporosis	Yes
Preterm birth	Yes
Psychosocial effects, depression	Yes
Rheumatic diseases	Yes
Sore feet	No
Spontaneous abortions	Yes
Swelling of the legs	No
Varicose veins/vascular function (in the lower legs)	No
Whole body fatigue	No

Source: based on a review of the sources listed in Appendix 2

## 4.2 Sitting and non-MSD health conditions

The non-MSD health effects of prolonged sitting include diminished cardiovascular health (including vascular function, circulation and blood pressure problems and heart disease), cancer, diabetes, weight gain, metabolic syndrome, higher risk of psychological distress, muscle degeneration, osteoporosis and a higher rate of mortality (Biswas et al., 2015; Callaghan et al., 2015).

### 4.2.1 Range of non-MSD health conditions associated with prolonged sitting/lack of exercise

It is important to recognise, understand and take account of all health effects in prevention practice, and prolonged sitting has been associated with a spectrum of other health risks. In general, more and stronger evidence is available regarding cause-effect relationships between non-MSD health complaints and prolonged sitting than MSDs and prolonged sitting; greater awareness of the adverse effects of sitting can be found in both research and grey literature. Some experts even refer to sitting as ‘the new smoking’ (Baddeley et al., 2016). For example, physical inactivity has been cited as the second greatest contributor, after tobacco smoking, to the cancer burden in Australia (Victoria State Government, undated).

According to a literature review by Callaghan et al. (2015), self-reported time spent sitting is positively related to chronic diseases and mortality. The review studies indicate that a higher prevalence of diminished cardiovascular health, chronic venous disorders, circulatory problems, increased stroke risk, difficulty in pregnancy, cancer, diabetes (type 2), weight gain, metabolic syndromes, psychological distress, muscle degeneration, osteoporosis and mortality occurs in combination with prolonged standing and/or prolonged sitting than occurs without prolonged sitting and/or standing (Callaghan et al., 2015).

### 4.2.2 Type 2 diabetes and the risk of cardiovascular disease

Prolonged sitting increases the risk of type 2 diabetes and the risk of cardiovascular disease (for example Biswas et al., 2015; IWH, 2017a, WHO, 2020). The crux of the problem seems to be in the leg muscles, the largest muscles of the human body; when sitting down, these muscles are hardly used. This increases the concentration of fats while decreasing insulin sensitivity (which causes sugars to be absorbed into the blood). Both processes (called fatigue and saccharification) play an important role in the development of cardiovascular disease and diabetes. Muscle activity in the legs is therefore important.

### 4.2.3 Cancer

There are indications of a link between prolonged sitting and a higher risk of some forms of cancer, in particular those associated with reproductive and metabolic health. One study found links to cancers of the breast, colon, uterus lining and ovarian epithelial cells (Biswas et al., 2015). The WHO (2020) has also found evidence that higher levels of sedentary behaviour in adults are associated with detrimental effects on the incidence of cancer and cancer mortality.

### 4.2.4 Mental health and depression

Sitting or lack of physical activity has been associated with an increased risk of mental disorders and depression (van Uffelen et al., 2013; Kandola, et al., 2020). However, to date, evidence on the impact of workplace sitting on workplace mental well-being issues, including job stress, depression and fatigue, remains limited.

### 4.2.5 Obesity

Regarding obesity, while some research has suggested a link between sitting behaviour and obesity prevalence, a study from 2013 concluded that the relationship between sedentary behaviour and obesity may be more complex than previously suggested (Pulsford et al., 2013).

### 4.2.6 Summary of evidence linking non-MSD health complaints and prolonged sitting

The second section of Table 4, based on the review of the 107 sources of information (see Appendix 2), summarises whether or not there is evidence relating different non-MSD health effects to prolonged sitting.

Figure 4 summarises graphically the health effects of prolonged sitting. It is based on a model by the French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases (Institut National de la Recherche et de la Sécurité — INRS) of the daily time spent sitting and the percentages of that sitting time spent in different activities, using data from a survey of the French working population (Debrosses, 2018).

Figure 4 Health risks associated with sedentary behaviour



Source: ©vhp human performance (based on information in Debrosses, 2018)

### 4.3 Sitting and mortality

High levels of sedentary behaviour are being increasingly recognised as a health risk linked to mortality (Biswas et al., 2015; Young et al., 2016; WHO, 2020). An analysis of data from six studies covering nearly 600,000 adults over the period 1989-2013 suggests a relationship between the amount of total daily sitting time and all-cause mortality risk (Chau et al., 2013). The main outcomes, after taking the protective effects of physical activity into account, were as follows:

- Each hour of daily sitting time was associated with a 2 % increase in all-cause mortality risk.
- The risk appears to increase significantly when adults sit for more than 7 hours a day, increasing by 5 % for each additional hour of daily sitting time.
- Mortality risk was an estimated 34 % higher for adults who sit for 10 hours a day.

In addition, the US National Health and Nutrition Examination Survey (NHANES) reported that inactivity equal to or in excess of 8.6 hours a day — objectively assessed — was significantly associated with increased all-cause mortality (Matthews et al., 2008). Importantly, regardless of whether or not a person who sits a lot is also active during the (working) day (walking, cycling, doing sports, etc.), the evidence clearly suggests that these health risks still occur (Hendriksen et al., 2013). Linked to this, accumulating evidence suggests that, independent of physical activity levels, sedentary behaviours are associated with increased risk of cardiometabolic disease, all-cause mortality and a variety of physiological and psychological problems.

As yet, there are no binding international regulations for preventing these health issues related to sedentary behaviour, as this type of research is considered still in its infancy (Ministerie van Sociale Zaken en Werkgelegenheid, undated).

### 4.4 Sitting versus standing

As previously mentioned, prolonged standing is associated with lower limb disorders and non-MSD health risks. Although prolonged sitting is associated with an increased risk of heart disease, prolonged standing has been associated with a greater risk of heart disease than prolonged sitting (Smith et al., 2018). This underlines the importance of not substituting prolonged sitting for prolonged standing. A combination of sitting, standing and moving on the job is likely to have the greatest benefits for heart health, and workplaces need to apply this message not only to workers who predominantly sit, but also to workers who predominantly stand (IWH, 2017b, 2018a).

### 4.5 Health benefits of increasing physical activity

There is now sufficient evidence to show that those who live a physically active life — both at work and at home — can gain a number of health benefits compared with those who sit for prolonged periods or have a sedentary lifestyle. According to the EU physical activity guidelines, these benefits include the following (EU, 2008):

- a reduced risk of cardiovascular disease;
- prevention and/or delay of the development of arterial hypertension, and improved control of arterial blood pressure in individuals who suffer from high blood pressure;
- good cardio-pulmonary function;
- maintained metabolic functions and low incidence of type 2 diabetes;
- increased fat utilisation, which can help to control weight, lowering the risk of obesity;
- a lowered risk of certain cancers, such as breast, prostate and colon cancer;
- improved mineralisation of bones at a younger age, contributing to the prevention of osteoporosis and fractures in older age;
- improved digestion and regulation of the intestinal rhythm;
- maintenance and improvement in muscular strength and endurance, resulting in an increase in functional capacity to perform activities of daily living;
- maintained motor functions, including strength and balance;
- maintained cognitive functions and reduced risk of depression and dementia;

- lower stress levels and associated improved sleep quality;
- improved self-image and self-esteem, and increased enthusiasm and optimism;
- decreased absenteeism (sick leave) from work;
- in very old adults, a lower risk of falling and prevention or delaying of chronic illnesses associated with ageing.

Those who are in the most active quartile of the working population are able to compensate for the adverse health effects of prolonged sitting by being more active during 'non-seated' hours. Research indicates that, if at least 60 minutes of moderate to vigorous physical activity a day is achieved, a worker could alleviate (but may not completely offset) the health risks of a highly sedentary lifestyle, including prolonged sitting (Wilmot et al., 2012). However, achieving 60 minutes of physical activity every day is likely to be quite a difficult target for most workers. For example, although the UK public health recommendations are 150 minutes per week of moderate-intensity physical activity, which is equivalent to 30 minutes a day, a health survey in England found that only 66 % of men and 58 % of women met this level recommendation (NHS Digital, 2017).

**Two things to remember:**

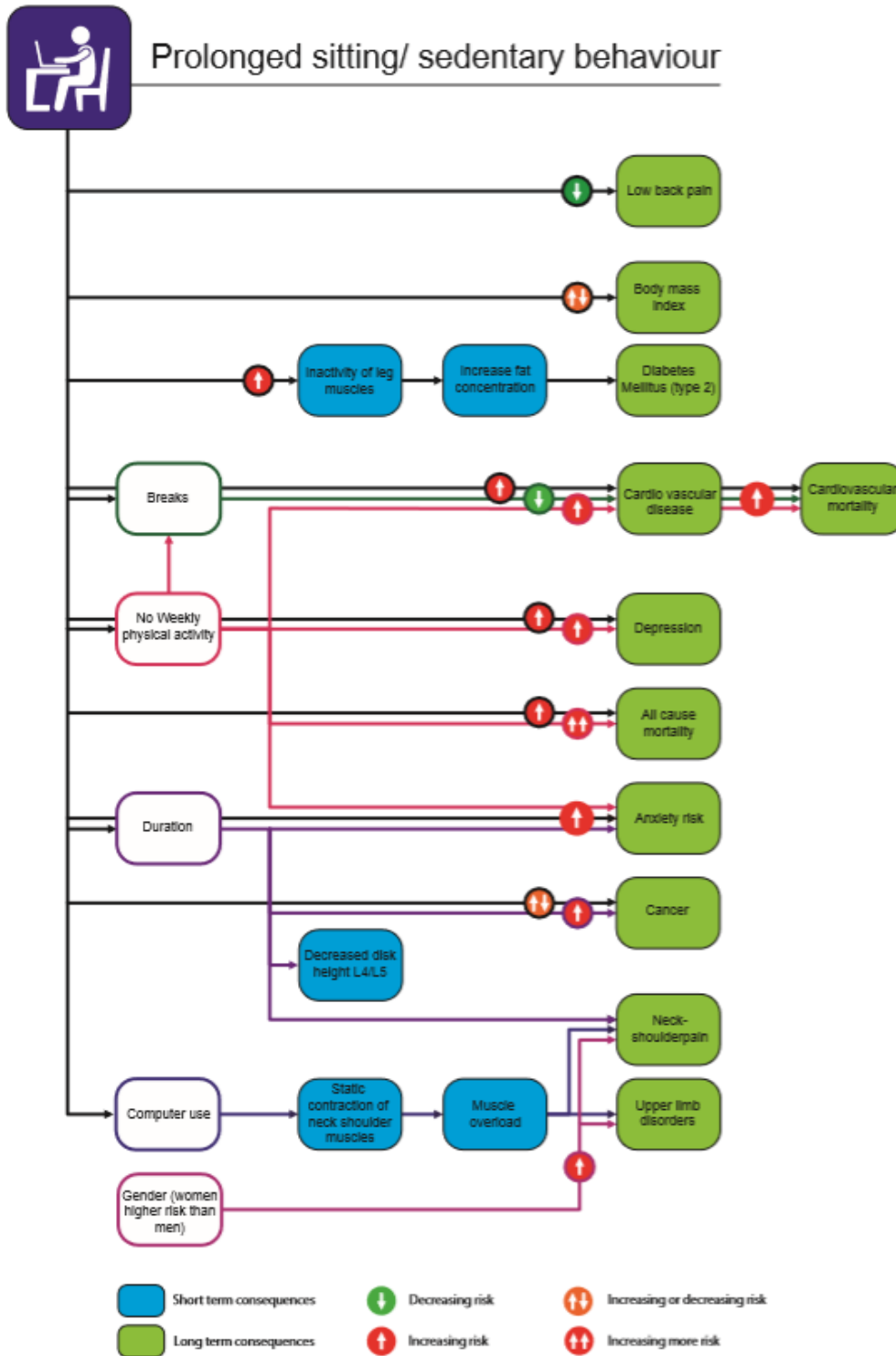
- A worker can be physically active and meet the guidelines of at least 2.5-5 hours of moderate intensity or 'huff and puff' physical activity per week, and still spend much of their time being sedentary.
- Health problems caused by prolonged sitting remain even if you exercise vigorously every day, highlighting the fact that excessive sitting and physical inactivity are separate health hazards.

Source: Work Safe Australia (undated)

## 4.6 Model of the cause-effect relationships between prolonged sitting and health

A model depicting prolonged sitting and its effects on health is given in Figure 5. The model was developed based on the short review of the literature listed in Appendix 2 and summarised in Table 4. The model covers both MSD- and non-MSD-related health effects. It does not attempt to cover all of the risk factors relating to MSDs, focusing instead on those for which relevant research has been identified. However, it also highlights some risk areas to which more attention could be given regarding sustainable work.

Figure 5 Diagram of the cause-effect relationship between prolonged sitting and health effects



Note: women report more complaints concerning neck-shoulder pain and upper limb disorders. This is linked to seated work; however, women are also over-represented in the jobs where workers are more at risk.

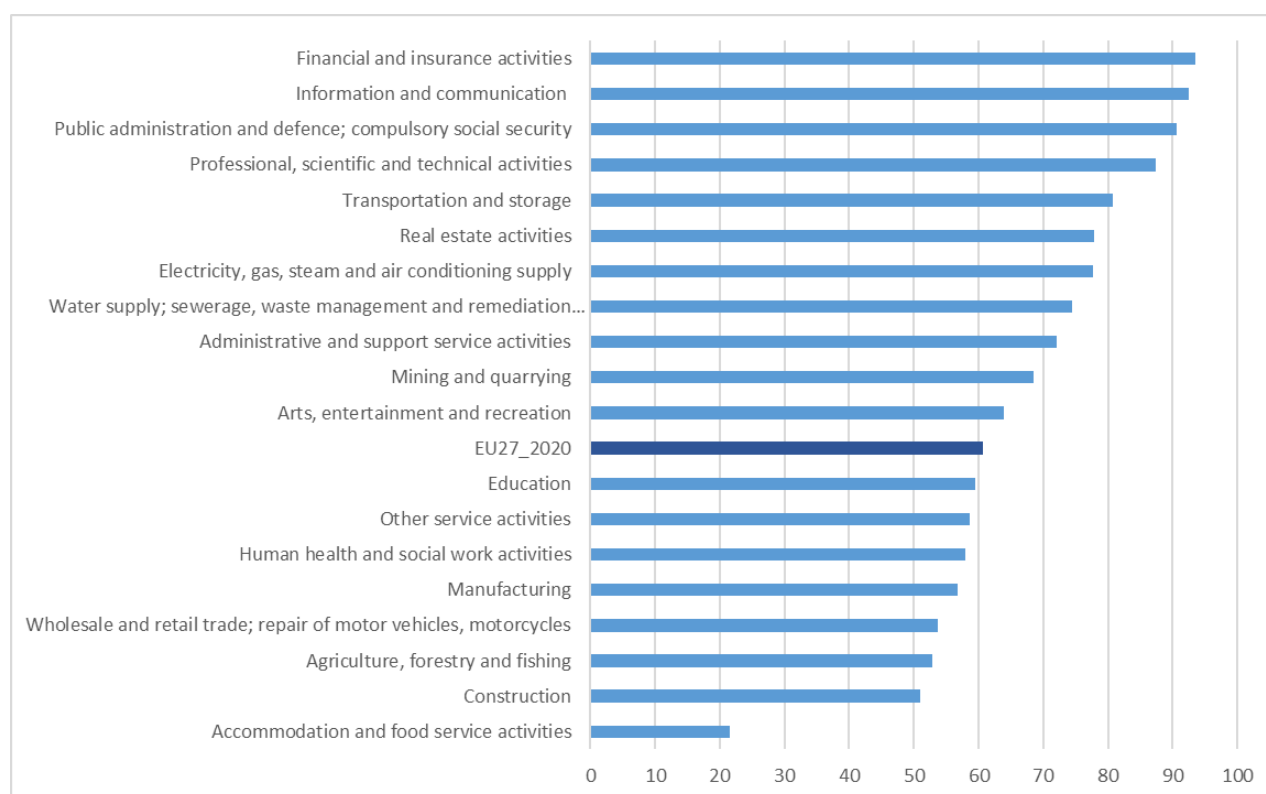
## 5 Workers at risk

### 5.1 Types of work

Office workers are most at risk of prolonged sitting. However, workers in many other jobs and work areas sit for prolonged periods, including drivers of road, construction, agriculture and warehouse vehicles, train drivers, pilots, crane operators, sewing machine operators, assembly line workers, including micro-assembly line workers, and those working at service desks and in laboratories, call centres and control rooms. Other professions concerned include casino workers and cashiers. Teleworking is increasingly common and may increase further as a result of the COVID-19 pandemic. Those working from home may be tempted to work for longer without a break, in what may be poorer ergonomic conditions than those present in the office. Drivers exposed to WBV from their vehicles are at increased risk of back problems.

The results by sector from the previously mentioned ESENER 2019 (EU-OSHA, 2019a) show that prolonged sitting was most frequently reported as a risk factor by establishments in financial and insurance activities (93 % of establishments in the sector in the EU-27), information and communication (92 %) and public administration (91 %). It was reported as a risk factor by at least 50 % of establishments in a wide range of other sectors (Figure 6) (EU-OSHA, 2019a).

**Figure 6 Percentage of establishments (per activity sector) reporting the presence of prolonged sitting as a risk factor in their workplace**



Source: ESENER (EU-OSHA, 2019a)

### 5.2 Women

More women report sitting at work almost all the time than men: in the EU, 31 % of women report that their work involves sitting almost all the time compared with 25 % of men (Eurofound, 2017). Women are more likely to report MSDs related to sitting and computer work than men. Women are over-represented in a number of predominantly seated jobs (e.g. office work, micro-assembly) that are often also of a low grade (EU-OSHA, 2011). This can mean that they have a lack of control over how they

work, including when they can take breaks to get up and move around. For women, work pace is more problematic: 61 % have to respond to an external demand immediately and to interrupt their tasks for other tasks (compared with 50 % for men) (Nicot, 2008).

Women's segregation into lower grade seated jobs, with few promotion opportunities, can also lead to long-term exposure to prolonged sitting. This applies for instance to sectors associated with a high degree of sitting work such as office work, manufacturing work and cashier work. Being low grade may mean that they lack control over how they work, including when they can take breaks to get up and move around. Moreover, in these types of jobs women can often be exposed to working at a very fast speed, resulting in a combined risk from prolonged sitting, highly repetitive work and working with higher muscular tension.

In contrast, more men are involved in driving work. However, if this results in drivers' cabs being designed for men rather than women, this could put female drivers, for example smaller women, more at risk of MSDs.

During pregnancy, prolonged sitting or standing can lead to backache and circulatory problems. There may also be links to possible increased risks of blood clots, miscarriages, premature birth and low birth weight (Paul, 2004). Pregnant workers need to avoid prolonged sitting by taking frequent breaks to stand and move around, especially as pregnancy advances.

### 5.3 Older workers

Avoiding prolonged sitting and promoting physical activity at work are both issues for sustainable working. The prevalence of MSDs increases with age (Yeomans, 2011); although ageing plays a part, this is also caused by the length of cumulative exposure to MSD hazards during the working life (EU-OSHA, 2016a). In addition, because of the increased sedentary nature of work and the rise in the official retirement age, workers today may be more exposed to sedentary work across their life course than were previous generations of workers.

Preventing workers from suffering from MSDs or other health problems and promoting workers' musculoskeletal and other health throughout their working lives, from their first job onwards, are key to allowing people to work for longer. As jobs become more sedentary, young workers may face greater exposure to prolonged sitting during their working lives than the older workers of today. Therefore, it is particularly important to pay attention to the cumulative exposure of workers to hazards, including prolonged sitting.

Health problems are most pronounced in workers involved in physically demanding jobs. This is especially important concerning (combinations of) repetitive and monotonous work, prolonged standing and sitting, stress and emotionally demanding work, machine-paced work and shift work (Eurofound, 2017). Improvements will have a positive effect on the employability of workers in the 50+ age group.

