RESEARCH REPORT - HEALTH

Work-related musculoskeletal disorders

DEFINITIONS REVIEW

November 2022

Te Kāwanatanga o Aotearoa
New Zealand Government

WORKSAFE
Mahi Haumaru Aotearoa

ACKNOWLEDGEMENT

This document was prepared by Dr Stephven Kolose CNZHFE and Cory Matulino NZRP, Human Factors/Ergonomics Team, WorkSafe New Zealand. The authors thank Leanne Hunter CNZHFE, Marion Edwin CNZHFE, Dr Katie Buckley CPSP (HFE team); Dr Mark Johnson (Manager, Research and Evaluation); Dr James McLeod (Occupational Health Physician) and the Health Team for their input during the peer review process. The authors also acknowledge the counsel, publications, and peer review comments by Professor Mark Boocock and Dr Fiona Trevelyan (Auckland University of Technology); Liz Ashby and Associate Professor David Tappin (Massey University), and Professor Joanne Crawford (Victoria University).

Citation details

WorkSafe New Zealand (2022). Work-related musculoskeletal disorders – Definitions review. [Prepared by Kolose, S. and Matulino, C.]. WorkSafe New Zealand.

EXECUTIVE SUMMARY

Background

Musculoskeletal disorders (MSDs) have a significant effect on people all over the world. Among many definitions, MSDs refers to injuries and conditions affecting the muscles, tendons, ligaments, joints, blood vessels, and nerves. Approximately 1.71 billion people are affected by MSDs worldwide. In New Zealand MSDs make up over 30% of the overall burden of harm from work-related ill-health and injury. This equates to over 15,000 disability-adjusted life years per annum (referring to the quality and length of life lost due to injuries and illness).

There is abundant literature on work-related musculoskeletal disorders (WRMSDs) and MSDs worldwide. However, there is no universally agreed definition of WRMSDs or MSDs due to differences in terminology, diagnoses, and profession. The WorkSafe Human Factors/Ergonomics (HFE) team are tasked with leading the musculoskeletal harm reduction programme. The first step towards achieving this goal is to define WRMSDs, therefore the purpose of this report is to:

1. review the definitions of WRMSDs and MSDs,
2. define WRMSDs and MSDs for use within WorkSafe New Zealand and New Zealand.

The study reviewed international and New Zealand WRMSDs and MSDs research using Google, Google Scholar, and university library online search engines; internal WorkSafe publications; ACC internal documents; and articles from New Zealand MSDs researchers.

Findings

New Zealand MSDs definitions have typically been based on sprains and strains and discomfort, pain, and injury. More recently, the term body stressing was introduced to describe work-related injuries resulting from repetitive and strenuous work. New Zealand research groups MSDs into four categories: generic terms, body regions, task orientated terminology and exposure/hazard-related terminology. In Australia, MSDs are commonly understood as an injury or disease of the musculoskeletal system covering sprains and strains, back injuries, joint and muscle injuries, nerve, muscular and vascular disorders, soft tissue, chronic and acute pain. There are minor variances amongst various Australian states (for example, the use of body stressing injuries and manual handling injuries).

Internationally, there is no universal WRMSDs definition, and many countries use the terms MSDs and WRMSDs interchangeably. European countries have done a significant amount of research on MSDs at a national level again with no clear WRMSDs definitions (they mostly refer to MSDs). Many of the definitions are associated with muscles, tendons, and ligaments and mentioned specific regions of the body (for example, shoulders, upper arms, hands, wrists, elbows, forearms, neck, hips, legs, knees, ankles, and feet). Some definitions were typified by repetitive motion or strain injuries, cumulative trauma injuries, overuse syndrome or soft tissue disorders caused by repetitive tasks, carrying of heavy loads, vibrations, and awkward/inadequate postures. Compared to WRMSDs, MSDs definitions were much broader and included inflammatory and auto-immune conditions, some infective conditions, and fractures or bone pathologies.

There were limited (WRMSDs or MSDs) definitions in reports by international compensation authorities (the equivalent of ACC in New Zealand). Terms used to describe WRMSDs (for example, OOS and RSI) are outdated which suggests that WRMSDs definitions depend on current trends. In New Zealand, the terms OOS, RSI and DPI have had periods of popularity and continue to be used by the public.

A good practice WRMSD definition for use by WorkSafe should consider the following:

- use the term work-related musculoskeletal disorders, that may be abbreviated to WRMSDs. For more common use, musculoskeletal disorders (MSDs) is proposed as an acceptable term. However, it should be recognised that in medical circles, use of musculoskeletal disorders is inclusive of a wider range of conditions, and not all are considered work-related
- provide clarity that while MSDs and WRMSDs can have the same risk factors, WRMSDs are work-related, occurring due to exposure to risk factors at work
- include the contributing factors for WRMSDs that differentiate them from general MSDs. These include biomechanical (forces/loads, task duration/ repetition, workplace layout, vibration, and postures), work organisation, environmental, individual, and psychosocial factors
- acknowledge the distinction between acute and gradual WRMSDs and the potential for acute injuries to occur against a background of gradually acquired WRMSDs
- incorporate the terms muscles, ligaments, bones, tendons, blood vessels and nerves as they are regularly used terms to describe WRMSDs in the literature
- avoid excessive listing of body regions (for example, back, shoulder, ankle, hands etc). This not only increases the length of the definition, but it may not account for all possible body regions affected by WRMSDs
- use language that is 'less medical' for external facing documents (for general use). For example, using a generic and catch all term of discomfort, pain, and injury. This can be shortened to discuss discomfort and/or pain as the worker's experience and injury when talking of recognised injuries and diagnosed conditions. Other terms such as strains and sprains or aches and pains may also be acceptable depending on the audience. It is also important to consider and include relevant words, terms and perspectives from Māori and other languages
- WorkSafe's definition of WRMSDs should reflect the risk factors for musculoskeletal conditions, regardless of the insurance compensation framework in which we operate. Therefore, WorkSafe's definition may differ to that of ACC.
- reference specific terms used in the Accident Compensation Act 2001 (if relevant).
- have consensus among New Zealand MSDs researchers as to the adequacy and relevance of using DPI, sprains and strains and body stressing in the definition.
- all parties with a vested or research interest in WRMSDs (for example, WorkSafe and New Zealand MSD researchers) should have an opportunity to contribute to the official WRMSD definition.

CONTENTS

1.0 **Introduction** 1

1.1 Background 2

1.2 WRMSDs and MSDs in WorkSafe and New Zealand 3

1.3 Purpose 5

1.4 Literature search criteria and limitations 5

2.0 **Literature on WRMSD/MSD definitions** 6

2.1 Evidence of WRMSD and MSD definitions in New Zealand 7

2.2 Evidence of WRMSDs and MSDs definitions in Australia 9

2.3 Evidence from international countries and organisations 9

2.4 International MSDs definitions 10

3.0 **Discussion** 11

3.1 Significant findings 12

3,2 Additional findings 13

3.3 WorkSafe WRMSD definition 13

3.4 Literature search limitation 14

3.5 Next steps 14

3.6 Conclusion 14

appendices

Appendix 1: Glossary 16

Appendix 2: New Zealand and Australian definitions 17

Appendix 3: International WRMSD and MSD definitions 21

Appendix 4: References 29

figure

1 Outline of the HFE approach for the development of musculoskeletal program foundational knowledge 4

1.0 Introduction

IN THIS SECTION:

1.1 Background

1.2 WRMSDs and MSDs in WorkSafe and New Zealand

1.3 Purpose

1.4 Literature search criteria and limitations

This section outlines the need for a formal WRMSD and MSD definition at WorkSafe.

1.1 Background

Musculoskeletal disorders (MSDs) affect 1.71 billion people worldwide and are the main contributor to the global need for rehabilitation (WHO, 2022). MSDs represent one of the most important causes of chronic disability, sick leave absence, reduced work productivity and quality of life (Briggs *et al*., 2018). Data from the 2017 Global Burden Disease study showed that MSDs were the highest contributor to global disability (16% of all years lived with disability – YLDs) (James *et al*., 2018). Furthermore, the prevalence of these disorders in specific working populations and/or occupational sectors is significantly higher than in general populations (Hagberg *et al*., 2012; Russo *et al*., 2020).

According to one definition, MSDs are injuries and illnesses of the muscles, tendons, ligaments, joints, nerves, and vessels (Silverstein, 2006). The term MSD is not a diagnosis, but a group of specific and non-specific diagnoses related to the above tissues that have some common features (Silverstein, 2006). According to the World Health Organization (WHO) more than 150 conditions are identified as MSDs (Trembearth & Crawford, 2021; WHO, 2022). MSDs related to work occur when there is an imbalance in the work system that overwhelms the individual either suddenly (acute onset) or over weeks, months or years (gradual onset) (Grant & Habes, 2006; Silverstein, 2006).

Work-related Musculoskeletal Disorders (WRMSDs) are known by many names around the world. This makes it difficult to identify one universal definition. For example, they are sometimes referred to as cumulative trauma disorders in the US, occupational cervicobrachial disorders (OCD) in Japan, Repetitive Strain Injuries (RSI) in Australia and Occupational Overuse Syndrome (OOS) more generally (Forcier & Kuorinka, 2006). Some of the definitions are now considered dated such as RSI and OOS. In the research literature (and more popular in the medical field) WRMSDs are also known as ergonomic injuries, neuromuscular disorders, neuromusculoskeletal conditions of the upper extremity, work-related upper extremity disorders (WRUED), work-related musculoskeletal disorders of the upper limb (WRMSD-UL), musculoskeletal misuse syndrome and work-related soft-tissue disorders (Forcier & Kuorinka, 2006; Trembearth & Crawford, 2021), or work-related upper limb disorders (WRULD). Some common-usage definitions of MSDs reflect an occupational relationship (for example, carpet layer's knee, golfer's elbow, tennis elbow, writer's cramp) while other WRMSDs are sometimes classified based on the anatomical structures (Trembearth & Crawford, 2021).

Both WRMSDs and MSDs are well researched in the health literature. However, there is a lack of consistency and standardisation in the way that they are defined.

Part of the issue is that MSDs are not caused by one factor. Boocock *et al*. (2009) found that whilst a simple and descriptive term should be used to encompass all WRMSDs, this can be difficult given the multifactorial nature of these conditions. Terms such as RSI may pre-suppose causation by identifying a single risk factor (repetition). Other terms may be too restrictive of body region or anatomical structure. Adding another term to the current range of terminology without establishing a well-defined classification system may only further confuse stakeholders. The preferred option is to use a generic label and focus on the name of a condition only when a well-defined disorder (for example, carpal tunnel syndrome) has been diagnosed.

In addition, the work-relatedness of injuries is seldom captured in reporting. Separating work-related MSDs from acute sprains and strains is difficult unless a code for causation is provided in the database (Grant & Habes, 2006). Unfortunately, not all MSDs databases have fields for such codes. Even if codes exist, they are often categorised by administrative or safety personnel who are more likely to make erroneous determinations of cause than medical (Grant & Habes, 2006) or work-related health professionals. There are few, if any, universal definitions for MSDs, and the lack of accepted definitions hampers efforts to evaluate disease trends and the effectiveness of interventions over time (Boocock *et al*., 2009; Grant & Habes, 2006).