A move from physically demanding work to sitting work can help someone remain in employment, but prolonged sitting needs to be combined with sufficient breaks, ergonomic workstation design and preventing prolonged static sitting to ensure that work is sustainable.

Age-associated functional declines can be lessened by regular physical activity (Kenny et al., 2008). Therefore, the promotion of physical activity at work is particularly important for older workers.

### 5.4 Workers with chronic musculoskeletal conditions

Prolonged sitting is a particular issue for workers who have developed chronic conditions such as back pain and rheumatic diseases, as long periods of sitting may provoke the pain associated with such conditions (Graveling, 2019; Woolf, 2019). As the workforce ages, there will be more workers with such conditions, underlining the importance of avoiding prolonged sitting for sustainable working and preventing early exit from work. Early intervention to provide timely support is essential for anyone with a chronic condition.



## 5.5 Migrant workers

Migrant workers are less likely to work in jobs involving mostly sitting than native workers (EU-OSHA, 2020a), which reflects that they are less likely to be doing office work. However, migrant workers are more likely to work in painful and tiring positions (EU-OSHA, 2020a), and those migrant workers who do sit to work may be more likely to work in some sectors where prolonged sitting in awkward postures is common, such as working on factory lines, where control over how to work and when to take breaks is also often limited. Female migrant workers may be particularly likely to carry out this type of work.

## 6 Regulations and guidelines

This section summarises legislation relevant to prolonged sitting work, guidelines on maximum and recommended sitting times at work and breaks, and guidelines on health and physical activity. They include official guidelines from governmental bodies, guidelines from research organisations and ergonomics bodies, and sectoral guidelines.

### 6.1 Regulations and directives related to sitting at work

#### 6.1.1 EU legislation

EU safety and health legislation, implemented through Member State legislation, sets minimum standards, and some Member States set higher or more detailed requirements than others. Although prolonged sitting is not specifically covered by any EU safety and health legislation, in accordance with EU directives, all employers in the EU have *general duties to carry out risk assessments* and put in place preventive measures based on these assessments<sup>(29)</sup>. In selecting the measures, employers should avoid risks if possible and adapt work to the worker. They must provide information, instruction and training and consult workers.

Any workers who habitually use display screen equipment (DSE) as a significant part of their normal work are covered by the directive on DSE<sup>(30)</sup>, which includes providing workers with a suitable workstation and chair and periodic breaks or changes of activity to reduce time spent on display screen work. The directive does not specify the frequency and duration of work breaks when working with DSE, nor is there any generally accepted standard, although some Member States set more detailed guidelines than others (some examples are given later in this section).

As well as the general requirements to prevent risks and the directive on DSE, directives on work equipment<sup>(31)</sup>, machinery<sup>(32)</sup>, vibration<sup>(33)</sup> and manual handling<sup>(34)</sup> may all be relevant to improving safety, health and ergonomics in relation to seated work. The regulation on working hours and breaks in road transport<sup>(35)</sup> relates to preventing driver fatigue. Further information on how safety and health legislation could apply to prolonged sitting is given in Box 3.

#### Box 3 Main EU legislation relevant to preventing prolonged sitting

EU safety and health legislation, implemented by Member States, sets minimum standards, and some Member States set higher or more detailed requirements than others. The EU-OSHA website provides links to these pieces of legislation and to sites where national legislation and guidelines may be found<sup>(1)</sup>.

**The OSH Framework Directive (89/391/EEC)**<sup>(1)</sup> requires employers to carry out risk assessments and put in place preventive measures, provide training and instruction, and ensure special protection to workers particularly sensitive to possible risks (e.g. if they cannot sit for long periods).

**The Workplace Directive (89/654/EEC)**<sup>(1)</sup> covers minimum requirements for the safety and health for workplaces. This includes suitable workstations and seating.

**The Display Screen Equipment Directive (90/270/EEC)**<sup>(1)</sup> sets minimum requirements, including requirements for suitable seating, the provision of breaks from display screen work and workstation dimensions and design to provide sufficient space for the worker to change position and vary movements.

<sup>(29)</sup> <https://osha.europa.eu/en/legislation/directives/the-osh-framework-directive/1>

<sup>(30)</sup> <https://osha.europa.eu/en/legislation/directives/5>

<sup>(31)</sup> <https://osha.europa.eu/en/legislation/directives/3>

<sup>(32)</sup> <https://osha.europa.eu/en/legislation/directives/directive-2006-42-ec-of-the-european-parliament-and-of-the-council>

<sup>(33)</sup> <https://osha.europa.eu/en/legislation/directives/19>

<sup>(34)</sup> <https://osha.europa.eu/en/legislation/directives/6>

<sup>(35)</sup> <https://osha.europa.eu/en/legislation/directives/directive-2002-15-ec>

**The Use of Work Equipment Directive (2009/104/EC)** <sup>(1)</sup> sets minimum safety and health requirements for the use of work equipment. Equipment could include seating and workstations. Employers must pay attention to the nature of work and hazards, and any additional hazards that could be posed by the use of the equipment when selecting work equipment. Workers must be given information and training in the use of work equipment and any hazards related to its use.

**The Machinery Directive (2006/42/EC)** <sup>(1)</sup> covers safety in the design of machinery. Machinery must be designed made using an ergonomic approach to minimise the discomfort, fatigue and psychological stress of the operator. The design must protect workers against mechanical hazards and reduce vibration hazards.

**The Vibration Directive (2002/44/EC)** <sup>(1)</sup> covers the identification and prevention of risks arising from vibration. When assessing the exposure, the employer must take into account working practices and working equipment. Particularly relevant to both standing and seated work is the prevention of exposure to WBV. Those particularly at risk of exposure include drivers and workers who work on platforms that vibrate because of machinery, operators and drivers of off-road machinery where the terrain is uneven, for example, in the construction industry and agriculture, or the use of forklift trucks. Prolonged sitting increases the risk (see sections 8.13 on WBV and 9.5.3 on driving).

**The Working Time Directive (2003/88/EC)** <sup>(1)</sup> covers requirements on adequate rest time and periods between working days. Work should also take account of the general principle of adapting work to the worker, with a view in particular, to alleviating monotonous work and work at a predetermined work-rate, and of safety and health requirements, particularly regarding breaks during working time.

**The Manual Handling Directive (90/269/EEC)** <sup>(1)</sup> covers the identification and prevention of manual handling risks. Sometimes workers lift while sitting, for instance during assembly work or at supermarket checkouts. The maximum weights that can be safely lifted while seated are lower than when standing; for example, the Dutch handbook of physical workload indicates that lifting when sitting should be avoided if possible and, in particular, lifting weights over 3 kilograms when seated should be avoided (Vermeulen and Peereboom, 2015).

**The Pregnant Workers Directive (92/85/EEC)** <sup>(1)</sup> covers requirements regarding the assessment and prevention of risks to pregnant or breastfeeding workers. The directive covers physical movements and postures, mental and physical fatigue and other types of physical and mental stress. This would include avoiding prolonged sitting (see sections 5 and 8.12).

**The Driving Hours Regulation (Regulation (EC) No 561/2006)** <sup>(1)</sup> covers maximum daily and fortnightly driving times, breaks and minimum daily and weekly rest periods for drivers engaged in the carriage of goods and passengers by road. The rules relate to avoiding accidents from fatigue. In general the daily driving period must not exceed 9 hours and breaks of at least 45 minutes should be taken after 4.5 hours at the latest. Drivers are permitted to split their breaks in two provided the first break is 15 minutes or more and the second break is 30 minutes or more — driving time in between these breaks still must not exceed 4.5 hours at any one time (e.g. drive for 2 hours, 15 minute break, drive for 2.5 hours, 30 minute break, drive for 4.5 hours, finish driving for the day). There are various exemptions for vehicles and driving circumstances, and van and taxi drivers are not covered.

**EU standards** (known as European Norms (ENs)) supplement these directives. These provide further details or information to enable the directives to be implemented and may also be relevant to seated work. A set of EN and labour standards issued by the International Organisation for Standardisation (ISO) for the protection of workers against work-related MSDs can be found in Appendix 3.

## 6.1.2 Member State OSH regulations and guidelines on regulations

Some Member States provide legislation or official guidance on safety and health that is more specific.

General provisions on the prevention of MSDs in *Sweden* cover all movements and postures, stating that workstations, jobs and work environment conditions should be designed and arranged in such a way that risks associated with physical loads, both static and dynamic, that are dangerous to health or unnecessarily fatiguing or stressful are averted (Swedish Work Environment Authority, 1998). The provisions cover repetitive work, work postures, ergonomic design of work equipment and areas, and the need for workers to change to different types of work and take breaks when they feel the need, as well as manual handling of loads. Employers must also assess the links between mechanical and psychosocial risk factors for MSDs.

In *Austria*, DSE workers are entitled to a 10-minute break after each 50-minute period of working in front of a screen. In *France*, employers must adapt the working time of employees working on a screen after a risk assessment is carried out, and a worker's activity must be scheduled in such way that daily screen time is periodically interrupted by breaks or changes of activity. In *Poland*, employees are entitled to a break of at least 5 minutes after each hour of work. In *Italy*, DSE workers are entitled to a 15-minute break for every 2 hours of continuous use. In *Estonia*, DSE workers have the right to breaks of at least 10 % of the time the employee works with the computer (for example, 6 minutes for every 60 minutes of work or 3 minutes for every 30 minutes) (Cabrita and Cerf, 2019). In the *Netherlands*, a 10-minute interruption or break every 2 hours or a 5-minute interruption or break every 1 hour is advised when working with DSE (van der Meulen, 2015).

In *Ireland*, official guidance on work breaks and DSE work covers four important points (HSA, 2007):

1. Rest breaks or changes in the pattern of work, where they are necessary, should be taken before fatigue sets in. Some employees suffer symptoms from the effort used to keep up performance while fatigued.
2. The employee should not sit in the same position for long periods and make sure to change posture as often as practicable.
3. Short frequent rest breaks are more satisfactory than longer breaks taken occasionally.
4. Rest breaks should be taken away from the VDU. Other duties may be assigned during this period, provided they are not too intensive.

## 6.2 Guidelines on sitting at work

### 6.2.1 Official guidelines

In addition to general requirements and guidelines for DSE work, there are a few official guidelines specifically related to the reduction of sitting at work, and maximum and preferred sitting times. One example comes from the Netherlands. The Dutch Ministry of Social Affairs guidelines for working seated and/or standing (de Langen and Peereboom, 2012) propose that workers:

- sit for a maximum of 2 hours, then take a break from sitting for at least 10 minutes (standing, walking, cycling);
- sit for a maximum of 5 hours in total at work in a working day.

Guidance from the Netherlands also advises that people work in an active manner, alternating between sitting, standing and walking (Peereboom, 2009).

### 6.2.2 Agreements and recommendations

Ergonomic guidance from Switzerland's National Accident Insurance Fund suggests the following division of activity for the working day (Suva, 2005):

- sit for about 60 % of the workday;
- stand for about 30 %;
- walk for about 10 %.

Germany's Federal Institute for Occupational Safety and Health (BAuA) suggests that a working day in an office should be divided as follows: 50 % sitting down, 25 % standing up and 25 % moving (BAuA, 2008a).

The Belgian Ergonomics Society advocates standing up for 10 minutes after every 30 minutes in the workplace, which results in at least 12 10-minute standing periods in the working day (VerV, 2018).

The Australian BeUpstanding campaign <sup>(36)</sup>, (Healy, 2019), based on research by the University of Queensland, recommends:

- spending 50 % or less of your workday time sitting;
- avoiding long periods of sitting — aim to get up every 30 minutes.

Breaks from display screen work or from sitting work can be covered by employer-trade union agreements, or sector social dialogue agreements of guidelines.

### 6.3 General health and physical activity guidelines

The Council of the European Union promotes physical activity through the workplace, and, according to its recommendation on promoting health-enhancing physical activity, physical activity is a prerequisite for a healthy workforce (EU, 2013).

Three examples of general national and international guidelines on sedentary activity, which are broadly similar, from the public health arena are given here.

The Dutch Ministry of Health provides three evidence-based guidelines (Gezondheidsraad, 2017):

1. the Dutch Healthy Exercise Standard, which recommends at least half an hour of moderate-intensity exercise, for example, walking briskly, at least five days a week;
2. the Dutch Fit Standard, which recommends at least 20 minutes of moderate-intensity exercise, for example running fast, at least three days a week;
3. the Combination Standard, where both the Exercise Standard and Fit Standard are recommended.

Based on these guidelines, the Dutch Ministry of Health makes the following general recommendations, which include a specific point on sitting:

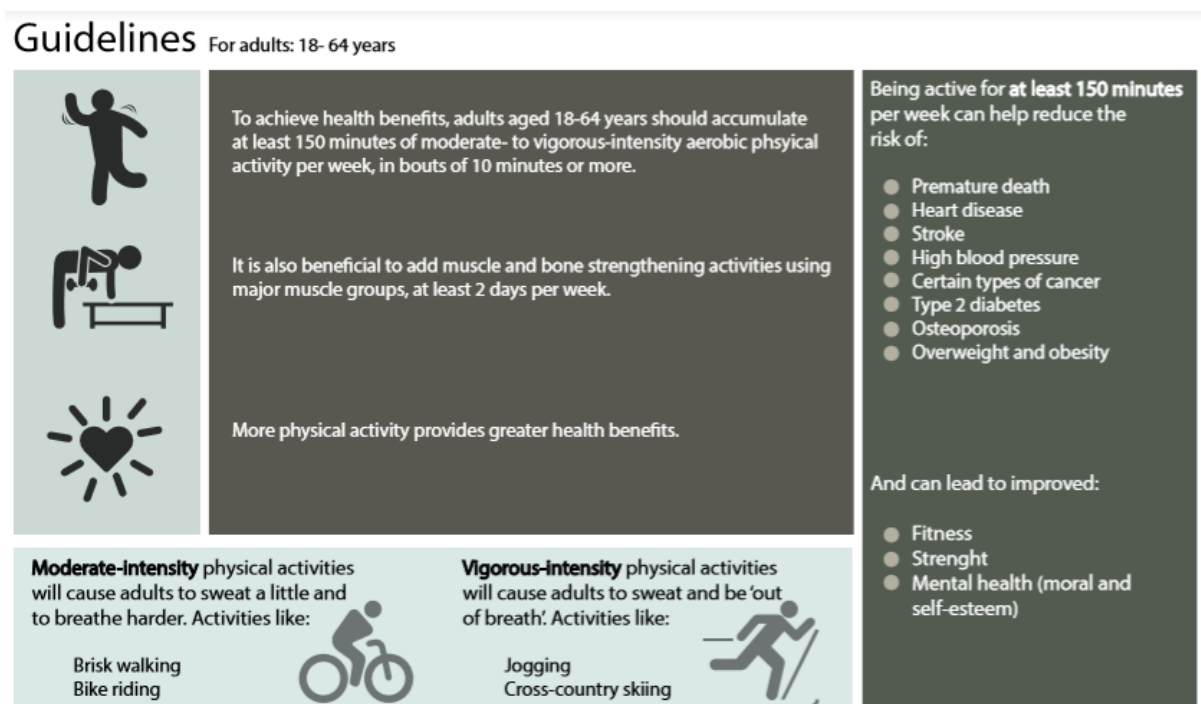
- do moderate exercise, such as walking and cycling, for at least 150 minutes a week, spread over various days;
- exercising for longer, more often and/or more intensively to gain extra health benefits;
- do muscle and bone strengthening activities at least twice a week; for the elderly, these should be combined with balance exercises.
- avoid sitting a lot.

In 2011, the Canadian Society for Exercise Physiology (CSEP) provided systematic evidence-based physical activity guidelines in the world (CSEP, undated). These guidelines are summarised in Figure 7.

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<sup>(36)</sup> <https://www.beupstanding.com.au/>

Figure 7 Canadian Physical Activity Guidelines



Source: ©The Canadian Society for Exercise Physiology (CSEP, undated)

The WHO's (2020) guidelines on physical activity and sedentary behaviour (in which sedentary behaviour was included for the first time) recommend the following:

- For physical activity:
  - All adults should undertake 150-300 minutes of moderate-intensity, or 75-150 minutes of vigorous-intensity physical activity, or some equivalent combination of moderate-intensity and vigorous-intensity aerobic physical activity, per week.
  - Regular muscle-strengthening activity is also recommended.
- For sedentary behaviour:
  - Adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits.
  - To help reduce the detrimental effects of high levels of sedentary behaviour on health, adults should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity.

The WHO found insufficient evidence to specify quantitative thresholds of sedentary behaviour, to determine whether specific health benefits vary by type or domain of sedentary behaviour and to determine the influence of frequency and duration of breaks in sedentary behaviour on health outcomes, but their basic conclusion was that sitting less and moving more is beneficial.

Further information on physical activity guidelines is given in Commissaris and Douwes (2020) and de Langen and Peereboom (2020b).

'Adults should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits. To help reduce the detrimental effects of high levels of sedentary behaviour on health, adults should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity.' WHO (2020)

## Guidelines on physical activity at work

Promoting physical activity at work goes hand in hand with preventing prolonged sitting at work. No matter which chair a worker uses or the level of workstation ergonomics that is applied, the benefits of physical activity, including regular sporting activity and exercise, contribute to lowering the risks of cardiovascular disease, diabetes and some types of cancers. Physical activity also contributes to improvements in musculoskeletal health and body weight control and has positive effects on mental health development and cognitive processes. Recognising the importance of the workplace in promoting or restricting physical activity, EU policy recommendations on promoting physical activity include the workplace (EU, 2013). The recommendations include indicators for Member State actions for the working environment, based on the EU physical activity guidelines (EU, 2008), and two specific guidelines cover the workplace:

- Guideline 33 — in their agreements, employers and trade unions should include requirements for the workplace which facilitate a physically active lifestyle. Examples of such requirements include (1) access to adequately equipped indoor and outdoor exercise facilities; (2) availability, on a regular basis, of a physical activity professional for joint exercise activities, as well as for individual advice and instruction; (3) support for workplace-related sport participation; (4) support for using cycling and walking as transportation to and from the workplace; (5) if the work is monotonous or heavy to the extent that it is associated with an increased risk of skeletal muscle disorders, access to exercises specifically designed to counteract these diseases; and (6) a physical activity-friendly working environment.
- Guideline 34 — national health certificates could be awarded to workplaces where a healthy, physically active lifestyle is given high priority.

A subsequent European Commission study on promoting physical activity at work (EC, 2018) advises that workplaces develop policies for physical activity that include:

- walking initiatives;
- workplace counselling and advice directed at workplace activity behaviour;
- active travel to work;
- promoting use of stairs;
- group-led/social exercise;
- environmental/office infrastructural changes to reduce sitting;
- multicomponent interventions;
- programmes focused on company engagement.

## 6.4 Recommendations and conclusions on guidelines for sitting at work

Several aspects of sitting behaviour (see Box 4) need to be taken into account. Both the total exposure and the pattern of exposure appear to be important. Unfavourable health effects due to prolonged sitting may occur after 2 hours of daily exposure. Both sitting at work and sitting during leisure time should be taken into account, and a more active workstyle (and lifestyle) that includes alternating between different types of postures is recommended. Given these factors, the following guidelines for sitting at work are suggested.

At work:

- spend 50 % or less of your working day sitting;
- avoid sitting for any length of time, as there is no safe limit — aim to get up at least every 20-30 minutes;
- always get up for at least 10 minutes after 2 hours of sitting — sit less whenever possible;
- do not exceed 5 hours of sitting at work each day;
- work in an active manner and change position between sitting (60 %), standing (30 %) and walking (10 %).

In leisure time:

- Exercise is good: the more exercise, the better. If at least 60 minutes of moderate to vigorous physical activity a day is achieved, a worker could alleviate — but not completely offset — the health risks of prolonged sitting. Exercising for longer, more often and/or more intensively will increase the health benefits.
- Workers should exercise moderately, e.g. by walking or cycling, for at least 150 minutes a week, spread over various days.
- Workers should perform muscle and bone strengthening activities at least twice a week. For the elderly, this should be combined with balance exercises.

Most importantly, workers should limit sitting.

**Box 4 Characteristics of sitting that are important for considering its effects**

- The total amount of exposure; for example, how much sedentary work is there per day?
- The pattern of sedentary work; for example, is it accumulated in prolonged bouts?
- The nature/context of the behaviour; for example, is it accumulated sitting in a truck?

Source: Work Safe Australia, undated



## 7 Strategy for preventing prolonged sitting

Apart from physical health improvements, the benefits of increased physical activity include lower stress levels, improved mental health and reduced risk of problems such as depression, and decreased sickness absence. There are clearly benefits for workers and employers of making work more dynamic and active.

It is important to change posture as much as possible. The general goal is to promote a dynamic, active workstyle: move more and sit less. Workers should be able to adopt a variety of positions when working and preferably be able to vary between sitting, standing and moving around. However, steps to achieve this goal must be taken in the context of good workplace safety and health, based on risk management and the provision of ergonomic workstations. This chapter outlines the elements of a prevention strategy to avoid prolonged sitting and promote active ways of working.

As with all areas of risk management, actions to avoid prolonged sitting should be implemented within a strategy that takes a systematic approach, uses risk assessment and follows a hierarchy of prevention measures (Straker et al., 2016; Kuhl and Bruck, 2017) (see Box 5). The prevention strategy should ensure good workplace ergonomics and worker participation, and include specific measures to limit prolonged sitting and promote movement at work. At the organisational level, supportive workplace policies and practices are needed. At the environmental level, changes to the workspace can encourage less sitting and more movement. At the individual level, workers need to be encouraged to work more dynamically and move more, for example taking microbreaks to stretch and using the stairs. The key elements for limiting and improving sedentary work are summarised in Box 6.

### Box 5 A prevention hierarchy applied to prolonged sitting

- Elimination — prolonged sitting should be designed out.
- Replacement/substitution — prolonged sitting should be replaced with something else.
- Engineering controls — sitting should be reduced by using new tools and equipment.
- Work organisation and administration controls — for example, sufficient breaks should be provided.
- Instruction and training should be given to reduce sitting.
- Personal protective equipment — not relevant.

### Box 6 Key elements for limiting and improving sedentary work

- Ensuring work organisation and a workplace culture that prevent risks and promote active and dynamic ways of working.
- Providing ergonomically designed workplaces and equipment, including adjustable equipment, so that correct working postures can be adopted; ensuring that the adjustable features, such as those of chairs, are used.
- Reducing sitting time by working more dynamically.
- Providing training and instruction to create awareness, including exercises during work.
- Promoting worker involvement in finding practical solutions and to motivate them to adopt more active ways of working.

The prevention strategy should include the following:

- **A comprehensive assessment of the full range of risks factors together**, including prolonged sitting, poor ergonomic postures, repetitive movements, manual handling and exposure to WBV.
- **A suitable ergonomic workstation** and suitable environmental conditions should be provided as a starting point, including an appropriate chair, stool, table or driver's seat. **Adjustability** is important to allow postural change and comfortable working, for example adjustable chairs that also facilitate postural change and 'dynamic sitting', adjustable workstation height, sit-stand workstations and cabins that can swivel.
- **Organise work to limit sitting and promote movement**: the tasks to be performed should be balanced and possibilities should be provided for active work, task rotation, job enrichment, minibreaks and individual control options. The approach chosen should be directed at active/dynamic work. Workers should be given sufficient control over their work so that they can alter how they work and take a break when needed.
- **Organise the work environment and culture to promote movement**: for example, bins and printers could be placed in a common area and time could be scheduled for stretching during meetings.
- Encourage consultation and **active worker involvement**: this is important for all aspects of a prevention strategy. By working together, employers and workers can find practical ways to promote more active ways of working.
- **Promote healthy behaviour**, for example through raising awareness of and providing training on prolonged sitting and exercising during work: this measure will be ineffective unless implemented together with the abovementioned elements.
- **Implement organisational policies and practices** to make sure the strategy is put into practice.

These specific elements are addressed in the strategy using 5 steps: preparation, assessing risks, action planning, taking action and evaluation. The process should be systematic and ongoing, and follow 3 key principles: do what works for you – tailor what you do to your circumstances and what is realistic; involve workers in each phase; show management support and commitment. EU-OSHA's practical guide to tackling psychosocial risks and musculoskeletal disorders in small business provides more information about applying a systematic prevention approach (EU-OSHA, 2018).

## 8 Workplace ergonomics and working conditions

This chapter covers risk assessment and the general approach to designing a workstation to ensure it is suitable for the task being carried out and the person performing it, and includes advice on the ergonomics of a sitting workstation. Some specific issues, such as ergonomic seating and WBV, are also addressed. Further resources on prevention are given in Appendix 4.

### 8.1 Risk assessment

The prevention approach should be based on risk assessment. It is important to assess the full range of musculoskeletal risks factors, including prolonged sitting, poor ergonomic postures, repetitive movements, manual handling and exposure to WBV, and to address them together, in a comprehensive way. Box 7 summarises the steps involved in risk assessment. A simple action plan can be made to implement the results of the risk assessment that sets out the hazards and the solutions, together with priorities for action, deadlines and responsibilities. An example of an action plan to reduce MSDs related to sedentary work is given in Appendix 5.

#### Box 7 Risk assessment steps

Risk assessment provides a systematic approach to making changes in the workplace. It is based on the following steps (EU-OSHA, 2018):

- collecting information;
- identifying hazards;
- assessing the risks arising from those hazards;
- setting priorities and planning actions to eliminate or reduce the risks;
- monitoring and evaluating the actions taken;
- involving workers throughout the risk assessment process.

### 8.2 General approach to workstation ergonomics

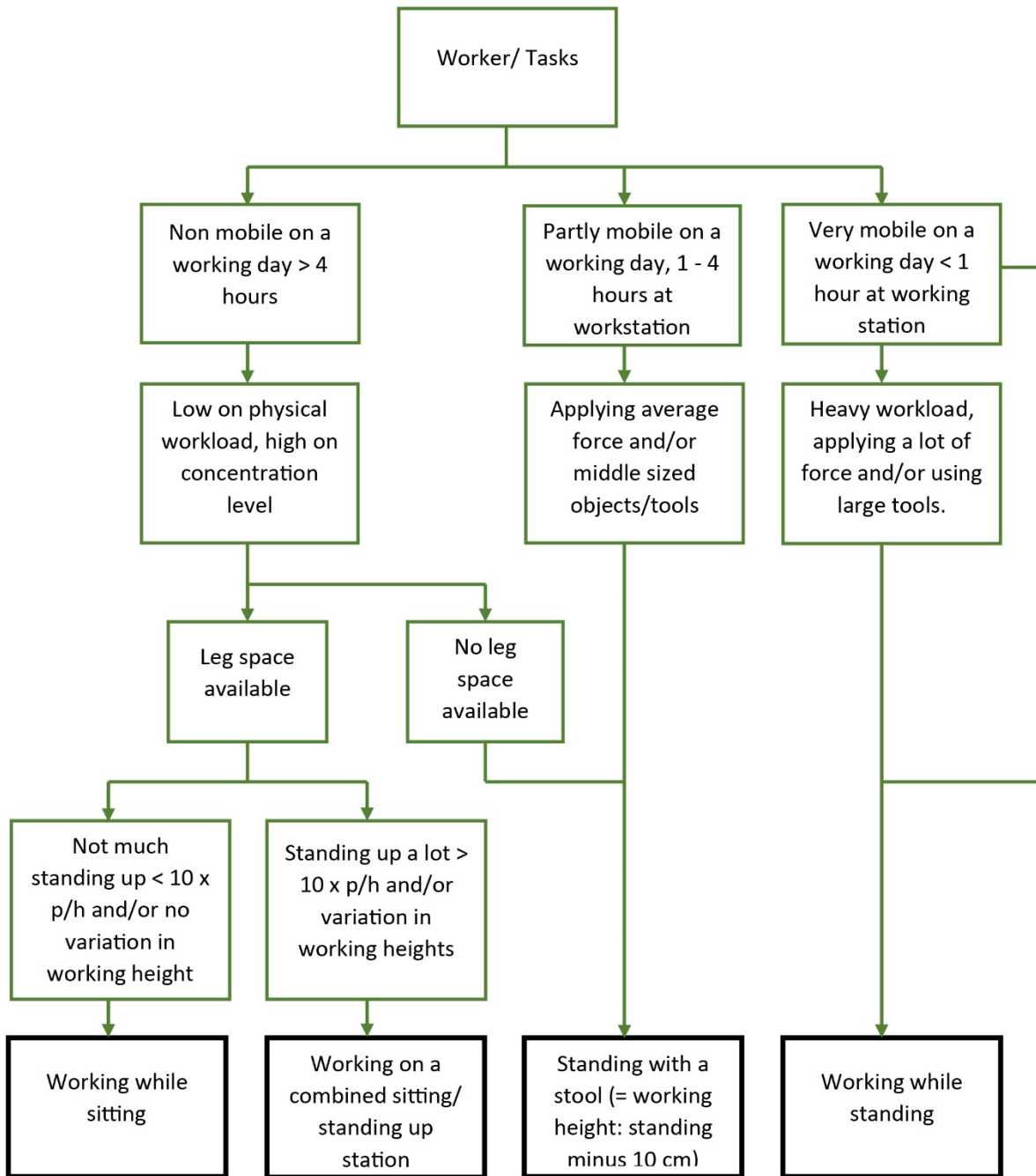
To prevent MSDs caused by prolonged sitting, it is important that the workplace design is adapted to the tasks and activities that the worker needs to perform. Within a preventive approach, the following generic ergonomic principles for seated work should be incorporated:

- **Sitting, standing and moving around:** workstation design and work organisation design that allows workers to alternate sufficiently between standing, being seated on a stool, being seated on a chair and/or walking should be applied.
- **Working surface height:** workstations should be designed according to the tasks to be performed, for instance in microelectronic-assembly work, a seated position is preferable, but standing is preferable if a task requires substantial force.
- **Adjustability:** workstations should be adjustable to take account of the varying sizes of workers.
- **Foot, knee and leg space:** the workstation should provide the correct leg, knee and foot space, regardless of the working position.
- **Reaching distance:** workstations should be designed to prevent workers from overreaching.
- **Viewing angle:** workstation design should allow comfortable viewing angles.

### 8.3 Deciding if work should be performed while sitting or standing

A correct workplace design helps to prevent unfavourable working positions. Figure 8 presents a basic tool to help decide whether a workstation should be sitting or standing. The tool was developed by vhp human performance for the Dutch government. Depending on the type and duration of the work, the chart enables decisions to be made between the options of sitting, standing, a combination of the two or standing using a perching stool. External expertise should be obtained where necessary, especially in more complex work situations, to help the employer make the right choices.

Figure 8 Flow chart for making the right choice concerning sitting or standing



Source: ©vhp human performance

Using a stool for standing work may be a suitable option. Figure 9 shows an example of a sitting workstation and a workstation that uses a stool/support (Lutgendorf and Peereboom, 2012).

## 8.4 The nature of the work affects the preferred work height and workstation design

As the flowchart (Figure 8) indicates, the requirements of the workstation depend on the characteristics of the work being carried out, that is, whether it is industrial work, checkout work, counter work, VDU

work, etc. The workstation needs to be appropriate for the task, for example depending on whether fine motor skills, high-visibility tasks, applying force or reaching are required.

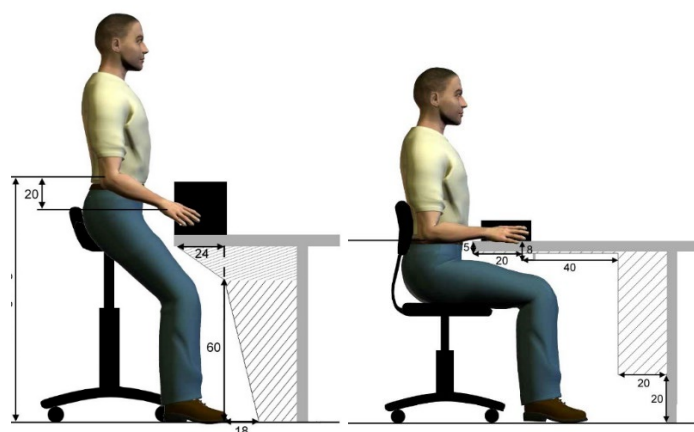
It is easier to apply force, for example, to chop something, standing than sitting; therefore, the choice to sit or stand should take account of guidelines concerning applied force. If the work frequently requires force to be applied that exceeds 4.5 kg (45 N) a standing workstation is preferable (Inspectie SZW, 2012). The maximum weight that can be lifted when sitting is considerably less than when standing.

If any lifting is required, the equipment and workstation should be arranged to allow the object to be kept close to the body, and to keep twisting or stretching to a minimum. Lifting even fairly light objects when seated should be minimised, as this can place a strain on the back (HSE, 2011).

## 8.5 Allowing enough leg space

The workstation should provide the correct leg, knee and foot space, regardless of the working position, to prevent both awkward postures, muscle tension and unnecessary reaching, especially when working while operating foot pedals. Figure 9 shows leg space requirements for workstations for working while seated and perching (Lutgendorf and Peereboom, 2012).

Figure 9 Leg space and working height overview for working while sitting and working with a stool

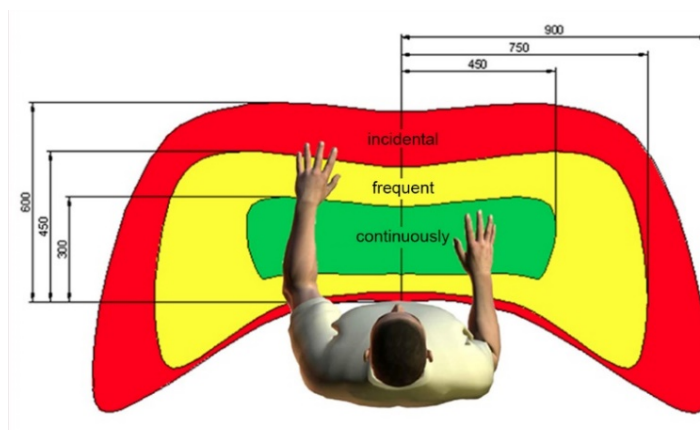


Note: Measurements in cm; the sitting table height should be at the worker's elbow height — the table should preferably be height adjustable - Source: ©vhp human performance

## 8.6 Avoiding overreaching

Workstations should be designed to prevent workers from having to reach too far or too high. Work and equipment that is used frequently needs to be placed within easy reach to avoid awkward stretching and twisting, which could lead to back pain or injury. The basic recommendations on reaching distances are given in Figure 10.

Figure 10 Reaching at a workstation while seated



Note: Green zone (< 30 cm), suitable for continuous activities; yellow zone (30-45 cm), suitable for frequent activities; red zone (> 45 cm), suitable for only incidental activities. Source: ©vhp human performance

## 8.7 Viewing angle

Workstation design should allow comfortable viewing angles, where workers can look at screens, tools and objects without having to work in an awkward neck and/or trunk position. In particular, looking upwards, including while tilting the neck backwards, and looking sideways, including neck rotation, should be avoided, for instance by including seat rotation possibilities, cabin rotation possibilities or using mirrors.

## 8.8 Why workstations should be adjustable

The workforce is very varied and workstations should be adjustable to take account of this. Providing a workstation designed for the average person (which often means designed for the average man) means that many workers will be uncomfortable using it. For 90 % of the population, the difference in height between small women and tall men is approximately 40 cm (TU Delft, 2020). For example, a short woman could measure 1.50 m and a tall man could be over 2.00 m but they could work at the same type of workstation. Clearly, a certain degree of adjustability is required if all workers are to have ergonomically safe working conditions.

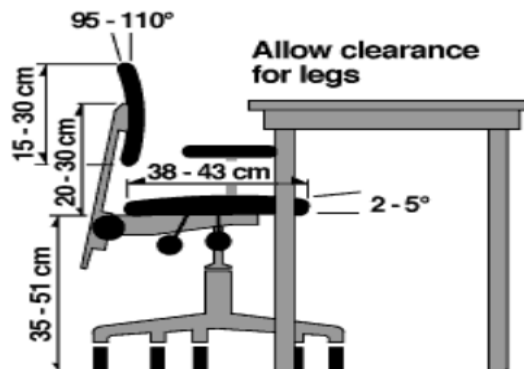
In the office, a sit-stand work desk allows the desk to be adjusted to the correct height when sitting.

## 8.9 Ergonomic office chairs

### 8.9.1 Providing the right seating

Although the aim is to allow workers to vary between sitting, standing and moving, when seated the seat needs to be appropriate and ergonomic. But what is an ergonomic chair? Ergonomic chairs are designed to suit a range of people; however, there is no guarantee that they will suit one person in particular. For example, a chair could be too high and the arm rests too far apart for a short, slim person. In addition, chairs may not suit every task or arrangement at the workstation. A chair becomes ergonomic only when it specifically suits a worker's size (body dimensions), their particular workstation, and the tasks that must be performed at that workstation. Figure 11 provides some basic specifications for an ergonomic office chair. Box 8 provides a checklist of features for choosing an office chair.

Figure 11 Ergonomic office chair



Source: ©Canadian Centre for Occupational Safety and Health <sup>(37)</sup>

### Box 8 Choosing an office chair

When choosing an office chair, keep the following features in mind:

- **Adjustability:** check to see that seat height is adjustable.
- **Seat height range:** check whether or not the seat height can be adjusted to the height recommended for the worker(s) who will use it. Other chairs may have to be selected for very short or tall workers.
- **Backrest:** check to see that the backrest is adjustable both vertically and in the frontward and backward direction, and has a firm lumbar support.
- **Seat depth:** select the seats that suit the tallest and the shortest users.
- **Stability:** check the stability of the chair; it should have a five-point base.

## 8.9.2 Sitting comfortably in your ergonomic seat

It is not enough for workers to be provided with ergonomic seating. They also need to know how to adjust it and their work area so that they are comfortable. Aimed at computer workers, BAuA developed the short checklist given in Box 9 (BAuA, 2009).

### Box 9 Checklist for the ergonomics of sitting for office workers

- Does the seat and back of your office chair support your body? Is the height adjustable? Does it feature a tilting device and a reclining mechanism?
- Have you fixed the height correctly? If you can place your feet flat on the floor and your legs are bent at a right angle, you have the correct position. You should sit supported against the back of the chair!
- Do your upper and lower arm form a right angle when you place your fingers on the keyboard? Is there sufficient space between the table edge and the keyboard to rest your wrists?

<sup>(37)</sup> Ergonomic chair, <https://www.ccohs.ca/oshanswers/ergonomics/office/chair.html>, OSH Answers, Canadian Centre for Occupational Health and Safety (CCOHS), January 7, 2021. Reproduced with the permission of CCOHS, 2021.

- Are the chair, desk and monitor positioned to enable you sit with a relaxed posture? Can you look at the monitor without twisting your neck or body? Is the distance between eye and screen correct? It should be at least 50 centimetres for a 15" monitor and correspondingly greater for larger screens!
- Are you able to look at the screen without tilting your head back? If not, your monitor is too high. The top line of your text should be below or at eye level.
- Have you enough space at your workplace? Can you move around easily without constantly bumping into something? And, most importantly, do you have sufficient leg room?.