Identifying whether MSDs are work or non-work related is complex. According to Silverstein (2006) workplace factors are not the sole cause of MSD. Personal factors such as age, gender, and ethnicity can contribute to MSDs. It is only when workplace factors become "significant contributors to the cause of the 'MSD' that they become 'work-related' or a WMSD[1]" (Silverstein, 2006). This is an important designation as some medical or compensation systems only accept acute injuries and not gradual (Forcier & Kuorinka, 2006).

This report investigates what a WRMSDs definition should or could look like for WorkSafe. A clear and concise WRMSD definition will provide a foundation for developing future interventions and measuring intervention impact. It also ensures that everyone (for example, regulatory, industry sectors, academia, and the public) is on the same page when discussing MSDs research and interventions.

1.2 WRMSDs and MSDs in WorkSafe and New Zealand

Musculoskeletal disorders affect the lives of many New Zealanders. They constitute over 30% of all work-related disability adjusted life years (DALYS[2]). That equates to 15,000 lost years of life in New Zealand. Industry sectors such as construction, agriculture, manufacturing, and transport, postal and warehousing have comparably high incidence of MSD claims by the rate per 1,000 workers in 2016–2018 (WorkSafe New Zealand, 2019, 2021d).

Despite these high rates, there is no universal definition to describe work-related musculoskeletal disorders. However, definitions have been provided within WorkSafe internal reports. For example, according to Barton (2021), "MSDs are a group of chronic/gradual process and acute disorders/injuries of muscles, tendons, blood vessels and nerves resulting from excess strain on bodily tissues", and WRMSD as "work-related musculoskeletal disorders are a group of chronic or gradual/injuries process and acute disorders of muscles, tendons, blood vessels and nerves, which are caused or aggravated by work-related excess strain on bodily tissues." A review of WRMSDs and MSDs within New Zealand is covered later in this report.

[1] The term WMSD is uncommon, for the purposes of this report 'work-related' MSDs will be referred to as WRMSDs.

[2] One disability adjusted life year (DALY) lost can be thought of as one lost year of 'healthy' life.

WRMSD literature review, definition, and report development process

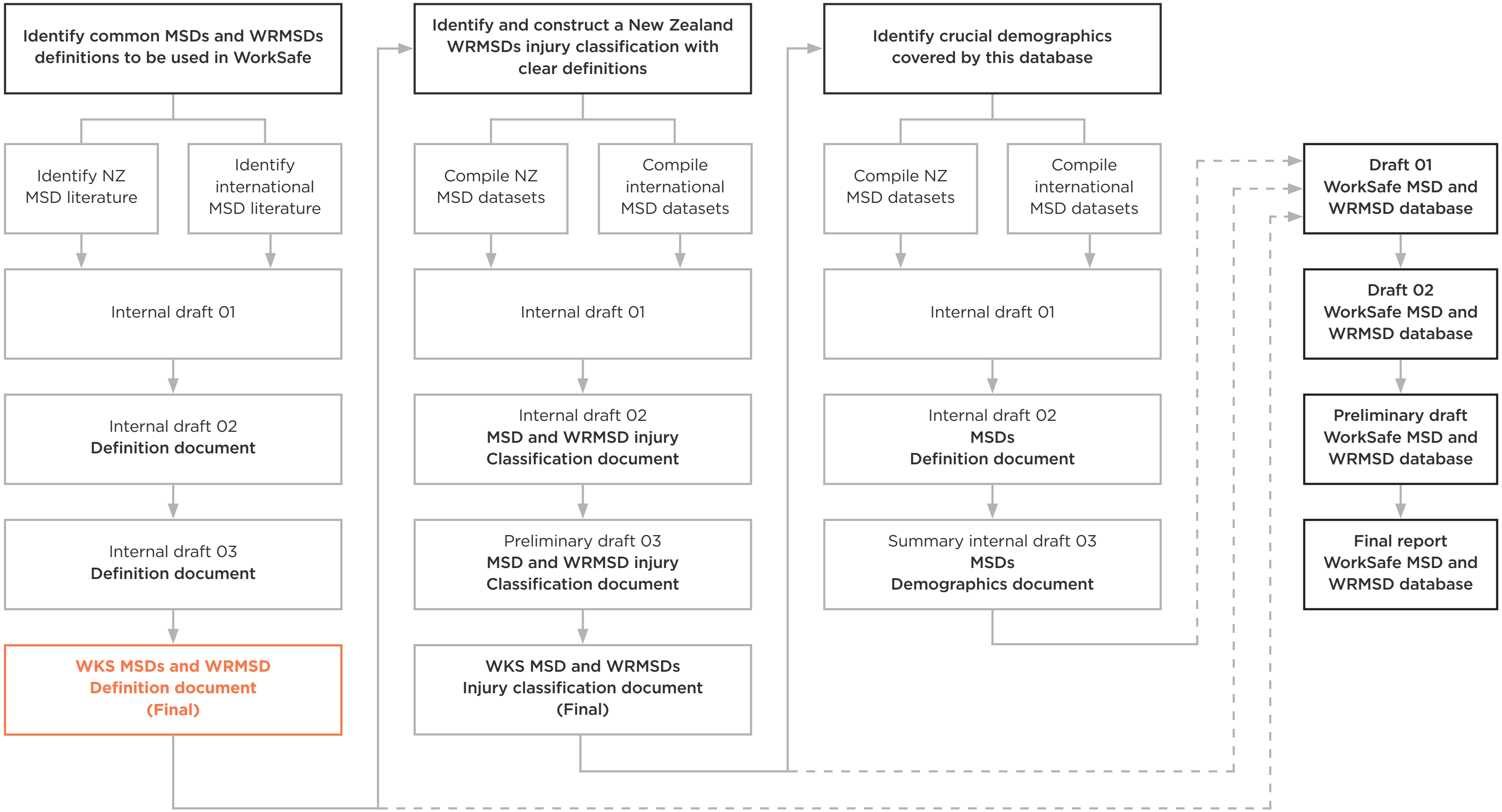

FIGURE 1: Outline of the HFE approach for the development of musculoskeletal program foundational knowledge