Source: BAuA, 2009

### 8.9.3 Using gym balls

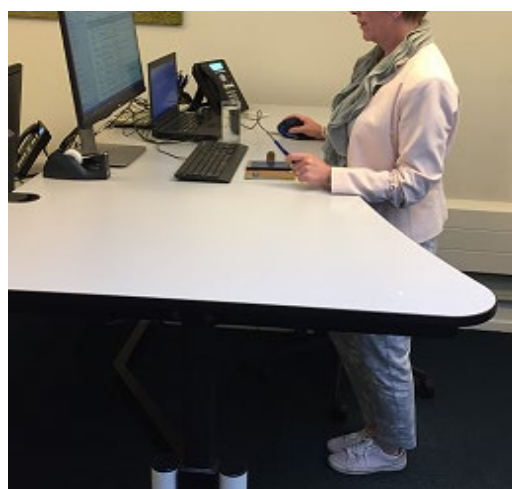
Gym or Pilates or fit balls should not be used for long periods of sitting. No-one can train core muscle for 8 hours. As the back is not supported you can twist your back or fall using fit balls (Straker et al., 2016). However, some people may find them useful for short periods of time — up to 20 minutes (Cooper, 2020) — to alternate with an ergonomic office chair. It is important to have the right size for the desk height. However, a fit ball in the office can be useful for part of a microbreak to tilt the pelvis slowly back and forward, from side to side and to gyrate the pelvis round slowly in a circle.

## 8.10 Sit-stand workstations

As mentioned, the possibility of varying between sitting and standing, and also adjustability for different sizes of workers is important. Although sit-stand desks can be helpful as part of facilitating postural change when working, they are not a panacea:

- They allow a change of posture from sitting, or perching on a perching stool if provided, to standing.
- When sitting, desks can be adjusted to exactly the desired height, which is useful for particularly tall or short workers, for example.
- When changing between sitting and standing work, you are moving between two static postures. Static standing for too long can bring its own problems. Frequent breaks for moving and walking should be incorporated into sit-stand work routines, and, when used, workers should also change frequently between sitting and standing.
- Standing for long periods may not be possible for some people, because of stiff joints or knee problems for instance, because it triggers pain, for instance in those suffering from sciatica, or for pregnant workers, etc.

Figure 12 Example of a sit-stand table



Source: ©vhp human performance



A basic sit-stand desk (see Figure 12) is height adjustable, permitting work while sitting, half-standing using a perch or standing at the press of an electrical button. Some adjustable workstations for office work are adjusted by using a personal code. It is possible to purchase electric legs or a stand to convert an existing desk to a sit-stand desk. The prices of sit-stand desks have come down and at least one multinational home furnishing store sells a relatively inexpensive version, which could be an option for teleworkers or small businesses with limited budgets.

### 8.10.1 Using a desk bike or treadmill?

Besides sitting or standing, could using a desk bike be an option? A desk bike lets a worker pedal underneath the desk while working. It can be used at a standing desk where computer work can be done by changing postures between standing up or using a desk bike. Advantages of using a desk bike are that:

- it can reduce sedentary time;
- when following guidelines on daily exercise, it helps to increase aerobic exercise minutes;
- it enhances blood flow and increases metabolism.

However, the relationship between sedentary behaviour and cognitive functioning still remains uncertain (namely, how well you can concentrate and pedal at the same time). Looking at productivity, studies report no significant effect on productivity when using a desk bike compared with seated work. Active workstations do not appear to decrease workplace performance, or only minimally (Straker et al., 2016), at least for low intensity cycling (Tronarp et al., 2018). Another issue is that workers might feel awkward using a desk bike because they might feel they look odd using it. They are not likely to be suitable for all workers and perhaps only those who are already most physical active would want to use one. The feasibility relating to the long-term use of desk cycling is yet to be determined, and there are issues related to localised discomfort, expense and noise (Straker et al., 2016).

Likewise, the long-term use of treadmills is still unclear and again barriers to their use include expense and noise, as well as possible fall hazards (Straker et al., 2016).

Nevertheless, some organisations have tried out desk bikes. In 2016, Deutsche Telekom in Germany conducted a 6-week pilot study, when 60 employees tested a variety of desk bikes; the desk bike approach proved popular and Deutsche Telekom purchased 500 of them. In 2017, this initiative was extended to international locations. Currently, Deutsche Telekom provides, on average, one desk bike for each 10-20 employees, depending on the location (Ecorys, 2017).

## 8.11 Managing stress at work

Workplace stress factors, especially when combined with physical risk factors, can contribute to MSDs. Regarding prolonged sitting, it is not enough to give workers control over when they can take breaks. If they feel that they under too much work pressure, because of either the workload itself or the negative attitudes of their manager or supervisor to taking breaks, they will not be able to take longer breaks and microbreaks as needed. Therefore, it is important to assess both work-related stress and physical risk factors for MSDs and address them together. An example of how an action to tackle prolonged sitting can also be a stress-reduction measure is given in Box 10. Practical advice on tackling stress and MSDs is given in an EU-OSHA guide for small businesses (EU-OSHA, 2018).

### Box 10 Stand up and shake it off

In a work environment where team members regularly experienced difficult phone calls they introduced 'standing up and shaking it off' following difficult calls. This allowed the individual to experience the benefits of breaking up their sitting time and also provided a non-verbal signal to other team members to check in with them.

Source: BeUpstanding, 2019

## 8.12 Sitting and workers with chronic MSDs or special needs

Workplace safety legislation requires employers to take account of workers with special needs, and employers have duties to make workplace accommodations for workers with disabilities.

As the workforce ages there will be an increasing number of workers who have a rheumatic or other musculoskeletal chronic condition. However, with the right workplace accommodations many with such chronic conditions can continue to work. Having good ergonomic working conditions and the promotion of good musculoskeletal health at work is particularly important for those who have a chronic MSD. Prolonged sitting and repetitive work can provoke the pain in affected joints, so avoiding static postures and limiting sedentary behaviour and repetitive movements and allowing workers to take minibreaks is particularly important. Support to remain physically active, within the limits of what is possible given their particular symptoms, is also very important for anyone with a chronic MSD (Woolf, 2019; EU-OSHA, 2021c).

Some individuals may have special sitting needs. For example, pregnant workers may require seating that can be adjusted without requiring awkward, bent postures. Workers with back problems or other mobility difficulties may have similar needs; for example, a higher than normal seat may help someone who has difficulties getting out of a chair, as may armrests and a forward-tilting seat. Workers with back, shoulder or neck pain may need a high, supportive backrest. Wheelchair users may need access to the workstation widened and their workstation height modified (HSE, 2011).

However, a workplace which is already designed to promote good musculoskeletal health reduces the need for the individual adjustments (Woolf, 2019). Measures that make a workplace more ergonomic for all workers and provide more opportunities for postural change and movement at work, such as sit-stand workstations, introducing microbreaks and providing good seating which allow dynamic sitting can prevent an individual with a chronic MSD from having to exit early from workforce.

## 8.13 Whole-body vibration and seated work

Some seated work may also expose workers to the risk of WBV, and employers have duties to assess exposure and take preventive measures. WBV is vibration from machines and/or vehicles that moves into the worker's body through the buttocks, back or feet (Government of Ontario, 2019).

The health risks from WBV increase when the vibration level is high, exposures are long, frequent or regular, the dominant frequency is below 20 Hz and there are severe shocks or jolts in the vibration, for example when driving over rough terrain. Exposure may cause discomfort, affect performance, aggravate pre-existing back injuries and cause motion sickness. There is evidence that long-term exposure can result in increased risk of disorders to the lumbar spine (such as low back pain, herniated disc and early degeneration of the spine), neck and shoulders, and some evidence that it can cause varicose veins and haemorrhoids (in combination with long-term sitting). MSDs of the back, shoulders and neck are likely to be caused by a combination of exposure to vibration and ergonomic factors. In some cases whole-body vibration can aggravate a back problem caused by another activity (HSE, 2005).

It is, therefore, very important that exposure to vibration is eliminated or reduced for seated workers. Ways of doing this include removing the source of the vibration, automating tasks, remotely operating equipment, purchasing vehicles with lower vibration emission levels, providing a suitable vehicle seat and tyres that are suitable for the terrain, organising cab layouts so the operator can maintain an upright neutral posture and avoid reaching or twisting, maintaining vehicles, rotating tasks and taking breaks to leave the vehicle to stretch (Martin et al., 2017; Government of Ontario, 2019). Standards are available to use when purchasing equipment, etc., or when evaluating the risks (ISO, 2004). WBV is covered further in section 9.5.3 on driving for work.

## 9 Limiting sitting and promoting movement — dynamic working

**Our next posture is the best posture.**

This chapter covers the part of the prevention strategy aimed at organising work and the work environment to promote active, dynamic working and movement and limit sitting, as summarised in Box 11. Further resources on prevention are given in Appendix 4.

### Box 11 Elements of making work active and dynamic

- Organise work to limit sitting and promote movement:
  - choose an approach directed at active/dynamic work;
  - balance the tasks to be performed;
  - provide possibilities for active work, task rotation, job enrichment, minibreaks and individual control options;
  - give workers sufficient control over their work so that they can alter how they work and take a break when needed.
- Organise the work environment and culture to promote movement, for example by putting bins and printers in a common area and scheduling time for stretching during meetings.

### 9.1 What is dynamic/active work?

'When it comes to physical activity levels, the opposite of prolonged sitting is not prolonged standing. The opposite of prolonged sitting is moving. People who sit on the job should get up at regular intervals to minimise the risk of sitting too long. People in standing jobs should sit down whenever they need to. Sit when you need to, stand when you want to and walk or move when you can is the concluding message' (IWH, 2018a). This fits with Australia's BeUpstanding campaign message that 'the best posture is the next posture' (BeUpstanding, 2017).

Dynamic work in relation to prolonged sitting is about sitting less and getting up and moving more (WHO, 2009; ABS, 2013). Alternating postures and working more dynamically is important for:

- increasing muscular activity and stopping muscles from shortening;
- easing the return of blood to the heart and stimulating blood circulation and the supply of blood to muscles and organs;
- keeping intervertebral discs in better shape by reducing the load on them and nourishing them.

Given the possible health effects of prolonged sitting, regularly changing posture between sitting, standing and moving should be the priority for jobs involving sitting. In addition, when sitting to work this should be dynamic, involving changes of posture and not in a rigid, static posture. The bottom line is doing any physical activity is better than doing none and studies show positive effects of dynamic/active work (EC, 2018). Being more active at work may also improve job performance, productivity and job satisfaction.

Three elements are considered key: performing activities that exceed the level of 1.5 MTEs (see Chapter 4), alternating as much as possible *between* different types of postures (sitting, standing, walking, cycling) and alternating as much possible *within* the same posture, be it sitting or standing. Applying these principles to work, dynamic/active work is achieved through:

- **regularly alternating** sitting work with standing or moving;
- **changing postures** while working as much as possible;
- when seated, **changing between different sitting postures**;
- **exercising** and stretching both at and away from the workstation.

Promoting dynamic work is not just about office work. Production line workers need to be able to change position and have breaks to move and stretch. Supermarket checkout workers need to be able to switch between sitting and standing. (See sections 9.5.4 and 9.5.2 for more information on these work areas.) Promoting health in the workplace is also an important part of maintaining the work capacity of an ageing workforce (Ilmarinen, 2012).

## 9.2 Promoting dynamic/active work at the organisational level

Promoting dynamic/active work requires:

- an organisational strategy to reduce musculoskeletal risks and make work more dynamic and active;
- the implementation of measures to limit sitting and make work as dynamic as possible;
- ensuring good workstation ergonomics and improving the quality of sitting;
- linking measures to other actions on workplace health promotion.

This section contains advice and tips for employers on how to make work more dynamic. Sources of this advice include BeUpstanding campaign resources <sup>(38)</sup>, NICE (2008), NIOSH (2017), BITC (2018), de Langen and Peereboom (2020b) and Chrodis Plus (undated). The advice addresses different elements of promoting active working. Some of the advice is more relevant to larger organisations, although the tips include small steps that workplaces of any size could take.

**Developing a plan:** as with any OSH area, a systematic approach is needed that incorporates supportive workplace policies and practices and which links to other relevant policies, such as workplace health promotion (NICE, 2008). Even smaller organisations can make a basic plan and assign this to somebody. Larger organisations can set up a working group. The person or group responsible must be given sufficient time and resources. An example of an action plan is given in Appendix 5.

**Organising work and workstations:** work and workstations need to be organised to improve activity levels for those in sedentary work (see Chapter 8 on workplace ergonomics and working conditions). Organisations should ask themselves the following:

- *Does the organisation ensure good ergonomics for seated work, including making seated work dynamic and active?*
- *Do jobs and workstations allow workers to alternate between sitting, standing and moving around?* For example:
  - Are workstations designed to allow movement, such as sit-stand workstations that permit changes in posture? Do workstations have good seating that allows posture change? Do workstations permit sitting, standing or perching?
  - Is work designed to accommodate several short breaks in the day to allow for movement? Do maximum sitting times need to be set?
  - Can job rotation and task rotation be used so that sitting/standing/walking tasks are more evenly distributed between workers? Can task rotation be planned within the same job?
  - Are there tasks that workers could choose to do 'on the move'?
- *Do workers have control over how much they sit, stand and move at work and when they can take breaks?*

<sup>(38)</sup> <https://www.beupstanding.com.au/>

- Do any jobs have *high physical demands that cause fatigue* and prevent physical activity in leisure time?
- Is there some *movement time between sitting and carrying out a physical task* such as lifting planned, so that the body can warm up?
- *Are any individual needs addressed* and reasonable adjustments and adaptations to workers' work made, for example for workers who cannot sit for long without getting up? Are workers returning to work after an injury not given only 'light duties' involving (prolonged) sitting work?
- Has the *purchasing department* been given a set of rules for buying office furniture, for example concerning adjustability?

**Creating the right culture and approach:** promoting dynamic/active work and embedding it in daily practice requires the right culture and commitment, as well as an organised approach. Organisations need to ask themselves the following questions regarding the level of commitment and their approach:

- Is there *commitment from the top* to creating and sustaining a dynamic workplace where sitting less and moving more is the norm?
- Is promoting movement *linked and integrated into existing workplace health, safety and well-being policies and actions and workplace health promotion activities*?
- *Are goals* set, linked to other relevant workplace policies, with dedicated resources?
- Do plans and measures *include all workers and different jobs* (e.g. actions are not limited to only office workers)? For example:
  - Are workers such as drivers, pilots, cashiers or factory line workers enabled and encouraged to have breaks, stand up, stretch and exercise (for physical health and concentration/alertness)?
  - How can short activity breaks be scheduled into the organisation of fixed work routines?
- Have *barriers* to implementing workplace changes to physical activity been identified?
- Does the organisation as a whole and do individual managers *support workers* who want to sit less and stand more and move more at work? Do workers feel supported by managers in the ways they use to move more at work?
- Do managers *lead by example* regarding standing and moving at work? Setting an example could include taking the stairs or standing during meetings?
- *Have managers been educated* on dynamic work and ways to promote it?
- *Are workers consulted and involved* in planning how to introduce more movement into work and evaluating measures on an on-going basis? Are workers kept informed and asked for their feedback and ideas on an on-going basis?
- *Have workers been educated* on the benefits of sitting less and incidental activity and facilitate self-monitoring of prolonged sitting? Is this part of induction training? Are sitting and activity actions also part of induction training?
- Are regular *reminders and updates* provided, for example through the organisation's newsletter or intranet, on information boards and/or screens in the canteen or as a regular item in meetings?
- Could a workplace *champion* be appointed to help spread the word? Can a worker be trained to lead short exercise breaks?
- Does the workplace encourage and support *open conversations* about health and *early reporting* of MSD symptoms and other health problems?
- Facilitated by changes at the organisational and environmental levels, *are individuals encouraged to take their own actions* to sit less and move more, for example by providing them with the kind of advice and tips given in section 9.3.
- Does the organisation *access any national or local schemes* to promote physical activity at work?

**Organising the workspace to encourage less sitting and more movement:** there are various ways to do this. For example:

- Organisations could consider *how the built environment can be used to increase movement*, such as workstation design, walkways within buildings, eating and rest areas, utility and mail rooms, meeting rooms and outside walking opportunities:
  - For example, could meeting rooms or eating areas have a standing area?
- *Physical activity could be enabled in meeting rooms.* For example:
  - chairs with wheels could make it possible to stand up without making a noise or disturbance, and people should be given sufficient room to move around;
  - any meeting room layout should allow standing and walking during conferences.
- *Adjustable working stations* could be provided for working both standing up and seated.
- *Stools* could be introduced so that a worker has a choice other than sitting or standing.
- For secondary work, such as reading and writing, *secondary work surfaces* (at heights 100-110 cm) could be provided so that these tasks can be performed while standing.
- *Cordless telephones* could be provided so that employees can walk during phone calls. Better still, providing *wireless headsets* would avoid awkward postures and allow walking during conference calls.
- *Shared resources could be provided in a central area.* For example:
  - personal bins/printers/shredders/mailboxes could be replaced with shared ones in a central location; if individual printers, etc., have to be used, they should be placed at a distance from the person's work station so they have to get up;
  - shared resources (e.g. policy manuals, reference books, procurement catalogues, phone books) should be moved from individual workstations to common resource areas.
- *Stair use could be encouraged by:*
  - providing an attractive stairwell, e.g. one that is attractively painted, with good lighting, access doors that are easy to open and close and plants or artwork; one company, for example, exhibited drawings by workers' children in the stairwell;
  - slowing the lift or the opening of lift doors to make taking the stairs a more attractive option and using posters to encourage the use of the stairs;
  - deploying directional signs leading to stairwells, such as arrows and footprints on the floor, at the point of choice between the stairs and the lift.

**Promoting dynamic work and movement at the organisational level with specific actions:** these could include:

- *Agreeing on organisational guidelines on sitting and moving:* such guidelines could include maximum sitting times without a break and the recommendation to get up at least every 30 minutes (see the guidelines in Chapter 6).
- *Making active meetings the norm by:*
  - putting stand and stretch breaks on meeting agendas;
  - encouraging workers to get up and move, and stretch if needed, during meetings; this can be done by the chairperson at the beginning of meetings, who should follow this recommendation themselves;
  - building short breaks into long meetings and by shortening meetings;
  - agreeing on a practice of standing to applaud speakers when they finish.
- *Providing consultations:* make supporting dynamic and active work part of the role of the organisation's physician or safety officer — can they provide consultation sessions for workers to give them an opportunity to ask questions on dynamic/active work and get guidance on this?

**Encouraging workers to move more**, for example:

- *Face-to-face dialogue* could be used to agree on actions as common practice, such as:
  - walking to talk to a colleague instead of emailing or phoning;
  - standing/walking while on the phone;
  - holding walking meetings and allowing standing and walking during larger meetings or conferences.
- A *20-30 minute break rule* could encourage workers to take short breaks or microbreaks and move every 20-30 minutes.
- *Workers could be encouraged to move* around more at work, for example by:
  - parking away from the building entrance;
  - taking the stairs instead of the lift if they can, or at least getting out one or two floors earlier;
  - performing exercises during work;
  - taking frequent posture breaks for any work undertaken in static or uncomfortable positions;
  - taking short walks during work breaks (see Box 13);
  - taking a walking coffee break with colleagues.
- *Break reminders could be implemented* by providing computer software to support break taking and self-monitoring of prolonged sitting, and providing information about activity devices or apps that workers can use on their phones. This could include:
  - Break and stretch software: this type of software runs in the background of a worker's computer. As well as providing break reminders, more sophisticated software can monitor computer use and when and how often workers take breaks. It may provide training, breaks and exercise reminders plus workload feedback tailored to the individual worker's needs. The application should enable employees to postpone or ignore the prompts if the timing is not right for a break.
  - Sitting time calculators: these online tools are used to show how much a worker is sitting and whether or not they are at risk of health problems from sitting.
  - Phone apps and wrist-worn activity trackers: these provide reminders on when to get up and step counts and they monitor brisk walking (see Box 12).
- *Sharing workers' ideas and experiences*: meetings could be held where workers share the actions they have taken to move more, their experiences with phone apps or other devices, etc.

**Box 12 Apps to help prevent prolonged sitting**

Even workers who have control over when to take breaks may skip them, because they are too concentrated on their work, or they feel under pressure of work to carry on. There are an increasing number of apps that could help individuals to move more and limit sitting. Some would need to be supplied by employers, such as exercise reminders installed on workers' computers. Others are free for workers to use on their phones and can be useful for supporting moving both at work and outside work.