The WorkSafe Human Factors/Ergonomics (HFE) team are leading the musculoskeletal harm reduction programme. The programme will clarify the requirements for managing musculoskeletal risks in workplaces. It will also provide guidance for risk assessment and control of the many factors that contribute to musculoskeletal risk. The first step towards achieving this goal is to define WRMSDs and identify the important elements which constitute a robust WRMSD dataset (Figure 1). The definition will provide a framework for developing a WorkSafe and New Zealand based WRMSDs classification and diagnostic (database) system. It is hoped that the system can be utilised in conjunction with existing health datasets such as the ACC read code system (ACC, 2021), and the ICD-10AM classification system (WHO, 2022).

1.3 Purpose

The purpose of this report is to:

1. review definitions of WRMSDs and MSDs, and
2. define WRMSDs and MSDs for use within WorkSafe and New Zealand.

1.4 Literature search criteria and limitations

Between September and November 2021 two members of the HFE team researched, reviewed, and collected definitions related to WRMSDs and MSDs.

International and New Zealand MSDs and WRMSDs research were identified through Google, Google Scholar, and university library online search engines. Research articles were also obtained through existing external networks such as ACC, the Human Factors and Ergonomics Society of New Zealand, regulatory publications (for example, WorkSafe, SafeWork Australia), academic reports, journal articles, textbooks, world health bodies publications (for example, World Health Organization, International Labour Organization) and relevant standards.

The search parameters used the following keywords:

- “musculoskeletal disorders”, “work related musculoskeletal disorders”, “musculoskeletal disorders OR work-related musculoskeletal disorders AND definitions”, “musculoskeletal disorders OR work-related musculoskeletal disorders AND international AND datasets”, “musculoskeletal disorders OR work-related musculoskeletal disorders AND definitions”, “musculoskeletal disorders OR work-related musculoskeletal disorders AND workers compensation OR statistics”, “(musculoskeletal disorders OR work-related musculoskeletal disorders) AND classifications OR injury mechanism OR country reports”, “(musculoskeletal disorders OR work-related musculoskeletal disorders) AND Australia OR United States OR United Kingdom OR Canada OR England OR Brazil OR Spain OR Europe”, “(musculoskeletal disorders OR work-related musculoskeletal disorders) AND .pdf OR.xls OR .xlsx OR .docx OR .doc OR .pdf.

2.0 Literature on WRMSD/ MSD definitions

IN THIS SECTION:

2.1 Evidence of WRMSD and MSD definitions in New Zealand

2.2 Evidence of WRMSDs and MSDs definitions in Australia

2.3 Evidence from international countries and organisations

2.4 International MSDs definitions

This section provides a review of WRMSD and MSD definitions from New Zealand and abroad.

Full definitions from New Zealand/Australia and international countries/bodies are provided in Appendix 2 and 3 respectively.

2.1 Evidence of WRMSD and MSD definitions in New Zealand

- The Accident Compensation Corporation (ACC) uses the term physical injuries and commonly refers to MSDs as sprains and strains (ACC, 2021). No formal definition can be found on their website for either MSDs or sprains and strains. However, some definitions were found in various documents published by ACC. For example, the following definition was found on the 2020 Workplace Injury Prevention Grants Investment Priorities (ACC, 2020):
  - "Sprains and strains are a range of symptoms, injuries and disorders which affect the muscles, tendons and/or ligaments. The onset of sprain and strain symptoms can be acute or gradual and can be the result of mild to strenuous activity."
  - "Sprains and strains can develop from a combination of factors – the physical characteristics of work and work tasks, the way work is organised, your work environment, and personal factors can all contribute significantly to the onset of Musculoskeletal Disorder (MSD) injuries. Another contribution making an impact to sprains and strains is what we call psychosocial factors. These factors are increasingly recognised as playing a significant role in the likelihood and severity of sprains and strains."

  Older reports use the term discomfort, pain, and injury, which relates to the previous Workplace Injury Prevention programme that was run by ACC (ACC, 2009). This programme highlighted that WRMSDs often had numerous contributing factors (those mentioned above). It emphasised that addressing all contributing factors where possible was important. The programme provided tools for employers to assess the issues, and resources to address them.

  More recent documents use the term body stressing to describe work-related MSDs (Basham, 2019). Cassin (2018) defined a body stressing injury as a "musculoskeletal, soft tissue, or other connective tissue injury associated with manual handling, strenuous movement, sustained posture, repetitive strain, twisting movement, or physical trauma".
- The Accident Compensation Act (2001) uses the following terms: personal injury and personal injury caused by work-related gradual process, disease, or infection. Key information for the terms is provided below:
  - Section 20 (2)(a) states that a person has cover for a "... personal injury caused by an accident."
  - Section 25 (a) states that an accident means "... a specific event or a series of events, other than a gradual process...".

  - Section 26 (1)(b) states that personal injuries include "... physical injuries suffered by a person, including, for example, a strain or a sprain...".
  - Section 30 outlines the key terms and circumstances relating to cover for personal injuries sustained by gradual process, disease, or infection. It does not state specific conditions that are covered, except those listed under schedule 2.
  - Schedule 2 lists the occupational diseases covered by ACC. Hand/Arm vibration syndrome is the only musculoskeletal condition listed as an occupational disease.
- On the WorkSafe website, the following information about musculoskeletal disorders is found (WorkSafe New Zealand, 2021c):
  - Musculoskeletal disorders are injuries like sprains and strains that are associated with manual work tasks.
  - Common musculoskeletal disorders include sprains and strains to lower backs, and upper or lower limbs. They include nerve compressions like carpal tunnel syndrome.
  - This includes discomfort, pain and injuries that may develop over time, as well as acute injuries from events like slips or stumbles.
  - These sorts of injuries are common to sedentary workers such as office workers and drivers, as well as to those in manual jobs such as construction and healthcare.

  WorkSafe also provides information on how whole body vibration, and hand-arm vibration, can lead to injury of the blood vessels, nerves and joints (WorkSafe New Zealand, 2021b). Carpal tunnel syndrome and Hand arm vibration syndrome can arise with regular and frequent use of handheld power tools and machines, especially for long periods of time. Whole body vibration can contribute to pain and discomfort in the back, neck, or shoulders.

  Recently, WorkSafe also started using the term body stressing when referring to MSDs. Body stressing was identified in the Harm reduction action plan as a key focus area that crosses multiple industries (ACC and WorkSafe NZ, 2016). The term is also used on the WorkSafe data centre (WorkSafe New Zealand, 2021a).

  The term body stressing was adopted from the Australian Type of Occurrence Classification System (TOOCS) (ASCC, 2008). TOOCS is an injury classification system used by the compensatory bodies in Australia. Body stressing is a mechanism classification group and is intended to give information about how the injury occurred. There are four options for Body stressing type injuries as listed below:
  - muscular stress while lifting, carrying, or putting down objects
  - muscular stress while handling objects other than lifting, carrying, or putting down
  - muscular stress with no objects being handled
  - repetitive movement, low muscle loading.
- Boocock *et al*. (2018) reviewed the international and New Zealand literature for terms and definitions. They identified that terms could be broadly grouped into four categories:
  - **Generic terms**: musculoskeletal disorders (MSDs), work-related musculoskeletal disorders (WMSD), musculoskeletal injuries (MSI), strains and sprains, and DPI.
  - **Specific to body regions**: upper limb disorders, lower limb disorders, low back pain, or back injuries.

- **Task orientated terminology**: manual handling, manual material handling (often with specific reference to lifting, carrying, pushing, and pulling), patient handling, moving and handling of people, or client handling, and computer use (office work, use of computers, display screen equipment, video display units).
- **Exposure/hazard-related terminology**: repetitive strain injuries (RSI), sedentary work, repetitive work (or repetitive manual handling), overexertion injuries, overuse injuries, occupational overuse syndrome (OOS), cumulative trauma disorders (CTD), and body stressing injuries.

Other examples of MSDs definitions in New Zealand are listed in Appendix 2.

2.2 Evidence of WRMSDs and MSDs definitions in Australia

- According to Safe Work Australia (2021), MSDs are an injury or disease of the musculoskeletal system. The musculoskeletal system is made up of muscles, bones, joints, and connective tissues. MSDs may include:
  - sprains and strains of muscles, ligaments, and tendons
  - back injuries
  - joint and bone injuries or degeneration
  - nerve injuries or compression (for example, carpal tunnel syndrome)
  - muscular and vascular disorders from hand-arm vibration
  - soft tissue injuries such as hernias
  - chronic pain (pain that lasts longer than three months)
  - acute pain (pain that lasts less than three months).

  MSDs can happen:
  - slowly, through gradual wear and tear from repetitive or continuous movements, including static body positions, or
  - suddenly, through strenuous activity or unexpected movements, for example, handling a load that shifts position.

  There are minor variances in definitions throughout the various Australian states and territorial authorities. Comcare lists MSDs as body stressing injuries on their website (Comcare, 2021), and Work Safe Victoria uses the term manual handling injuries. Queensland specifies that MSDs do not include trapping or crushing injuries (WorkSafe Queensland, 2021).
- According to Oakman *et al*. (2019) the Australian National Data Set (NDS) holds all compensation injury information throughout Australia. The term work-related MSDs (WRMSDs) is used. WRMSDs are categorised into two main groups:
  - Traumatic joint/ligament and muscle/tendon injuries encompassing codes related to acute injuries (for example, dislocations, traumatic tearing away part of the muscle/tendon structure, avulsion, trauma to tendon).
  - Musculoskeletal and connective tissue diseases encompassing codes related to cumulative MSDs (for example, joint diseases, spinal vertebrae and intervertebral disc diseases, diseases of the muscle tendon and related tissue, and diseases involving the synovium and related tissue).
- Other examples of MSD definitions in Australia are listed in Appendix 2.

2.3 Evidence from international countries and organisations

Our search identified WRMSD and MSD definitions from Canada, United Kingdom and Europe, North America, and Asia. In general, there is no universal definition to describe work-related musculoskeletal disorders. However, many definitions shared similar themes or characteristics which can be used as a guide to develop a future WorkSafe WRMSD definition.