For example, the American Heart Association has developed a free StandApp (StandApp, 2019). The app can be installed on worker's smartphones and it provides alarmed reminders to take standing breaks from the desk and it also includes exercises. In France a health insurance company offers a Smartphone coach (Ameli, 2019); this app follows the worker's activity and encourages them to maintain and develop healthy postures and behaviour by sending messages in the app on the workers mobile phone.

**Promoting physical exercise:** a workout or short period of exercising at work may improve job performance, productivity, job satisfaction and health, and there is growing evidence that investing in exercise at work can also positively influence physical activity more generally (Ecorys, 2017). One study

found that leisure-time exercise levels were higher among workers who had access to some combination of the following facilities at or near work: a pleasant place to walk, playing fields, a gym, fitness classes, organised team sports, showers/changing rooms and programmes to improve health (IWH, 2018b). It is important to include measures to maximise the opportunity for all employees to participate (NICE, 2008), not just those who are already keen runners or football players. There are various ways that employers could promote physical exercise at work:

- *Equipment for light exercise*, such as exercise balls, elastic exercise bands, light weights, exercise mats or a balance board, could be provided. In addition:
  - although items could be placed in a well-being room, some articles could be placed in common areas near to where workers work or take breaks;
  - posters could be provided near the equipment illustrating simple, light exercises that could be done using the equipment.
- *Physical activity could be planned for*, by including it in daily or weekly routines when making worksite plans or programmes.
- *Physical activity could be incorporated into the job*, for example by scheduling a short, collective stretching session immediately before the start of breaks (e.g. SUVA, 2005).
- *Active travel could be encouraged*, for example by encouraging workers to take an alternative, more active commute to work such as running, walking or cycling rather than taking the car, bus or train, or even just getting off the bus or metro one stop earlier.
- *Facilities and information to support physical activity could be provided*, for example :
  - *Simple information could be shared about easy and safe exercises* that can be done at the workstation or work. This could include flyers or posters or short (1-2 minute) videos. A lot of material on simple exercises that can be done in a short period of time is available online. Videos could also be made by the workers or by a local physical education instructor or physiotherapist.
  - Information (e.g. maps and distances) could be provided on *convenient walks* in and around the office; the same could be done for *cycle routes*.
  - *Changing and shower facilities* could be provided.
  - *Cycle racks* could be provided.
  - *Workplace bikes could be made available to borrow* during lunch breaks or for running work errands (care must be taken to ensure that this does not introduce any additional safety hazards).
- *Walking could be encouraged*, as it is a cheap and easy action that almost anyone can join in with (see Box 13).
  - *Pedometers could be purchased* to measure the number of steps taken in a day with the aim of achieving 10,000 steps a day, and a workplace pedometer challenge could be organised.
- *Exercise instruction* could be arranged. A trainer, physiotherapist or occupational therapist could visit the workplace and instruct workers in simple exercises. Some workers may need tailored exercises, so scheduling additional visits on a regular basis would allow workers to have short individual sessions for instruction in specific exercises. Exercises in groups can be more effective as it provides group motivation.
- *Goals and challenges*: workers could be encouraged to set goals on how far they walk and cycle, step count challenges could be organised and group challenges could be set.
- *Workers whose work involves frequent travel* could stay in accommodation with sports facilities.
- *Weekly activities could be introduced*, which could include:
  - introducing a weekly 'wearing sneakers to work day';
  - introducing a weekly 'walk in the park during lunch time day';
  - introducing a weekly 'meeting while standing up day'.
- *Participation in external activities* such as fundraising sports events or 'fun runs' could be encouraged.



- *Health promotion* could involve making workers aware of information, support and programmes that promote increased physical activity, a healthier weight and healthy eating.

### Box 13 Walking at work

Increasing walking, both within the office and through workplace challenges, is a realistic workplace activity as it is both low cost and low intensity. Walking interventions initiated in the workplace appear to be one of the most common interventions among the studies of individual interventions. There is also generally consistent and strong evidence that walking interventions initiated in the workplace have successful outcomes, at least in the short-term. According to Stanford University research, creative thinking improves while walking and shortly thereafter (Oppezzo and Schwartz, 2014).

'We were promoting the health side, but also more social ways of working. We'd be walking and talking instead of calling or emailing... getting my leadership team out to walk broke the flow of the day quite productively and got different conversations going. You talk in a different style when you're walking.' (BITC, 2018).

**Be creative!** Some examples of creative ways to promote being active at work are given below:

- In the Netherlands, a health insurance company introduced a 'fitcoin system'. By standing up or being active the worker earns fitcoins. These fitcoins can be used to earn benefits (a bike, good shoes, sports club membership, courses on healthy lifestyle, discount on health insurance fees, etc.). Activity is tracked with an app and the worker also receives the fitcoins in the same app. Tracking can be done by a smartphone or a smartwatch, or a pedometer (step counting software) can be included (ICT&Health, 2018).
- Workers' children could be invited to make posters on sitting less and standing more.
- What else?

An OSHwiki article related to this report summarises the steps to take to promote moving and exercise at work (de Langen and Peereboom, 2020b)

## 9.3 Ways for individuals to work more actively

The section provides a compilation of simple activities that workers could do throughout the day and could be given to workers. Workers can be asked to contribute their own suggestions and experiences of what works well for them.

### Box 14 An example of a microbreak

Stand-up, with a relaxed posture for 10-20 seconds, then raise both arms and push towards the ceiling, look up at the ceiling, inhale slowly, and sit down. The exercise extends the low back — a lumbar extension — and it fires neurons in the brain, enhancing alertness, for increased productivity.

### 9.3.1 Tips for working more actively

- *Workstation:*
  - Use the rocker feature on the chair (instead of having the backrest fixed in one, upright position).
  - If you have a height-adjustable workstation, or the opportunity to work both sitting and standing, change posture frequently between sitting and standing.
  - If you have a printer or rubbish bin in your office, move it away from your desk. Use common areas instead. Stand up or walk during phone calls if you have a hands-free phone or headset. Make it a habit to stand up as soon as the phone rings.

- Put your mobile phone out of reach. What else could you put out of reach to make you get up more often?
- Do not have a large water bottle on your desk. Use a small glass and go to the water dispenser or kitchen to refill it frequently. Drink water — it enhances blood flow and means that you will walk to the toilet more.
- *Speaking with colleagues:*
  - Talk with colleagues standing up. Walk during short meetings rather than sit down.
  - Walk to your colleague's workstation instead of phoning or emailing them.
  - Stand up whenever someone comes to your workstation to talk.
- *Planning tasks:*
  - Can you plan change into your work? When you have to do tasks that involve both standing and sitting, can you rotate between them — stopping one in the middle and then coming back to it?
  - What tasks could you do 'on the move'?
- *Taking breaks:*
  - Use breaks to move. Walk during lunch breaks and during down times (see Box 15).
  - Incorporate microbreaks into how you work to stretch and briefly get up. For example, in the office, take a break from your computer and stand up and stretch at your desk for 20 to 30 seconds every 20 to 30 minutes. Moreover, get up and stretch the moment you feel any ache or pain (see Box 14).
  - Never sit for more than 2 hours at a time.
  - Use a sitting time calculator and change your sedentary behaviour if needed.
  - Use a 'screen breaks' app or timer on your mobile phone as a reminder.
  - Stand and stretch whenever you yawn. Yawning is a sign of tiredness.
  - Eat your lunch away from your desk.
- *Increasing physical activity:*
  - Take the stairs, rather than the lift; start by getting out of the lift one floor too early. Alternatively, take breaks to walk up and down the stairs for 5 minutes.
  - Stand at the back of the room during presentations.
  - Take a short lunchtime walk, even if it is for only 10 minutes around the car park.
  - Form a walking group with colleagues, for coffee breaks or a short lunchtime walk.
  - Keep an elastic exercise band in your desk drawer or locker and take it with you when you go to make a coffee.
  - Park your car a distance away from the office entrance.
  - Make your commute more active, such as by running, walking or cycling to work rather than taking the car, bus or train, or get off the bus or metro one stop earlier.
  - Add a minimum of 10 minutes of moderate- or vigorous-intensity aerobic exercise to the day, which is enough to get the heart pumping and burn calories.
- *Outside work:*
  - Follow the same practices for sitting, taking breaks and small finding ways to be more physically active during the day.
- *What else could you do?*

#### Box 15 Purposeful breaks

Periodic posture breaks are important. A real break is the opposite activity from what you have been doing. In the case of static sitting, the opposite is moving (not static standing): breaks need to be purposeful and dynamic.

### 9.3.2 *Dynamic sitting: vary your sitting posture!*

Some people think that sitting is just sitting. Not true. Even when you need to sit, there are still ways you can change your posture. In fact, there are many ways to sit (BAuA, 2008b), including leaning forward, leaning backward, leaning sideways, on a chair, on a stool, pelvis tilted forward with back support, pelvis tilted backwards without back support. Work should offer sufficient variation between not only sitting, walking and standing but also while sitting. 'Our next posture is the best posture' also applies while sitting. Below are some tips on sitting dynamically. Additional advice on how to liven up sitting comes from Germany (BAuA, 2008b).

#### ▪ **Tips for dynamic sitting at work**

You can vary your sitting posture in the following ways:

- by leaning forwards, leaning backwards and leaning sideways;
- by tilting the pelvis forward with back support, and tilting the pelvis backward without back support;
- by shifting your weight sometimes more on to the right and sometimes more to the left buttock;
- by using the dynamic chair 'back' setting if you have one;
- when sitting forward, by supporting yourself on the desk;
- by taking frequent microbreaks from intensive computer work to stretch your hands, wrists and fingers;
- by rolling your shoulders and rotating your neck;
- by standing up, stretching and moving for 20-30 seconds around every 30 minutes, particularly if you feel any tension in your neck, wrist, shoulders or back;
- by doing gentle exercises every 2 hours;
- by taking a break to breathe in deeply and out slowly a couple of times — this is relaxing and good for the spine.

### 9.3.3 *Simple exercises to do at work*

#### ▪ **Simple stretches**

Simple stretches that workers can do at their workstation include the following:

- lift your arms above your head and do arm circles;
- shrug your shoulders and roll them backwards and forwards a few times;
- roll your neck gently from left to right, focusing on tight spots;
- roll your ankles, point your toes and flex your feet;
- stretch your hip flexors by pointing one knee at the floor and pushing the hips forward;
- lean back in your chair and push your upper arms back onto the chair to stretch the chest and shoulders;
- clasp your hands behind your chair and stretch your shoulders backwards.

#### ▪ **Sitting and standing exercises <sup>(39)</sup>**

The following are simple exercises that workers can do during the day.

Exercises to do while *sitting*:

- squeeze your buttocks for 5-10 seconds;
- use a hand gripper to work out your hands and forearms;
- do bicep curls with a heavy stapler or full water bottle;
- swivel in your chair for an ab workout;
- do leg raises under your desk;
- squat over your chair for 15-30 seconds;
- raise yourself above your chair using your arms.

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<sup>(39)</sup> <https://beupstanding.com.au/>

Exercises to do while *standing*:

- do leg lifts while taking a coffee break;
- do incline push ups while you wait for the printer;
- do one-legged squats while you wait for the printer;
- do calf raises for 1 minute;
- do wall sits for 30-60 seconds.

Box 16 contains some tips on doing exercises at work.

#### Box 16 Workplace training tips

The Danish 'Job and Body' ('Job og krop') campaign provides resources on exercises to do at work. The poster '4 exercises with elastic bands' — aimed at training the 'computer' muscles — includes some training tips for exercises that are relevant and adaptable for doing other exercises at work:

- Perform the four exercises three times a week — or daily if you prefer.
- Do the exercises with colleagues as an active break away from the computer.
- Follow the '5-minutes before lunch' programme: repeat each exercise as many times as you can, resting a minute in between each exercise\*.
- Start out easy and increase resistance when you can do 20 repetitions in a row\*.
- If an exercise feels uncomfortable or makes your pain worse, then reduce the resistance and have someone check whether or not you are doing it correctly. Otherwise, skip the exercise.
- You may feel muscle soreness during the first week of training. This is quite normal.

\*The number of repetitions and resting time depends on the type of exercise.

For video instruction on elastic band exercises to do during work breaks, see also NIVA Education (undated).

Source: Danish Working Environment Information Centre, undated. More resources (in Danish) are available from the Danish Work Environment Information Centre at: <https://at.dk/vaerktoej/i/job-og-krop-materialer/>

Appendix 4 lists some resources that provide additional simple exercises that can be done at work. Additional resources on exercises can also be found in the EU-OSHA MSD database (EU-OSHA, 2021e).

## 9.4 Communication and worker participation

All employers in the EU have legal obligations to consult workers on health and safety. EU-OSHA studies show that worker participation consistently appears as a key factor for the successful identification of problems and implementation of practical solutions, regardless of the size or type of workplace or type of problem (EU-OSHA, 2012a). Workers should also be encouraged to report early any health and safety problems related to prolonged sitting — the sooner problems are acted upon, the easier they are to deal with.

The identification and implementation of any measures to avoid prolonged sitting and promote more active working will be more successful if they have involved workers rather than the measures being imposed on workers. Australia's BeUpstanding programme<sup>(40)</sup> points out that it is critical to ensure that staff are engaged and committed to any proposed changes. BeUpstanding also points out that there is no 'one size fits all' for making the working environment more active, as organisational policies, the physical environment, workplace culture and, importantly, individual preferences all play a role. As every workplace is different, it is important to decide together what will work best. This includes the broader strategy and organisational measures as these can have the biggest impact over the long term. It is also

<sup>(40)</sup> <https://www.beupstanding.com.au/>

important to address any concerns workers may have about being more active at work (see Table 5). A starting point can be to organise a survey or meeting to discuss moving at work and get ideas.

### 9.4.1 Tips for worker involvement

The BeUpstanding programme provides practical resources on staff involvement, including practical tools for worker surveys and on how to organise workplace discussions <sup>(41)</sup>. Their advice on worker involvement includes the following:

- Have positive conversations. Although it is important to note the concerns of participants, it is crucial that the conversation is solution focused. Instead of leaving the discussion on a negative note, if a solution cannot be identified at the time, a commitment can be made to follow up and report back.
- Set realistic expectations, as some suggestions may be dependent on management support and approval.
- Management should, ideally, participate in discussions to identify strategies: management participation demonstrates commitment to the project; and if management are involved in the identification of solutions they can make approval processes more streamlined.
- During discussions, focus both on ideas that require longer term planning and ideas that can be easily and quickly implemented in the workplace.
- Ensure ideas cover both healthy workplaces and healthy people, and that strategies do not just focus on individual behaviours.
- In particular, listen to and address workers' concern. BeUpstanding provides examples of common concerns and some sample solutions, given in Table 5. Workers can also be asked during discussion to voice any concerns, and the group asked to discuss possible solutions.
- Remember that consultation takes time and change takes time.

**Table 5 Possible solutions to worker concerns**

Concerns	Possible solution
Feeling uncomfortable, weird or rude standing in a meeting or room	<ul style="list-style-type: none"> <li>▪ Change workplace culture to support standing (e.g. insert a standing break into a meeting agenda; lead by example)</li> </ul>
Fear of not being productive or not having enough time to take breaks/being perceived by others as not being productive	<ul style="list-style-type: none"> <li>▪ Inform managers and staff that dynamic workplaces have not been shown to negatively impact productivity</li> <li>▪ Make any changes to work scheduling part of a policy decision and established system of work.</li> <li>▪ Engage management in using the behaviour they want their workforce to undertake</li> </ul>
Physical design of office or building (e.g. blocking peoples' view behind you when standing/lack of privacy in open office space or low partitions between workstations)	<ul style="list-style-type: none"> <li>▪ Review how the office layout changes with increased standing. Strategically place privacy screens, monitors, pot plants in other positions to preserve privacy for staff</li> <li>▪ Designate 'stand-friendly' areas (e.g. put up posters in certain locations/rooms 'This a Stand-Friendly Zone'); rearrange meeting rooms to make it easy/more comfortable to stand</li> </ul>
Concern that the task they do prevents them from being able to sit less at work	<ul style="list-style-type: none"> <li>▪ Ask others in the discussion if they have any ideas. If there are several doing the same job, discuss together with them if there are ways tasks can be changed</li> </ul>

Source: Adapted from 'Planning tool for workplace well-being committee', BeUpstanding <sup>(42)</sup>.

<sup>(41)</sup> <https://www.beupstanding.com.au/>

<sup>(42)</sup> Available at: <https://beupstanding.com.au/>

## 9.4.2 Discussion activities

EU-OSHA has produced some workplace group discussion activities for use with short, amusing film clips using the cartoon character Napo (Napo, undated). Two of these relate to incorporating more movement into work. They could be a good starting point for discussing the issue at work and what could be done in practice, for instance by using Napo's short animated movies entitled *Think to move* and *Take a break* <sup>(43)</sup>.

Simple questions for a short workplace discussion or brainstorming session could include:

- How can the way tasks are planned and carried out be changed to combine sitting and standing options as much as possible in your workplace?
- How could short periods of exercise be built into the working day?
- How could your workplace encourage you to be more active?
- What steps can management take to promote more moving and dynamic sitting in the office?
- What steps can individuals take? What can I do?

Discussions can be open, or lists of possible organisational and individual measures that could be implemented can be used with participants, although it should be made clear that these are not definitive lists of options.

**Further information:** an EU-OSHA booklet (2012b) and OSHwiki article (Copsey et al., 2021) provide further information on worker participation.

## 9.5 Advice for specific jobs and tasks

Many different types of jobs can involve prolonged sitting and all jobs and tasks involving prolonged sitting should be examined to see what improvements can be made. This section provides some advice and tips for some specific types of work and workers. Often actions are simple and low cost.

### 9.5.1 Practical tips for home-based telework

Teleworking is becoming increasingly common. However, it can lead to more sedentary working. A survey in the UK during the Covid-19 pandemic (Active working, 2021), when many workers moved to teleworking from home, found that 47% of office workers surveyed spent nearly their whole working day (7 hours or longer) sedentary, up from 26% pre-pandemic. Two thirds of respondents also indicated that their workday sitting time had increased during the Covid-19 lockdown. Three principles for staying active and healthy when working from home are setting up a proper work environment, taking active breaks and moving more while sitting (Ulyate, 2020a). Tips for sitting less and moving more when working from home include the following (Ulyate, 2020b; vhp human performance, 2020):

- Take regular breaks during the day to get out of your chair and move around. Whether that is to make a cup of tea or simply walk up and down the stairs a couple of times will help you stretch, relax and refresh, ready to concentrate again. Do some exercises while you wait for the kettle to boil.
- Take advantage of the opportunity to wear comfortable clothing you can move easily in. Set reminders on your phone or computer to take microbreaks and get up and stretch every 20 to 30 minutes.
- Put your mobile phone away from your desk.
- Take a walk around your garden. If you have a dog, have a run around the yard with them as a break. Take out the rubbish as a break. If you live in an apartment block, walk back up the stairs.
- Do a small house household task. This gives you a sitting break and has you moving as well.

<sup>(43)</sup> <https://www.napofilm.net/en/learning-with-napo/napo-in-the-workplace/take-break>

- Since your home is more private than an office environment, it is easy to do some stretching, yoga, a few strength exercises, jogging on the spot, push-ups, or jumping jacks during a break of a few minutes.
- Do a 'walk and talk' wearing headphones with your colleague, instead of sitting.
- On a group conference call, if your camera is turned off and you have a wireless headphone and microphone, you have much more freedom to move around, stretch and adopt different postures than in an office meeting.
- Suggest scheduling a standing break at the start, middle and end of online meetings, so everyone gets up for a few seconds. Such breaks can be made part of remote meeting etiquette.
- Suggest scheduling some pre-lunch group exercise using teleconferencing.
- Get out and go for a walk around your neighbourhood during your lunch break.
- Invest in a height-adjustable standing desk converter that can turn any ordinary desk into a sit-to-stand desk. Some low-cost home furnishing stores sell reasonably priced sit-stand desks.
- Avoid eating lunch at your desk.
- Move more whilst sitting, fidget in your seat, stretch a little, turn your head occasionally.
- Treat exercise with the same priority as a work phone call. Blocking out time away from your desk means that you are more likely to do it.
- Are there different ways you could work for short periods, other than sitting at your desk the whole time (Soles, 2020)? An adjustable ironing board could be used for short periods of work standing (CIEF, 2020) or switch from sitting at your desk to standing at the kitchen bench a few times a day.

Some of these tips are only suitable for temporary teleworking. The employer is still responsible for their employees' safety and health if working from home. When teleworking is carried out on a regular basis, work is subject to risk assessment and, in general, the employer should ensure adequate ergonomic working conditions and provide any equipment if necessary. A European Union framework agreement on teleworking from home covers health and safety arrangements <sup>(44)</sup> (see also Munar, 2020).

"I stand up every 30 minutes from my chair even if it's for as little as 30 seconds. I also use a small water glass which I refill often throughout the day. As I work from home I don't tend to walk anywhere too far during the work day so I make a point of doing some stretches during the day in the mornings and afternoons to stretch out my legs, shoulders and neck."

Researcher from Australia's BeUpstanding campaign.

## 9.5.2 Supermarket checkouts and cash registry work

### ▪ Supermarket checkouts

Common problems that supermarket checkout staff may face include long-term nonadjustable seating, lifting and handling customers' goods and lack of breaks from checkout work. If the checkout is badly designed, the work involves standing while twisting the upper body and moving goods. Prolonged sitting and other factors that could contribute to musculoskeletal problems such as lifting, twisting and reaching should be examined together as part of a risk assessment. General control measures to avoid prolonged sitting include:

- making sure that operators can swap between seating and standing when they need to;
- providing suitable seating which is adjustable, stable and movable and footrests;
- organising the checkout workstation and equipment so that work can be carried out seated without creating other musculoskeletal problems;

<sup>(44)</sup> <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM%3Ac10131>

- providing regular breaks away from the checkout through organised/scheduled rest breaks or encourage task variety and job rotation — guidance from larger supermarket chains suggest times varying from 2 hours out of 4 to 3.5 hours out of 4, depending on the type of checkout;
- being able to stand to handle heavier items (guidance from the UK Manual Handling Operations Regulations advises that handling goods over 5 kg (men) or 3 kg (women) when the operator is seated is likely to cause injury (HSE, 2020));
- having well-designed checkouts, for example with narrower conveyor belts so that the goods are carried directly to workers and allow checkout operators to slide heavy goods, such as cases of beer, straight over the scanner to avoid lifting;
- training in manual handling, seat adjustment, posture, the type of checkout and scanning procedures.

If you want to assess your own checkout, these practical tools may help:

- The 'Guide to healthy checkouts' from Usdaw (Union of Shop, Distributive and Allied Workers) contains a useful table comprising a 10-point checklist (Uzdaw, 2010).
- The Department of Consumer and Employment Protection in Western Australia offers a 21-page booklet that explains all the relevant aspects of working at a supermarket and which can also be checked (Department of Consumer and Employment Protection, 2005).
- In the United Kingdom, the Health and Safety Executive (HSE) offers a leaflet for employers on managing MSDs in checkout work (HSE, 2013).

#### ▪ **Cash register workstations in gas stations**

Working at a cash register in a gas station has specific features, such as working alone, working at night and a lot of sitting including a degree of mobility by getting up (e.g. selling cigarettes from behind the counter, refilling shelves). The following checklist comes from sectorally agreed on guidelines which must be followed (ARBOcatalogus, undated a):

- The depth of the desk towards the customer must be at least 80 cm.
- Free leg space must be available when seated (60 cm depth and 70 cm width).
- After at the most 2 hours of sitting at a cash register, the worker always stands up, but for no longer than 1 hour.
- Seating must be available that meets the following ergonomic requirements:
  - the backrest and the seat height are adjustable in height;
  - the seat is stable — it cannot fall over when in extreme postures;
  - the seat does not slip away while seated;
  - the worker can adjust the seat so that she/he is comfortable (including specifications on this).
- The screen must be adjustable in terms of viewing distance and height.
- The top of the desk must be matt and light in colour.
- Screen the worker from looking direct light sources. Use a (sun)light protective layer (foil or film) for windows which are a direct light source.

#### ▪ **Cash register choice checklist in retail fashion shops**

To make the right cash register choices, Dutch fashion shops can use a cash register checklist (ARBOcatalogus, undated b): The main points are:

- If the worker is very mobile and moving about a lot, they should stand at a cash register.
- If the worker is at the register for more than 1 hour, or for more than 4 hours in total per day, seating or a stool should be available. If they are:
  - getting up more than 10 times per hour, they should stand at the cash register and sit/walk in between;
  - getting up less than 10 times per hour, they should sit at the cash register and stand/walk in between.



- Workers should always schedule a break (lasting 10 minutes) after 2 hours of sitting and/or 1 hour of standing.

### 9.5.3 Driving for work

#### ▪ Road vehicle drivers

Drivers are exposed to a number of risk factors for lower back pain. This includes those who often drive long distances in cars as part of their work, to commute or to visit client's premises. For drivers of cars, trucks or buses, it is difficult to stand up during the working day. The important issues are the:

- prolonged sitting, in an unnatural posture, which is influenced by the drivers' cab and seat design;
- the cumulative exposure to WBV;
- the cumulative exposure to manual handling activities, such as loading and unloading vehicles, assisting passengers with items of baggage.

*Reasons for back pain* in drivers can include (HSE, 2005):

- poor design of controls, making it difficult for the driver to operate the machine or vehicle easily or to see properly without twisting or stretching;
- incorrect adjustment by the driver of the seat position, and hand and foot controls, so that it is necessary to continually twist, bend, lean and stretch to operate the machine;
- sitting for long periods without being able to change position;
- poor driver posture;
- repeated manual handling and lifting of loads by the driver;
- repeatedly climbing into or jumping down from a high cab or one that is difficult to get in and out of;
- excessive exposure to WBV, and particularly to shocks and jolts.

If employees drive for work, a workplace *risk assessment* should be carried out and measures introduced to protect all workers, with additional measures for those who are vulnerable, for example because of a health problem (ETSC, 2016). This should include musculoskeletal risks, as well as fatigue and other risks. Employers should consider the design and ergonomic features when purchasing company vehicles, including:

- a fully adjustable seat and supportive features inside the car (e.g. neck support, back support);
- the allocation of a suitable vehicle (e.g. not giving a small vehicle to a tall person);
- features to improve the ease of getting in and out;
- features on vehicles to make loading and unloading easier.

Drivers may have limited scope to stand-up and move during the working day, nevertheless there are steps that they can take.

*Tips for driving include: (BackCare, 2010a, 2010b and 2020b)*

- Plan and take regular breaks to move around, and do back stretches (IMCCA, 2018).and other exercises during the journey, when it is safe and possible to do so, as well as stretching before starting a journey.
- Get out of the vehicle to eat or smoke. This is also important for safety reasons.
- Do not take breaks sitting in the vehicle. Where office tasks on a tablet or personal computer (PC) are necessary, carry them out at a table at a quiet location during a break, not in the vehicle.
- Get out of the vehicle to conduct telephone calls (for safety reasons calls should preferably be conducted when the vehicle is stationary. Even hands-free calls are a distraction).
- Adjust the seat properly, using an additional lumbar support (roll or cushion) if necessary to support the back to avoid fatigue and excessive vibrations that can hurt the body (Winslet, 2017).

- Focus on sitting correctly by maintaining a good driving posture; this is easier to do if the driver can take regular breaks.
- Loosen up first before starting to load, unload and carry any loads (BackCare, 2010b).
- Watch your posture as you drive and avoid leaning into the wheel while driving (Thorpe, 2017).
- Include back care for drivers (BackCare, 2010b).
- Stretch before beginning a journey and any time it is possible during and after the journey (IMCCA, 2018).
- Stand up as frequently as possible. If stopping for lunch or to obtain fuel, spend a minute or two extra, and at least walk around the vehicle before getting back in. If there is more time, do some exercises that help improve circulation, and that are good for back health, for example toe-ups, stair steps, back bends.
- Increase physical activity during leisure time to improve cardiovascular health.

Actions for *controlling WBV risks* could include the following (see also section 8.13 on WBV):

- a seat designed to support the back in a posture that minimises spinal stress, and to isolate the seat from the effects of vibration and road shock;
- avoiding driving at speed;
- following worksite routes to avoid travelling over rough, uneven or poor surfaces;
- maintaining roadways to keep them smooth and avoid bumps;
- maintaining machinery;
- maintaining vehicle suspension systems correctly (e.g. cab, tyre pressures, seat suspension);
- replacing solid tyres on machines such as fork-lift trucks, sweepers and floor scrubbers before they reach their wear limits;
- obtaining appropriate advice (from seat manufacturers, machine manufacturers and/or vibration specialists) when replacing a vehicle seat; seats need to be carefully matched to the vehicle to avoid making vibration exposure worse;
- introducing work schedules to avoid long periods of exposure in a single day and allowing for breaks where possible.
- avoiding high levels of vibration and/or prolonged exposure for older employees, people with back problems, young people and pregnant women.

A complete guide to good practice for managing work-related vehicle risks in the EU, including driving for work can be found at EU-OSHA (2021f).

#### ▪ **Train drivers and operators**

Regarding WBV, train operators and drivers should be trained and instructed to enable them to (HSE, 2005):

- adjust the driver weight setting on their suspension seats, where it is available, to minimise vibration and to avoid the seat suspension 'bottoming out' when travelling over rough ground;
- adjust the seat position and controls correctly, where adjustable, to provide good lines of sight, adequate support and ease of reach for foot and hand controls;
- adjust the vehicle speed to suit the ground conditions to avoid excessive bumping and jolting;
- steer, brake, accelerate, shift gears and operate attached equipment, such as excavator buckets, smoothly.

The normal driving position for train drivers is seated, and prolonged standing is not recommended as the risks of WBV are increased when standing. However, consideration should be given to allowing the option of standing up and driving, if required, for short periods of time, according to train drivers' trade unions. According to drivers, the standing option may also help to overcome fatigue. In addition, the driver's seat should be fully adjustable to provide maximum flexibility for the multiple users of the traction unit (ASLEF, undated; *Hazards*, 2005; LDAG, 2018).

As an example, Transport for London carried out an intervention with train drivers to find ways to introduce more movement, using active worker participation to find bespoke solutions. Guidance for the drivers covered key points to consider when adjusting and using train cab seats and the cab

environment, and advice about adopting a variety of postures throughout each shift. The advice is to break up periods of prolonged sitting where possible, for example, at stations or stops where there is time to do so or when operating the switches, and wherever possible, to get out of the cab to walk. Drivers have also been provided with exercises that they can do seated or standing in the cab (Webster, 2021).

### 9.5.4 Factory and production line work

Factory work should also allow workers to vary between sitting and standing and make time for movement. Some advice for achieving this comes from the United Kingdom (Shawcross, 2020):

- Before, during and after their shifts, staff should be encouraged to move in a different way to how they moved during their working hours. If they have been static for long periods or continually leaning across a conveyor belt, a few stretches or a walk around the block will help loosen off the muscles.
- Microbreaks and rotation are especially useful for work team members who have particularly repetitive roles, which leads to pressure on key areas of their body. This can be achieved by:
  - introducing breaks throughout the day that are shorter and more frequent rather than longer and less frequent will not affect working hours and production time, but will provide workers with more breaks in which to stretch and loosen up, as well as get some fresh air and rest;
  - changing tasks and more having frequent breaks should mean that workers are more alert on the job.

An example of active exercise breaks comes from an orchid propagation factory where group stretching during work breaks was introduced. A 5-minute exercise programme takes place at the workstations immediately before scheduled morning and afternoon breaks. Workers leading the stretching have been trained by a physiotherapist <sup>(45)</sup>. SUVA (2005) also provides examples of group exercise breaks.

## 9.6 Examples of workplace initiatives

### 9.6.1 Changed work schedule and workers consultation hour for casino workers

In Holland Casino in the Netherlands, many workers are seated, including croupiers, office workers and cashiers. Holland Casino introduced various changes to improve seated work. First, Holland Casino changed the work schedules for croupiers: a croupier works 45 minutes at a gaming table and then has a rest of 15 minutes. During these 45 minutes a croupier can sit for a maximum of 15 minutes and stand up for 30 minutes (15 minutes standing, 15 minutes sitting, 15 minutes standing). This is important because a croupier needs to reach often (for picking up cards, chips and money). The table managers make sure that the schedules are followed. Following this, Holland Casino implemented a consultation hour <sup>(46)</sup>: workers with questions about their working conditions and sit-stand schedules or who are beginning to have health problems are invited to an ergonomic consultation hour to get advice and — if needed — counselling on which treatment they should choose. The consultation hour is independent and confidential. After 13 years, this project was evaluated by an independent research company, which found that:

- In 13 years, almost 6,000 consultations were recorded, representing an average of 1.4 visits per casino worker.
- In the first 2 years, most workers visiting the consultation hour had MSD-type complaints, but in the last 11 years, most workers visiting the consultation hours had questions. This was exactly the purpose. After the presentation of the study, a happy casino manager quoted: 'yes, we stopped working the problem, we now prevent the problem'.

<sup>(45)</sup> vhp human performance, unpublished.

<sup>(46)</sup> vhp human performance, unpublished

- All visits were recorded in a database system, including body mapping. The database system showed which type of MSD complaints were occurring at each type of workstation. By analysing the database system, a number of workstation flaws have been repaired. For example, croupiers with a height of 187 cm or more reported a greater than average number of leg complaints while seated at the punto banco gaming table. It appeared that the leg space was insufficient and all of the tables have been adjusted in all 13 casinos.
- Special types of training on the job were implemented based on the results of the consultation hours.
- Sick leave due to MSDs was cut significantly and savings could be made on fees for health insurance. This added up to savings of EUR 23 million after extracting all costs. The project not only significantly improved the health of workers but also produced greater cost—savings than initially expected (a ratio of EUR 20 saved per euro invested).

### **9.6.2 Call centre interventions**

Call centre work is very sedentary. Workers can spend up to 90 % of their workday sitting, with 30 % of this time accrued in uninterrupted bouts of 30 minutes or more. The nature of the work also makes them susceptible to musculoskeletal injuries, so it is important that workers break up their sitting time. A health call centre implemented the Australian BeUpstanding programme (BeUpstanding, 2020). Factors that facilitated the implementation of the programme included having a supportive manager, access to electric sit-stand desks and a strong motivation to address prolonged sitting, while limited stair access and staff turnover during the course of the programme were some of the barriers identified. An evaluation following the implementation of the programme found that the call centre workers sat less than others in their sector, spending around 60 % of their working day sitting (compared with the average of 90 % previously reported for this sector). Therefore, even in highly sedentary work such as this, it is possible to make a difference.

See also Box 10 in section 8.11 where team members in a healthcare call centre 'stand up and shake it off' following difficult calls (BeUpstanding, 2019).

### **9.6.3 Improved sitting for nursery-school teachers**

ErgoKita (EU-OSHA, 2020b) is an example of an ergonomic intervention in the education sector. The project studied risk factors for MSDs in nursery school teachers and the effects of an intervention. It started with physiological work measurements, covering awkward postures such as sitting and lifting, and included the provision of ergonomic equipment. Furniture designed for adults and not only for children promoted workers' health. Worker participation in decision-making encouraged buy-in and raised awareness, changing behaviour off the job as well as at work. The participatory ergonomic approach has been applied successfully in many sectors, and the intervention is transferable to other day nurseries and other countries.

### **9.6.4 Ergonomic stations, work rotation, and change of tasks: tailoring work**

Employees of a tailoring division of a company reported problems caused by long periods spent sitting in a static position and from lifting and pulling heavy loads. The company decided to introduce new ergonomic stations and other organisational interventions. In terms of ergonomics, it was decided to use new adjustable seating; adjust the pedals of the machines to suit the employee; replace the heavy trolleys by installing a mechanical system of rolling; train employees in correct lifting methods and the use of the lifting devices. Other interventions included rotation of work and moving older employees to lighter tasks. The organisation also created a pleasant and spacious room for rest and recreation with a canteen. As a result of these changes, the company decreased the number of reported MSDs, decreased absenteeism and improved productivity (EU-OSHA, 2000).

In another example, a mattress factory introduced a height adjustable platform for sewing the mattresses to improve working positions and allow workers to change between sitting and standing. It was part of a number of improvements (EU-OSHA, 2000).

## 9.7 Physical exercise and active workplace examples

- Bingo: the team picked a key word (e.g. KPIs (key performance indicators)) and when that word was spoken in a meeting, it was a prompt for everyone to stand up. The idea helped raise awareness and encouraged behaviour change as well as increasing attention in meetings.

Source: BeUpstanding, 2019

### 9.7.1 Getting active in a software company

A Dutch software company ran a programme, Run Your Health, to raise awareness of the risk of occupational inactivity and foster a healthy workplace culture through strong leadership. It took a holistic and proactive approach in addressing seated desk work. Measures taken included information and encouragement to move frequently throughout the day, ergonomic improvements, such as height adjustable desks and taller tables for standing meetings, and workshops and other exercise equipment. Staff were given biofeedback trackers and posters prompted them to take action. Poster campaigns were used to remind employees to move regularly and exercise throughout the working day, such as taking the stairs instead of the lift. Workshops were run on a variety of topics — including nutrition, stress and sleep — to explain the impact of overall health. Health challenge activities with small incentives were organised. Staff were also offered counselling services to support them in making changes for a healthier lifestyle and advice on avoiding sedentary work was built into the return-to-work programme (EU-OSHA, 2017).

### 9.7.2 A whole-company approach to introducing more movement and exercise at work

The Lithuanian company UAB EUGESTA — a distribution company of consumer goods with over 900 staff — focused on maximising methods of engagement in physical activity by employees. To ensure that UAB EUGESTA is viewed as the best option for customers, they actively targeted creating emotional well-being within the workforce. The company directors are physically active people and encouraged their employees to live an active lifestyle and installed these values throughout the organisation. A range of physical activities are offered that have been culturally embedded in the company since it was established in 1992 (Ecorys, 2017). Examples of the activities offered include:

- basketball;
- volleyball;
- table tennis;
- fitness balance balls;
- exercising during 5-minute breaks twice a day on the job;
- working out on the Swedish ball;
- callanetics;
- table football;
- gym workouts and swimming: employees can go to a gym and a swimming pool, can get discounts for various wellness activities and are offered sports clubs season tickets;
- electric bicycling (employees are encouraged to commute to work by bicycle, not by car).

These activities are offered in the workplace during working hours and also outside work. Many different activities are offered and employees are free to choose whether they want to exercise individually or in groups, indoors or outdoors, with or without equipment. The times of exercise are also flexible, allowing everyone the option to participate in activities at times that are preferable to them. In addition, ergonomic sit-stand tables have been provided at work. As a result of the company ethics, employees often create and initiate new activities that interest them. Most employees have shown interest in at least one of the physical activities on offer. Following the intervention, the level of absenteeism and employee turnover decreased and productivity increased. Employees were less fatigued and more motivated, and the company reputation and employee loyalty improved.

### **9.7.3 Strength exercises for MSD pain among laboratory workers**

To encourage workers to move or exercise it is important to make things as simple as possible. Laboratory workers with neck and shoulder pains were trained to do simple strengthening exercises. Dumbbells were placed immediately outside the laboratory area, together with wall posters showing how to perform the simple exercises. Therefore, the workers would see them when they left the work area, for example when going to lunch, and were reminded to perform the exercises (Zebis et al., 2011).