- Most of the definitions associate WRMSDs with muscles, tendons and nerves (CCOHS, 2021; Corral, 2022; Crawford & Davis, 2020; Eurofound Norway, 2007; Giaccone, 2007) with some examples relating to the spine or lumbar area, fascia, and bones (Giaccone, 2007).
- Not all the definitions state that WRMSDs are associated with work or occupational activities (Douwes, 2007) while some definitions (HSE, 2020) clearly state that it is the result of work-related, occupational-related accidents, or associated with work tasks or the work environment (Eurofound Denmark, 2022; Eurofound Germany, 2022; Eurofound Norway, 2007; Lehto, 2022). The HSE (HSE, 2020) definition also mentions a time element that is missing in most WRMSD definitions or a sense that these injuries were the result of a gradual process. For example, "Most WRMSDs develop over time. They can be episodic or chronic in duration" (HSE, 2020). The term gradual was used regularly amongst the international definitions.
- Numerous definitions state that WRMSDs affect certain areas of the human body. For example, the neck, shoulders, upper arms, elbows, forearms, wrists, hands, hips, lower body, legs, knees, ankles, and feet (Corral, 2022; Crawford & Davis, 2020; Douwes, 2007; Eurofound Belgium, 2022; Eurofound Denmark, 2022; Giaccone, 2007; Kordosova, 2021; Safiri *et al*., 2021).
- Some WRMSDs are harder to define due to differences in terminology. For example, they are grouped as repetitive motion or strain injuries, cumulative trauma injuries, overuse syndrome or soft tissue disorders (CCOHS, 2021). Many of these are caused by repetitive tasks (Douwes, 2007; Eurofound Belgium, 2022; Giaccone, 2007; Kordosova, 2021; Lehto, 2022) associated with the carrying of heavy loads (Eurofound Belgium, 2022; Giaccone, 2007; Kordosova, 2021), vibrations (Eurofound Belgium, 2022; Eurofound Germany, 2022; Kordosova, 2021) and inadequate postures (CCOHS, 2021; Eurofound Belgium, 2022; Giaccone, 2007; Kordosova, 2021).
- Many countries do not have an official definition of WRMSDs but use the term loosely or interchangeably with MSD definitions (Corral, 2022; Douwes, 2007; Eurofound Denmark, 2022).
- Countries such as China (Jia *et al*., 2021) do not recognise WRMSDs in their list of occupational diseases; rather, they are considered work-related diseases. In 2019, China under the Healthy China Action initiative sought to include WRMSDs in their national health action goals with a specific focus on WRMSDs in key industries.

2.4 International MSDs definitions

Internationally, definitions for MSDs were far more popular in the literature compared to WRMSD. Therefore, not all MSDs definitions were considered in this report. MSDs covered a wider range of diagnoses and health conditions/medical conditions than WRMSDs.

- Some definitions also referred to MSDs as covering inflammatory conditions (for example rheumatoid arthritis), osteoarthritis (Public Health England, 2021) and fragility fractures (Public Health England, 2021) and the spine (WHO, 2022).
- Some MSD definitions were typified by limitations of mobility, dexterity and overall level of functioning (WHO, 2022).
- Some countries such as Cyprus and the US listed ergonomics risks as a MSD (Stavrou, 2007; U.S. Bureau of Labor Statistics, 2020).

Other examples of international WRMSDs and MSDs definitions are listed in Appendix 3.

3.0 Discussion

IN THIS SECTION:

3.1 Significant findings

3,2 Additional findings

3.3 WorkSafe WRMSD definition

3.4 Literature search limitation

3.5 Next steps

3.6 Conclusion

This section provides considerations for a WRMSD and MSD definition based on the key findings of the review.

Various elements of these definitions can be used to establish WRMSDs and MSDs definitions for WorkSafe. While pockets of WRMSDs and MSDs research have been conducted in New Zealand, there is no clear or nationally accepted definition of WRMSDs. This is also reflected in the international literature with many sources providing MSDs definitions, but limited WRMSDs definitions.

3.1 Significant findings

- New Zealand MSDs definitions are traditionally focussed on sprains and strains as well as discomfort, pain, and injury. WorkSafe does not have an updated definition for WRMSDs and has used the term body stressing to describe MSDs. Body stressing is a term adapted from the Australian TOOCS system.
- New Zealand research identified various definitions of MSDs that can be grouped into four categories; generic terms, body regions, task orientated terminology and exposure/hazard-related terminology. Examples of other New Zealand research in MSDs are provided but none provide a clear WRMSDs definition.
- In Australia, MSDs are an injury or disease of the musculoskeletal system covering sprains and strains, back injuries, joint and muscle injuries, nerve, muscular and vascular disorders, soft tissue, chronic and acute pain. There are minor variances in MSDs definitions throughout the various Australian states and territorial authorities. Variances include the use of the terms body stressing injuries and manual handling injuries.
- The Australian National Data Sets categorises WRMSDs into two groups:
  - Traumatic joint/ligament and muscle/tendon injuries encompassing codes related to acute injuries (for example, dislocations, traumatic tearing away part of the muscle/tendon structure, avulsion, trauma to tendon).
  - Musculoskeletal and connective tissue diseases encompassing codes related to cumulative MSDs.
- Most of the definitions associated WRMSDs with muscles, tendons and nerves with some examples relating to the spine or lumbar area, fascia, vascular and bones.
- Internationally, there is no universal WRMSD/s definition.
  - Europe (via EU-OSHA and EUROFOUND) have done a significant amount of research on MSDs at a national level. However, not all nations have clear WRMSDs definitions (they mostly refer to MSDs).
  - Many of the definitions identified attribute WRMSDs to conditions associated with muscles, tendons, and ligaments (same as MSDs).
  - Some definitions mention specific regions of the body, for example, shoulders, upper arms, hands, wrists, elbows, forearms, neck, hips, legs, knees, ankles, and feet.

- WRMSDs definitions are typified by repetitive motion or strain injuries, cumulative trauma injuries, overuse syndrome or soft tissue disorders caused by repetitive tasks, carrying of heavy loads, vibrations, and awkward/inadequate postures.
- Compared to WRMSDs, MSDs definitions also encompass injuries of the spine, inflammatory conditions, and fractures.
- Many countries use MSDs and WRMSDs interchangeably.