### **9.7.4 Various employer experiences with workplace activity initiatives**

The following are examples of activities and experiences from activity programmes implemented by employers (BITC, 2019):

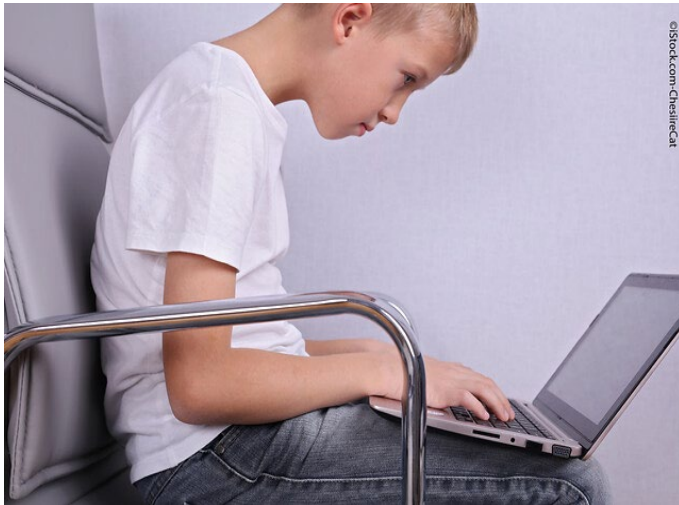
‘...we purchased pedometers to measure the number of steps taken in a day with the aim of achieving 10,000 steps a day. This even led to organising a workplace pedometer challenge’.

‘...we found that the biggest incentives for participating in a workplace wellness programme were having facilities available at a convenient time at a convenient location, with employer-provided paid time off during the workday’.

‘...we have established an annual sports weekend which provides a focal point for our many physical activity programmes. This event aims to bring together teams and individuals at a sporting weekend designed to enable all standards to compete in a wide range of activities ranging from running to dragon boat racing’.

‘...walking to and from work helps workers to clear the mind at the beginning and end of a busy day’.

## 10 School ergonomics and promoting movement in schools



What applies to adults regarding prolonged sitting and lack of movement is equally, if not more, important for children. Schools can play a role in reducing prolonged sitting by planning the school environment and addressing behaviour in children. Both the promotion of movement and the ergonomics of sitting need attention and a life-course approach, tailored to age, to MSDs in children and young people is needed (Taylor, 2020). What should be common practice in offices also applies to schools, and if musculoskeletal health and physical activity are incorporated into education, this knowledge and behaviour should extend into adult life.

BAuA (2008a) provides some tips:

- Someone in the school should be assigned responsibility for this area.
- Tables and chairs should be matched to the physical height of the individual pupil. To do this:
  - schools need an adequate assortment of differently dimensioned tables and chairs, and chair and table heights must be matched; colour coding can help achieve this;
  - in classrooms permanently assigned to a single class, the tables and chairs should be re-matched to the requirements of growing children every 6 months, with the active involvement of the pupils;
  - the teaching staff should make sure that pupils sitting together at double desks are, as far as possible, of equal size;
  - in special subject classrooms, the chairs should be height adjustable and should be individually adjusted before every lesson.
- Behavioural prevention of prolonged sitting should be introduced, for example by:
  - introducing movement breaks;
  - explaining and encouraging dynamic sitting;
  - tolerating 'lolling around' on the chairs — but not 'rocking', as this can be dangerous.

BAuA (2008a) provides the example of the 'Das bewegte Klassenzimmer' (the Mobile Classroom) approach from the (German) Federal Working Group for Posture and Movement Promotion at Primary Schools. The approach shows how learning can be combined with movement so that body and mind are in a state of balance. It is based on the following modules:

- *Sitting in motion*: promotion of dynamic sitting, provision of different sitting facilities, improvement of ergonomic design by means of desk mountings and wedge cushions, use of special 'reclining chairs'.
- *Learning in motion*: here, for example, children depict numbers and letters physically. Tasks are resolved in the form of movement activities, such as running dictation or arithmetical gymnastics.
- *Movement breaks*: these are inserted flexibly into the teaching routine. Activities involving motion alternate with relaxation breaks. The school playground is divided up into playing zones and quiet zones.

A more recent programme is Finland's 'Schools on the Move' programme (Liikkuva Koulu, undated; Niemi, 2020). This is a national action programme that aims to establish a physically active culture in Finnish comprehensive schools. It is carried out by the Finnish National Agency of Education and the Ministry of Education and Culture. According to the programme:

- The promotion of physical activity among school-aged children consists of both increasing physical activity and decreasing sedentary time.
- During the school day, physical activity can be increased by adding more physical education lessons, promoting active commuting and encouraging physically active breaks.
- During schools lessons, sedentary behaviour can be decreased by implementing active learning methods involving short active breaks, to support optimal learning and avoid long periods of continued sitting.
- Decreasing excessive sitting during school lessons is an opportunity for all school personnel to participate in the programme ideology.
- Involving students in planning and decision-making can increase success.
- Examples of 'Schools on the Move' activities include:
  - activity-based methods during classes;
  - standing workstations, using gym balls instead of chairs;
  - students organising activities for peers during breaks;
  - having facilities and schoolyards that encourage physical activity;
  - promoting active school commutes.

Austria has the teaching and research cooperation initiative 'Educational Landscapes in Motion' <sup>(47)</sup> (see also EU-OSHA, 2020c). In one project supported by the initiative, a classroom was redesigned to provide a wide range of possibilities for the playful promotion of physical activity in everyday school life <sup>(48)</sup>. It took into account spatial constraints and regulatory requirements, and was based on an analysis of obstacles and problem areas to create a visually attractive, functional and versatile space. Commercially available exercise balls, soft balls, hula hoops and fold-out gymnastic mats are part of the solution. This group room is bright and colourful and can be used in a flexible way, allowing different educational games and movement activities.

Box 17 lists some resources for schools from EU-OSHA and others.

#### Box 17 Resources and guidance related to schools

- Jolly Back (<https://www.jollyback.com/resources/>);
- Educational landscapes in motion (<http://www.bildungslandschaften.at/>; see also Musialek, 2019)
- ENETOSH (European Network Education and Training in Occupational Safety and Health): see the good practice database and "Hot Topic" #17: Integration of ergonomics into education and training' ([https://www.enetosh.net/webcom/show\\_article.php/c-178/\\_nr-18/\\_p-1/i.html](https://www.enetosh.net/webcom/show_article.php/c-178/_nr-18/_p-1/i.html))

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<sup>(47)</sup> <http://www.bildungslandschaften.at/>

<sup>(48)</sup> <http://www.bildungslandschaften.at/news/pausenfueller>



## 11 Design for the future

Given the importance of movement at work for health, the freedom to adopt different postures and a balance between moving, sitting and standing, it should become a design principle for building, workspace, and equipment and machinery designers. Adjustable chairs and tables, totally new office concepts, moving crane cabins and dynamic control room settings are all examples of trends concerning technical developments to alleviate workers from health risks caused by prolonged sitting. At least one futuristic suggestion 'the end of sitting' drastically questions the traditional desk and chair set-up in the traditional office space (Withagen and Caljouw, 2016). Although sitting per se should not be eradicated, prolonged sitting should be avoided and working environments, both inside and out, can be designed from the outset to facilitate postural change, moving, walking and exercise.

## 12 Conclusions and policy pointers

### 12.1 Conclusions for the workplace

Prolonged static sitting is related to various serious health problems, including cardiovascular problems, type 2 diabetes and low back pain. Our bodies need movement, and avoiding static postures is part of making work sustainable. Although many jobs in Europe involve prolonged static sitting, much can be done to organise work to limit prolonged sitting and facilitate more movement and physical activity at work, to ensure good ergonomics and to make sitting work more dynamic. Important factors identified in this report include the following:

- Overall, 2 hours is considered the maximum time for continuous sitting as health risks may occur, particularly when this 2-hour limit is exceeded on a regular basis. Within this timeframe, getting up every 20-30 minutes is important.
- Our next posture is the best posture. This means changing position between sitting, standing and walking. It also means varying posture as much as you can when you are sitting — ‘dynamic sitting’ and doing occasional stretching exercises, either sitting or getting up.
- Workers need control over how they work, when they can take breaks and should be encouraged to take microbreaks.
- Prolonged sitting should not just be replaced with prolonged standing because prolonged standing is also associated with serious health effects. The approach can be summed up as ‘sit when you need to, stand when you want to and walk or move when you can’ (IWH, 2018a).
- The general approach to avoiding prolonged sitting at work should be through a prevention strategy that ensures good workplace ergonomics and worker participation and that includes specific measures to limit prolonged sitting and promote movement at work within the strategy.
- As with all MSDs, early reporting of problems related to prolonged sitting is important.

Key elements to be included in the prevention strategy are given in Box 18.

#### Box 18 Key elements that should be included in the prevention strategy

- Comprehensively assessing **the full range of risks factors together**, including prolonged sitting, poor ergonomic postures, repetitive movements, manual handling and exposure to WBV.
- Providing a **suitable ergonomic workstation** and suitable environmental conditions as a starting point, including an appropriate chair, stool, table and driver’s seat. Adjustability is important to allow postural change and comfortable working, for example adjustable chairs that also facilitate postural change and ‘dynamic sitting’, adjustable workstation height, sit-stand workstations and cabins that can swivel.
- **Organising work to limit sitting and promote movement:** balance the tasks to be performed and provide possibilities for active work, task rotation, job enrichment, minibreaks and individual control options. Choose an approach directed at active/dynamic work. Give workers sufficient control over their work so that they can alter how they work and take a break when needed.
- **Organising the work environment and culture to promote movement**, for example by placing bins and printers in a common area and scheduling time for stretching during meetings.
- Encouraging consultation and **active worker involvement:** this is important for all aspects of the strategy. By working together, employers and workers can find practical ways to promote more active ways of working.
- **Promoting healthy behaviour**, for example through raising awareness of and providing training on prolonged sitting. This measure will be ineffective unless it is implemented together with the other elements mentioned previously.
- **Implementing organisational policies and practices** to make sure that the prevention strategy is put into practice.

## 12.2 Pointers for policy-makers

### 12.2.1 General

- Many workplace interventions are simple and low cost; however, employers must be provided with information to understand the basics.
- Guidelines on workstations and active working are needed and should preferably be sector-specific. This includes simple, sector-specific resources for MSEs.
- More attention needs to be given to preventing prolonged sitting in non-office work.
- Improved research tools are needed, especially questionnaires, to assess and investigate prolonged sitting.

### 12.2.2 OSH and workplace health promotion policy

- Prolonged sitting should be included in any OSH risk assessment that is carried out.
- Avoiding prolonged sitting should become part of all workplace health promotion campaigns.

### 12.2.3 Gender and age

More women than men report that their work involves sitting almost all of the time. Women are over-represented in a number of predominantly seated jobs (office work, micro-assembly), which are also of a low grade:

- More research and guidance are needed on the health effects and risk prevention of prolonged sitting in jobs carried out by women. This includes when prolonged sitting is combined with other musculoskeletal risks.
- More attention needs to be given to the types of sedentary work that women do.

With regard to age, studies show that the prevalence of MSDs increases with age; this is partly due to the length of cumulative exposure to MSD hazards over the work-life course:

- For workers aged over 65 years, there is a need to develop an understanding of the impact of the extended duration of exposure owing to their extended working lives.
- More research is needed on moving older workers to less demanding, predominantly seated occupations without exposing them to prolonged sitting.

### 12.2.4 Public health policy

- A combined approach aimed at reducing sitting time both at work and at home and promoting physical activity is needed. Greater collaboration between the areas of OSH and public health is needed to achieve this.
- Public health programmes should include advice for the workplace on making work more dynamic and limiting prolonged sitting, and healthcare professionals should be educated so that they can provide appropriate advice.
- The cause-effect relationship between sitting and health effects is not fully understood. More research is needed in this area.

### 12.2.5 Schools

- Education about prolonged sitting and actions to limit it should take place in schools.
- More attention needs to be given to the ergonomics of classrooms.

## 12.3 Overall conclusions

Tackling prolonged sitting at work is part of making work more sustainable, as well as part of tackling sedentary lifestyles. Workplaces should provide good ergonomic working conditions, facilitate postural change between sitting, standing and walking and 'dynamic sitting', whereby sitting positions are continuously altered, and promote more physical movement at work. This should be part of a combined

prevention and health promotion strategy. There are many simple and low-cost steps that MSEs can easily take to reduce prolonged sitting at work and increase movement.

**Remember**

Our next posture is the best posture! Sit when you need to, stand when you want to, and walk or move when you can.

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## 14 Abbreviations

BAuA	Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (German Federal Institute for Occupational Safety and Health)
BMI	body mass index
CSEP	Canadian Society for Exercise Physiology
DSE	display screen equipment
EN	European Norm
ESENER	European Survey of Enterprises on New and Emerging Risks
EU	European Union
EU-27	27 Member States of the EU
EU-OSHA	European Agency for Safety and Health at Work
EWCS	European Working Conditions Survey
HSE	Health and Safety Executive
INRS	Institut National de la Recherche et de la Sécurité (French National Research and Safety Institute for the Prevention of Occupational Accidents and Diseases)
ISO	International Organisation for Standardisation
MET	metabolic equivalent of task
MSD	musculoskeletal disorder
MSEs	micro and small enterprises
OSH	occupational safety and health
VDU	visual display unit
Usdaw	Union of Shop, Distributive and Allied Workers
WBV	whole-body vibration
WHO	World Health Organisation

## Appendix 1 Methodology

To meet the objectives the following research questions were addressed:

1. What definition of sitting should be used in order to understand the cause-effect relationship in a proper manner?
2. Which types of MSDs are to what extent caused by prolonged static postures?
3. Which types of non-MSD health complaints are to what extent caused by prolonged static sitting postures?
4. In what way do MSD-type complaints and non-MSD-type complaints interfere with, and consequently strengthen or weaken, each other's effects?
5. What can be considered a 'safe' threshold exposure time for guidelines on sitting?
6. Which prevention practice approach is successful, to what extent and how does this relate to the type(s) of MSD and/or non-MSD complaints that have been identified?
7. Which types of prevention practice approach focusing on promoting physical activity are considered successful?
8. Which target audiences can best be approached with which type of prevention strategies?

Regarding questions 2-6, a study was performed on 107 of selected sources of information that had been identified (listed in Appendix 2). Regarding prevention practice and guidelines, reference was also made to grey literature and campaigns. The results were incorporated into a model of the cause-effect relationship for both MSD and non-MSD health effects (section 4.6).

Regarding questions 7 and 8, a prevention practice overview was conducted, focusing on avoiding prolonged static sitting. This provides an overview of good practice recommendations in relation to avoiding prolonged sedentary work and promoting dynamic sitting and working.

A number of these prevention practices have been included in the report and additional resources on prevention practice were identified using the four steps listed below.

1. Gathering available and known sources containing knowledge and/or tools on (prolonged) sitting and promoting physical activity at work. This included the following sources:
  - the results of a consultation of EU-OSHA national focal points on MSD prevention tools;
  - resources identified for the EU-OSHA toolbox of practical resources for MSDs prevention (EU-OSHA, 2021d);
  - consultation of OSH specialists, including vhp human performance (Netherlands), NOFER (Poland) and EUROGIP (France);
  - European Trade Union Institute (ETUI) and European TUC European Trade Union Confederation (ETUC) and OSH organisations in countries including the United States, Australia and New Zealand, Institute of Work and Health (IWH) (Canada), INRS (France), DGUV (Germany), INSSBT (Spain), OSHA and NIOSH (United States). The Dutch Labour Foundation (Netherlands), BAuA (Germany), Central Institute for Labour Protection (CIOP) (Poland), National Research Centre for the Working Environment (NRCWE) (Denmark), National Institute for Safety and Health at Work (INSST) (Spain), Työterveyslaitos (Finnish Institute of Occupational Health (FIOH) (Finland), Hellenic Institute for Occupational Health and Safety (ELINYAE) (Greece), HSE (United Kingdom).
2. Additional extensive internet searches were performed using an agreed keywords strategy. The following search terms were used:
  - sitting, static sitting, types of sitting, prolonged static sitting, sedentary, seated, low energy expenditure.
  - Combined with and/or search-term combinations comprising:
  - MSD, musculoskeletal disorders, lower limb disorders, back problems, upper limb disorders, health complaints, pain, cardiovascular disorders, diabetes, mortality, physical activity at work, exercise at work, physical activity at work, prevention practice, dynamic office work, risks in the workplace, guidelines, retail work, factory/production line work, construction work, office work,

occupational safety, stretching, breaks, health-promotion, workstation design, woman/female workers, MSE, good practice recommendations, work organisation, job rotation, (office) chair, stool, support, tasks, work equipment, reach envelope, (sit-stand) table, adjustable, design for all, anthropometrics, human size, (active) lifestyle.

- Within the search context the following issues were specifically taken into account:
  - specific jobs known for seated work, such as: office workers, administrative staff, control room workers, drivers, pilots, air traffic controllers, production line workers, confectionary industry workers, installation service workers, beauticians, surveillance/security, education, desk staff;
  - influences of gender-specific issues relevant to female workers and working while seated;
  - actions focused on seated workstations (work organisation, breaks, tasks, work equipment, exercise and stretching at work, workplace health promotion, etc.);
  - steps employers can take to encourage more active lifestyles in workers both at work and outside the workplace;
  - more dynamic ways of sitting to allow for postural change and ways of reducing long periods of time spent sitting without a break;
  - introduction or facilitation of a more active workplace situation (sit-stand, use adjustability);
  - suitability of actions for teleworkers (working at home);
  - issues related to prolonged sitting and inactivity in schools;
  - identifying advice that is suitable for both MSEs and larger companies, and, in particular, simple steps that MSEs could take that would be practical and easy to implement.
3. To identify and examine good practice guidance and recommendations on avoiding and minimising the risks from prolonged static sitting at work, members of the Centre for Registration of European Ergonomists (CREE) network of ergonomists and expert organisations from outside the EU (mainly from Canada, Australia, United States) were consulted. This helps guarantee that the prevention practice overview includes a broad spectrum of both EU Member States and worldwide initiatives.
4. Consultation of experts and quality control of the cause-effect model, preventive measures and the formulated guidelines on prolonged seated work (maximum sitting time thresholds).

Assessments on the suitability of the gathered prevention practices for MSEs were performed. This included checking they:

- secured the involvement of workers;
- were cost-effective;
- were time-effective;
- required the minimum amount of paperwork;
- were low on text and high on pictures and images;
- did not require experts for deployment;
- were easy to apply;
- produced quick and simple results;
- satisfied statutory requirements.

## Appendix 2 Sources of evidence used for the health effects of prolonged sitting model

The model presented in section 4.6 and Figure 5 is based on a short review of the 107 scientific publications listed below.

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## Appendix 3 EU standards and norms

The Directives referred to in the report are complemented by a set of European Norms (ENs) and labour standards issued by the International Organisation for Standardisation (ISO) for the protection of workers against work-related MSDs. Those norms and standards comprise areas such as general design principles, safety of machinery, physical environment, physical workload, mental workload, workplace and equipment design, visual information and display terminals and software, displays and controls and personal protective equipment. There are many standards available and most of them are directed towards specific work environments.

Concerning prolonged sitting, two more generic orientated standards are considered especially appropriate:

- EN 1005-4:2005(E) EN Safety of machinery — Human physical performance — Part 4: Evaluation of working postures and movements in relation to machinery
- ISO 11226:2000(E) Ergonomics — Evaluation of static working postures
- EN-EN 1335-1:2018 EU standard for office chairs
- NEN-EN 14386:2002 Ergonomic design principles of mobile machinery

EN 1005-4:2005(E) emphasises that, with respect to working postures, the work should offer sufficient variation between and within sitting, standing and walking. Awkward postures, such as kneeling, squatting and crouching, should be avoided whenever possible. It highlights that measures meant to induce variations of posture should not lead to monotonous repetitive work.

ISO 11226 is directed at OSH specialists and focusses mainly on specific joint positions.

EN-EN 1335-1:2018 delivers an EU standard for office chairs and this norm should be mentioned. As many EU workers are VDU workers it is important that employers purchase an ergonomic type of chair that meets basic ergonomic demands and fits the body dimensions of the worker.