3.2 Additional findings

- There was limited research on WRMSDs or MSDs definitions within reports by international compensation authorities (the equivalent of ACC in New Zealand).
- One important observation is that terms used to describe WRMSDs, for example, OOS and RSI are outdated. This suggests that WRMSDs definitions, or components of, are subject to current trends. In New Zealand, the terms OOS, RSI and DPI have had periods of popularity and continue to be used by the public.
- Although it was not part of this report, most of the literature reviewed did not provide a full breakdown of the injury diagnoses, for example, read codes or classification system. They provided high-level summaries.

3.3 WorkSafe WRMSD definition

A good practice WRMSD definition for use by WorkSafe should consider the following:

- Use the term work-related musculoskeletal disorders, that may be abbreviated to WRMSDs. For more common use musculoskeletal disorders (MSDs) is proposed as an acceptable term. However, it should be recognised that in medical circles, use of musculoskeletal disorders is inclusive of a wider range of conditions, and not all are considered work-related.
- Provide clarity that while MSDs and WRMSDs can have the same risk factors, WRMSDs are work-related, occurring due to exposure to risk factors at work.
- Include the contributing factors for WRMSDs that differentiates them from general MSDs. These include biomechanical (forces/loads, task duration/repetition, workplace layout, vibration, and postures), work organisation, environmental, individual, and psychosocial factors.
- Acknowledge the distinction between acute and gradual WRMSDs; and the potential for acute injuries to occur against a background of gradually acquired WRMSDs.
- Incorporate the terms muscles, ligaments, bones, tendons, blood vessels and nerves as they are regularly used terms to describe WRMSDs in the literature.
- Avoid excessive listing of body regions (for example, back, shoulder, ankle, hands etc). This not only increases the length of the definition, but it may not account for all possible body regions affected by WRMSDs.
- Use language that is ‘less medical’ for external facing documents (for general use). We suggest the generic and catch all term of discomfort, pain, and injury. This can be shortened to discuss discomfort and/or pain as the worker’s experience and injury when talking of recognised injuries and diagnosed conditions. Other terms such as strains and sprains or aches and pains may also be acceptable depending on the audience. It is also important to consider and include relevant words, terms and perspectives from Māori and other languages.
- WorkSafe’s definition of WRMSDs should reflect the risk factors for musculoskeletal conditions, regardless of the insurance compensation framework in which we operate. Therefore, WorkSafe’s definition may differ to that of ACC.

- Reference specific terms used in the Accident Compensation Act 2001 (if relevant).
- Have consensus among New Zealand MSDs researchers as to the adequacy and relevance of using DPI, sprains and strains and body stressing in the definition.
- All parties with a vested or research interest in WRMSDs (for example, WorkSafe and New Zealand MSDs researchers) should have an opportunity to contribute to the official WRMSDs definition.

3.4 Literature search limitations

This report focussed on definitions that were obtained from national-level data, programmes or initiatives pertaining to the public. However, it was not without limitations. The literature search did not cover industry-specific (for example, MSDs of nurses, construction workers, manufacturing etc) or health-specific (for example, medical research) research as there were simply too many articles to cover in a short timeframe. Some publications were not available online due to confidentiality. Some publications (such as international standards) were not available as WorkSafe had limited journal and database access. The relationship between slip, trip, or fall incidents and acute onset WRMSDs was not investigated but may be an area for future New Zealand focus.

3.5 Next steps

The key findings of the literature review were used to develop a new WorkSafe WRMSDs definition (Kolose, *et*., 2022e) (Annex 1).

3.6 Conclusion

This report is the first step towards WorkSafe's goal of reducing musculoskeletal harm in New Zealand. Defining WRMSDs is a first, but crucial step towards developing a WRMSDs classification database for WorkSafe. Its purpose is to ensure that all researchers in New Zealand conceptualise WRMSDs in the same way.

Appendices

IN THIS SECTION:

Appendix 1: Glossary

Appendix 2: New Zealand and Australian definitions

Appendix 3: International WRMSD and MSD definitions

Appendix 4: References

Appendix 1: Glossary

TERM	DEFINITION
ACC	Accident Compensation Corporation
Acute	Describes the sudden onset of an injury or condition, usually from a specific event or series of events
Aetiology	The causation of a disease, disorder, or injury
Body stressing	A category in the Australia Type of Occurrence Classification System (TOOCS) mechanism of incident taxonomy for injuries resulting from stress placed on muscles, tendons, ligaments, and bones
Classification	A systematic arrangement of conditions and disease into groups or categories according to an established criterion
DALY	Disability-Adjusted Life Years. Refers to the quality and length of life lost due to injuries and illness
Diagnosis	The act of identifying a disease from its signs and symptoms
Disease	A disease is normally an established pathological condition, with a defined group of symptoms
Disorder	A disorder is characterised by functional impairment and a disruption to the normal function and structure
DPI	Discomfort, pain, and injury
EU-OSHA	The European Agency for Safety and Health at Work
EUROFOUND	The European Foundation for the Improvement of Living and Working Conditions
Gradual	Describes the onset of an injury or condition occurring over time
HFE	Human Factors/Ergonomics
HSE	Health and Safety Executive (UK)
Musculoskeletal	The body system which includes muscles, ligaments, tendons, bones, nerves, and blood vessels
OOS	Occupational Overuse Syndrome
Prevalence	The proportion of a particular population found to be affected by that condition
RSI	Repetitive Strain Injury
Sprain	Overstretching or tearing of a ligament
Strain	Overstretching or tearing of muscle or tendon
TOOCS	Type of Occurrence Classification System. This is the Australia classification system used for coding of workers' compensation injury data
WHO	World Health Organization

Appendix 2: New Zealand and Australian definitions

NEW ZEALAND

According to Tappin *et al*. (2021):