NEN-EN 14386:2002 Ergonomic design principles of mobile machinery concerns seated work, focusing, for example, on working in cabins of mobile machinery in cranes, in transport, forestry and agriculture.

## Appendix 4 Resources for promoting physical activity and reducing sitting at work

Table 6 provides some examples of campaigns, guides, tools and tips that can help workplaces to carry out activities to promote physical activity and reduce sitting. The table also covers examples of technical solutions, and personal computer software and phone apps. It includes examples from public health and OSH organisations. The suitability of each resource for small organisations is indicated, although most resources provide something relevant to small organisations. The examples may also be useful to anyone wishing to develop similar campaigns or resources.

**Table 6 Resources and further information**

Country	Resource /example	Description	Target audience	MSE friendly?
<b>Campaigns providing multiple resources</b>				
Australia	Department of Health and Social Care/Physical activity and exercise <sup>(49)</sup>	These webpages from the Australian Government provided resources of exercise and physical activity	All	Yes
Australia	BeUpstanding/University of Queensland and partners <sup>(50)</sup>	This is a comprehensive campaign, supported by the Australian government and other partners, which aims to get workplaces to stand up, sit less and move more and provides many resources. It provides a toolkit of resources for a structured approach to introducing more movement into the working day. It is based on building a supportive culture for change and encouraging staff to take action to achieve this change	Employers, workers	Yes
Canada	Get Canada Standing <sup>(51)</sup>	This campaign website on sedentary lifestyles includes a sitting time calculator and a resources section for employers	All	Yes
Canada	ParticipACTION Canada/Public Health Canada <sup>(52)</sup>	This long-running campaign aims to get Canadians healthy by getting them more active and encouraging them to sit less. The website includes videos of exercises, movement guidelines and an activity tracer app	All	Yes

<sup>(49)</sup> <https://www.health.gov.au/health-topics/exercise-and-physical-activity>

<sup>(50)</sup> <https://beupstanding.com.au/>

<sup>(51)</sup> <http://getcanadastanding.org/>

<sup>(52)</sup> <https://www.participaction.com/en-ca/>

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Country	Resource/example	Description	Target audience	MSE friendly?
The Netherlands	Alles over Sport/National Physical Activity Programme <sup>(53)</sup>	The Netherlands promotes at least 30 minutes of moderate physical activity a day (enough to raise the heart beat) and muscle and bone strengthening exercise twice a week and sitting less. More generally, the website provides find knowledge for research, policy and practice on sport and exercise.	All	Yes
United Kingdom	Get Britain Standing <sup>(54)</sup>	This campaign website contains many different resources aimed at avoiding sitting and promoting movement and exercise. It is aimed at lifestyle issues and work issues. There are specific resources for employers and active workplaces, and suggestions for sit-stand solutions for every budget (for home and office). It promotes 'Wiggle it, waggle it. Don't just sit on it'	Workers and employers	Yes
United Kingdom	Lifestyle-oriented programme/preventing MSDs/BITC <sup>(55)</sup>	..by physical activity, healthier eating and healthier weight	Employers	Yes
United States	Move it Monday/The Monday campaigns <sup>(56)</sup>	Website with an extensive amount of free resources, tips, initiatives, information, guidance on promoting moving. It includes guidance how to get your own campaign started.	Workers, employers, students	Yes
<b>Tools and guidance on sitting less and being more active</b>				
Australia	Make your move — Sit less Be active for life/Getting active <sup>(57)</sup>	This brochure provides Australia's physical activity guidelines and tips on how to achieve them	Workers	Yes
Canada	Sitting or standing? Which is best?/Institute for Work and Health (IWH) <sup>(58)</sup>	Video that raises awareness about the negative health effects of prolonged sitting and prolonged standing	All	Yes
Canada	Sedentary Behaviour Research Network (SBRN) <sup>(59)</sup>	SBRN aims to connect sedentary behaviour researchers and health professionals, and disseminate research to both researchers and the public. The website includes a research database and many practical resources	OSH experts, policy-makers	No

<sup>(53)</sup> <https://www.allesoversport.nl/artikel/terugblik-campagne-30minutenbewegen/>

<sup>(54)</sup> <http://www.getbritainstanding.org/>

<sup>(55)</sup> <https://www.bitc.org.uk/toolkit/physical-activity-healthy-eating-and-healthier-weight-a-toolkit-for-employers/>

<sup>(56)</sup> <https://www.moveitmonday.org/about/>

<sup>(57)</sup> <https://www.health.gov.au/resources/publications/make-your-move-sit-less-be-active-for-life-family-guide>

<sup>(58)</sup> <https://www.iwh.on.ca/videos-and-presentations>

<sup>(59)</sup> <https://www.sedentarybehaviour.org/>

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Country	Resource/example	Description	Target audience	MSE friendly?
EU	Practical tools and guidance on MSDs (filtered for sedentary work)/EU-OSHA <sup>(60)</sup>	This database contains links to resources on preventing prolonged sitting at work. The resources come from across Europe and worldwide	Employers and workers	Yes
EU	Physical activity at the workplace/Directorate-General for Education, Youth, Sport and Culture (European Commission) <sup>(61)</sup>	This publication provides an overview of best practices on physical activity in the workplace, including case examples. It identifies which types of workplace physical activity interventions are effective in changing physical activity behaviour in different work sectors and types of workplace	Employers	No
France	Guidance on repetitive strain injury (RSI) /INRS — French national research institute on OSH/ <sup>(62)</sup>	Guidance on repetition injury risks that may occur in connection with seated work	Employers, OSH professionals	Yes
Ireland	Exercise/HSE <sup>(63)</sup>	Webpages from Ireland's health service providing information and tips on how to get moving, how to fit physical activity into the day, being active with a health condition and getting kids of different ages more active	Workers	Yes
New Zealand	Keeping active/Canterbury District Health Board <sup>(64)</sup>	These webpages provide simple advice and tips on being more active	Workers and employers	Yes
United Kingdoms	Driving and back pain/BackCare <sup>(65)</sup>	Information sheet on how to deal with long hours of driving and back pain	All	Yes
United Kingdom	SMART Work and Life <sup>(66)</sup>	SMART Work and Life resources, aimed at reducing sitting at work and outside work, were developed with employers. There are resource kits for managers, workplace champions and workers. It includes resources for setting up a workplace programme, which cover an education workshop; provision of height adjustable desks/platforms; a device to keep track of sitting time and provide movement reminders; a sitting calculator and feedback on sitting behaviour; action planning and goal setting; motivational posters; and brief 'progress' sessions	Employers and workers	Yes

<sup>(60)</sup> [https://osha.europa.eu/en/themes/musculoskeletal-disorders/practical-tools-musculoskeletal-disorders?f%5B0%5D=field\\_msd\\_priority\\_area%3A4673](https://osha.europa.eu/en/themes/musculoskeletal-disorders/practical-tools-musculoskeletal-disorders?f%5B0%5D=field_msd_priority_area%3A4673)

<sup>(61)</sup> <https://op.europa.eu/en/publication-detail/-/publication/9fc2b8a0-e537-11e7-9749-01aa75ed71a1/language-en>

<sup>(62)</sup> <http://www.inrs.fr/media.html?reflNRS=ED%20957>

<sup>(63)</sup> <https://www2.hse.ie/healthy-eating-active-living/exercise/>

<sup>(64)</sup> <https://www.healthinfo.org.nz/how-active-should-i-be.htm>

<sup>(65)</sup> <https://backcare.org.uk/wp-content/uploads/2015/02/704-Driving-and-Back-Pain.pdf>

<sup>(66)</sup> <https://www.smartworkandlife.co.uk/>



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Country	Resource/example	Description	Target audience	MSE friendly?
United Kingdom	Physical activity, healthy eating and healthier weight: a toolkit for employers/Business in the Community <sup>(67)</sup>	This toolkit has been created by employers for employers, building on their experience and expertise. It includes practical guidance on promoting physical activity in companies as part of an integrated health and well-being programme. Among the contents are a 12-step model for planning, executing, reviewing and updating a physical activity initiative, and examples of best practice and lessons learned from companies	All	Yes
-	Why sitting is bad for you/Murat Dalkilic <sup>(68)</sup>	Short, animated TED-ed film about the hidden risks of sitting	All	Yes
<b>Ergonomic and technical solutions</b>				
Canada	eOfficeErgo — Ergonomics e-learning for office workers/Institute for Work and Health (IWH) <sup>(69)</sup>	Evidence-based online training programme on the proper way to set up and work at office workstations to prevent MSDs and other injuries	Workers	Yes
Canada	MSD Toolbox/Occupational Health and Safety Council of Ontario <sup>(70)</sup>	Contains examples of worksheets, surveys and hazard identification tools that the workplace parties can use to help them in their MSD risk assessment and prevention efforts	Employers	Yes
Canada	Ergonomic office chair/Canadian Centre for Occupational Health and Safety <sup>(71)</sup>	Short guidance on selecting an ergonomic chair	Employers, OSH experts	Yes
Germany	Up and Down — Up and Down/BAuA <sup>(72)</sup>	This booklet provides practical advice about sitting less, and dynamic sitting and standing in the office.	Workers	Yes
Germany	The Ups and Downs of Sitting at Work and Elsewhere/BAuA <sup>73</sup>	This booklet provides practical advice about dynamic sitting in the office		
The Netherlands	Orthopaedic surgeon initiative/Swopper Zami <sup>(74)</sup>	An example of alternative ergonomic seating: 'wobble' seating developed by an orthopaedic surgeon	Employers, OSH professionals	Yes
Spain	Posturas de trabajo [work postures]/INSST — National Institute on Work Safety and Health <sup>(75)</sup>	Various resources on improving work postures can be accessed from this web page	Employers	Yes

<sup>(67)</sup> <https://www.bitc.org.uk/toolkit/physical-activity-healthy-eating-and-healthier-weight-a-toolkit-for-employers/>

<sup>(68)</sup> <https://www.youtube.com/watch?v=wUEi8KrMz14> (full lesson: <https://ed.ted.com/lessons/why-sitting-is-bad-for-you-murat-dalkilic>)

<sup>(69)</sup> <https://www.iwh.on.ca/tools-and-guides/eofficeergo-ergonomics-e-learning-for-office-workers>

<sup>(70)</sup> <https://www.iwh.on.ca/tools-and-guides/msd-prevention-series>

<sup>(71)</sup> <https://www.ccohs.ca/oshanswers/ergonomics/office/chair.html>

<sup>(72)</sup> [https://www.baua.de/DE/Angebote/Publikationen/Praxis/A65.pdf?\\_\\_blob=publicationFile&v=1](https://www.baua.de/DE/Angebote/Publikationen/Praxis/A65.pdf?__blob=publicationFile&v=1)

<sup>(73)</sup> [https://www.baua.de/DE/Angebote/Publikationen/Praxis/A66.pdf?\\_\\_blob=publicationFile](https://www.baua.de/DE/Angebote/Publikationen/Praxis/A66.pdf?__blob=publicationFile)

<sup>(74)</sup> <http://www.swopperusa.com/>, <https://ergonomicshealth.com/standing-desk-stools/>

<sup>(75)</sup> <https://www.insst.es/riesgos-ergonomicos-carga-de-trabajo-posturas-de-trabajo>

Prolonged static sitting at work - Report

Country	Resource/example	Description	Target audience	MSE friendly?
Spain	Recognising forced postures/INSST — National Institute on Work Safety and Health <sup>(76)</sup>	A brochure including explanation and (checklist) tools on recognising forced postures	OSH professionals	No
United State	Just Stand/height adjustable desks <sup>(77)</sup>	Overview of possible solutions for working stations that make changing between sitting and standing possible	Employers, workers, students	Yes
United States	Desk bike <sup>(78)</sup>	Article about desk bikes and one person's experience	Employers	No
<b>Practical tips</b>				
The Netherlands	Walking meetings for a healthier lifestyle!/JDE Professional <sup>(79)</sup>	This webpage presents the benefits of walking meetings and provides tips. [In Dutch]	All	Yes
Canada	Factsheets/CCOHS <sup>(80)</sup>	Easy-to-read, question-and-answer factsheets on sitting at work	Workers	Yes
Canada	Pictograms to prevent MSDs/IWH <sup>(81)</sup>	Pictograms on preventing MSDs for awareness-raising and training	Employers	Yes
Spain	Muevete en la oficina [Move in the office]/INSST <sup>(82)</sup>	Poster and video to encourage workers to avoid prolonged sitting and move	Workers	Yes
<b>Workplace exercises</b>				
Canada	Exercises at your workstation — prevention through intervention/Occupational Health Clinics for Ontario Workers <sup>(83)</sup>	This short guide provides illustrated exercises that can be done at the desk or workstation. It is aimed at office workers who may sit or stand for long periods, although the exercises are suitable for other workers who need a break from working in one position. The exercises cover the neck and upper limbs, lower limbs and trunk	Workers	Yes

<sup>(76)</sup> <https://www.insst.es/documents/94886/96076/Posturas+de+trabajo.pdf/3ff0eb49-d59e-4210-92f8-31ef1b017e66>

<sup>(77)</sup> <https://www.juststand.org/stand-up/>

<sup>(78)</sup> <https://www.insider.com/pros-and-cons-of-a-desk-cycle-2016-10>

<sup>(79)</sup> <https://www.jacobsdouweegbertsprofessional.nl/inspiratie/5-voordelen-walking-meetings/>

<sup>(80)</sup> [https://www.ccohs.ca/oshanswers/ergonomics/sitting/sitting\\_overview.html](https://www.ccohs.ca/oshanswers/ergonomics/sitting/sitting_overview.html)

<sup>(81)</sup> <https://www.iwh.on.ca/tools-and-guides/pictograms-to-prevent-msds>

<sup>(82)</sup> <https://www.insst.es/documentacion/catalogo-de-publicaciones/sedentarismo-ganar-en-salud-ano-2016>

<sup>(83)</sup> [https://www.ohcow.on.ca/edit/files/fact\\_sheets/exercises\\_at\\_your\\_workstation.pdf](https://www.ohcow.on.ca/edit/files/fact_sheets/exercises_at_your_workstation.pdf)

Prolonged static sitting at work - Report

Country	Resource /example	Description	Target audience	MSE friendly?
Denmark	4 exercises with elastic bands [English version]/Danish Work Environment Authority <sup>(84)</sup>	This poster illustrates simple exercises, aimed at computer workers, for strengthening the arms, shoulders and neck	Workers	Yes
EU	Practical tools and guidance on musculoskeletal disorders (filtered for exercises)/EU-OSHA <sup>(85)</sup>	This database contains links to resources on exercises suitable for the workplace. The resources come from across Europe and worldwide	Employers and workers	Yes
Finland	Video: work from home exercise program/NIVA <sup>(86)</sup>	Video instruction on elastic band exercises to do during work breaks	Workers	Yes
<b>Software and apps (a few examples of the many available)</b>				
Australia	Need a prompt to get up? We road tested some break apps for your computer and phone/BeUpstanding <sup>(87)</sup>	Article describing various break apps for phone and computer, and the author's assessment of how they performed	All	Yes
France	Smartphone coach/Heath Insurance Company <sup>(88)</sup>	App that follows your activity and encourages you to maintain and develop healthy postures and behaviour by sending you messages on your mobile phone or in the app	Workers	Yes
United Kingdom	Active 10 app/Public Health England <sup>(89)</sup>	Active 10 app monitors brisk walking to encourage people to do at least 30 minutes of brisk walking during the day	All	Yes
United States	StandApp/American Heart Association <sup>(90)</sup>	StandApp provides alarmed reminders to take standing breaks from your desk. It includes 30 low- to medium-intensity exercises that anyone can do at work. Users can set reminders as a timer or an alarm	All	Yes
United States	Accupedo/Corusen <sup>(91)</sup>	Accupedo is an accurate pedometer app that monitors your daily walking on the home screen of your phone	All	Yes

<sup>(84)</sup> <https://at.dk/media/4745/exercises-with-elasticband.pdf>

<sup>(85)</sup> [https://osha.europa.eu/en/themes/musculoskeletal-disorders/practical-tools-musculoskeletal-disorders?f%5B0%5D=field\\_prevention\\_measures%3A4395](https://osha.europa.eu/en/themes/musculoskeletal-disorders/practical-tools-musculoskeletal-disorders?f%5B0%5D=field_prevention_measures%3A4395)

<sup>(86)</sup> <https://niva.org/course/video-work-from-home-exercise-program/>

<sup>(87)</sup> <http://beupstanding.blog/2020/07/need-a-prompt-to-get-up-we-road-tested-some-break-apps-for-your-computer-and-phone/>

<sup>(88)</sup> [https://www.ameli.fr/assure/sante/themes/lombalgie-aigue/application-activ-dos#text\\_36268](https://www.ameli.fr/assure/sante/themes/lombalgie-aigue/application-activ-dos#text_36268)

<sup>(89)</sup> <https://www.nhs.uk/oneyou/active10/home>

<sup>(90)</sup> <https://standapp.biz/>

<sup>(91)</sup> <http://www.accupedo.com/>

## Appendix 5 Example of an action plan to reduce MSDs related to sitting

Problem	Priority	Solutions	Responsibility	Resources	Timeline	Evaluation
Sedentary work: prolonged periods of sitting while carrying out office work and computer-based tasks.	High	<p><i>Targeting the workplace</i></p> <ul style="list-style-type: none"> <li>– Use ergonomic work furniture (adjustable, appropriate for different visual display unit tasks and individual differences)</li> <li>– Use standing desks (to break up and reduce sedentary time by alternating sitting and standing postures)</li> </ul>	Owner/ manager	<p><i>Time for owner/ manager to:</i></p> <ul style="list-style-type: none"> <li>– assess and decide on work furniture to be bought</li> <li>– assess and decide along with workers on the changes to be introduced in work organisation to address sedentary work</li> <li>– provide training</li> </ul>	End Quarter 2	<p>Gather feedback on how the implementation is progressing at every monthly meeting.</p> <p>Evaluation after six months from completion</p> <p>(Do workers feel/perceive improvements? Is there a reduction in sickness absence because of MSDs?)</p>
		<p><i>Targeting work organisation to reduce prolonged sitting</i></p> <ul style="list-style-type: none"> <li>– Organise the work so that breaks are possible</li> <li>– Ensure task variation with the aim of alternating sitting and standing postures</li> </ul>	Owner/ manager	<p><i>Monetary resources needed:</i></p> <ul style="list-style-type: none"> <li>– to replace chairs and tables with new ergonomic furniture</li> <li>– to involve a health and safety expert/ ergonomist</li> </ul>	End Quarter 3	
		<p><i>Targeting psychosocial factors</i></p> <ul style="list-style-type: none"> <li>– Foster work autonomy (workers should be able to exercise some control over their work, to allow breaks, to alternate/vary standing and sitting postures)</li> </ul>	Owner/ manager		End Quarter 3	
		<p><i>Targeting workers</i></p> <ul style="list-style-type: none"> <li>– Increase awareness about health outcomes related to sedentary work</li> <li>– Training workers on correct techniques to adjust work furniture; use of mouse and keyboard or other data input devices; use of work surface to ensure a comfortable, neutral work posture.</li> <li>– Encourage the use of breaks to stretch fingers, hands, arms and legs</li> </ul>	Owner/ manager, workers		End Quarter 1	

Source: EU-OSHA (2018)

**The European Agency for Safety and Health at Work (EU-OSHA)** contributes to making Europe a safer, healthier and more productive place to work. The Agency researches, develops, and distributes reliable, balanced, and impartial safety and health information and organises pan-European awareness raising campaigns. Set up by the European Union in 1994 and based in Bilbao, Spain, the Agency brings together representatives from the European Commission, Member State governments, employers' and workers' organisations, as well as leading experts in each of the EU Member States and beyond.

**European Agency for Safety and Health at Work**

Santiago de Compostela 12, 5th floor  
48003 Bilbao, Spain  
Tel.: +34 944794360  
Fax: +34 944794383  
Email: [information@osha.europa.eu](mailto:information@osha.europa.eu)

<http://osha.europa.eu>