- Musculoskeletal disorder is a term used to describe impairments of body structures including muscles, tendons, bones, joints, nerves, and blood vessels (the musculoskeletal system).
- They arise when the demands of manual handling are too great, resulting in discomfort, pain, or an injury. They can occur in any part of the body but usually involve areas most used in work (that is, upper limbs, neck and back). MSDs are also referred to as manual handling injuries or strains and sprains.
- Most MSD are cumulative disorders, usually becoming symptomatic gradually from repeated exposures to high or low intensity loads over a long period. Somewhat paradoxically, they can also suddenly become symptomatic in relation to a specific event or period of activity. As they are cumulative, there are a range of factors that can contribute to their causation. The combined weight of MSD research indicates that the main causative factors can be physical (for example, force, repetition, posture), psychosocial (for example, stress, control, support), and individual (for example, physical capacity) in nature.

According to the 'Guidelines for using computers' (ACC and Department of Labour, 2010):

- Physical discomfort: A range of physical conditions may develop or be made worse by working with computers. By physical conditions we mean problems that may affect muscles, connective tissues, tendons, ligaments, joints, bony structures, the blood supply, nerves and the skin. The symptoms associated with these conditions are sometimes given a medical diagnosis such as epicondylitis or carpal tunnel syndrome, or a general umbrella label such as gradual process injury (the currently accepted umbrella term for these types of injury). The terms occupational overuse syndrome (OOS) or repetitive strain injury (RSI) have also been used, amongst others. Within the literature, there are many umbrella terms that have been used to describe these symptoms. Many people experience upper limb, neck or back discomfort and pain, whether they work with computers. However, the onset of symptoms and the movements or body postures adopted while working at computers are often related. Symptoms may include:
  - pain
  - fatigue
  - muscle discomfort
  - stiffness
  - burning sensations
  - weakness
  - numbness
  - tingling.

According to the 'Code of practice for manual handling' (ACC and Department of Labour, 2001):

- Musculoskeletal disorders (work related): A collective name for a range of conditions that affect the muscles, tendons, bones, and joints. This term includes occupational overuse syndromes, back injuries, and acute low back pain.

As summarised in 'Preventing and managing discomfort, pain and injury' (Part 1) (ACC, 2009):

- Discomfort, pain, and injury covers many conditions of the muscles and bones:
  - gradual process injuries (GPI)
  - simple back pain
  - strains and sprains.
- Usually, these arise gradually over time, rather than from sudden events, that is, there is no immediate force that sets off the discomfort, pain, and injury.
- Sometimes discomfort, pain and injury may appear as one of these conditions after a sudden event. The sudden event may have been merely 'the straw that broke the camel's back'. For example, a person may experience low back pain when bending over to tie their shoelaces. Although they experience the pain immediately on bending, it's unlikely simply bending over is the actual cause of their pain. Rather, it is a culmination of many events that have gone on before.

AUSTRALIA

Within Safe Work Australia (Safe Work Australia, 2021):

- MSDs are an injury or disease of the musculoskeletal system. The musculoskeletal system is made up of muscles, bones, joints, and connective tissues.
- MSDs may include:
  - sprains and strains of muscles, ligaments, and tendons
  - back injuries
  - joint and bone injuries or degeneration
  - nerve injuries or compression (for example carpal tunnel syndrome)
  - muscular and vascular disorders from hand-arm vibration
  - soft tissue injuries such as hernias
  - chronic pain (pain that lasts longer than three months)
  - acute pain (pain that lasts less than three months).
- MSDs can happen:
  - slowly, through gradual wear and tear from repetitive or continuous movements, including static body positions, or
  - suddenly, through strenuous activity or unexpected movements, for example, handling a load that shifts position.

In WorkSafe QLD (WorkSafe Queensland, 2021):

- A musculoskeletal disorder, as defined in the WHS Regulations, means an injury to, or a disease of, the musculoskeletal system, whether occurring suddenly or over time. It does not include an injury caused by crushing, entrapment (such as fractures and dislocations) or cutting resulting from the mechanical operation of plant.
- MSDs may include conditions such as:
  - sprains and strains of muscles, ligaments, and tendons
  - back injuries, including damage to the muscles, tendons, ligaments, spinal discs, nerves, joints, and bones
  - joint and bone injuries or degeneration, including injuries to the shoulder, elbow, wrist, hip, knee, ankle, hands, and feet
  - nerve injuries or compression (for example, carpal tunnel syndrome)
  - muscular and vascular disorders because of hand-arm vibration
  - soft tissue hernias
  - chronic pain.

- MSDs occur in two ways:
  - gradual wear and tear to joints, ligaments, muscles, and inter-vertebral discs caused by repeated or continuous use of the same body parts, including static body positions, or
  - sudden damage caused by strenuous activity, or unexpected movements such as when loads being handled move or change position suddenly.
- Injuries can also occur due to a combination of these mechanisms, for example, body tissue that has been weakened by cumulative damage may be vulnerable to sudden injury by lower forces.

Within WorkSafe Western Australia (Department of Mines Industry Regulation and Safety, 2021):

- A musculoskeletal disorder is an injury or disease of the musculoskeletal system. Musculoskeletal disorders may arise in whole or in part from performing manual tasks in the workplace, whether occurring suddenly or over time.
- Musculoskeletal disorders include body-stressing injuries (as classified in the worker's compensation code system) and conditions such as:
  - sprains and strains of muscles, ligaments, and tendons (for example, back strain)
  - joint injuries or degeneration (for example, frozen shoulder or arthritis of the back)
  - disc protrusions, disc herniations or disc degeneration of the back or neck
  - nerve injury or compression (for example, carpal tunnel syndrome)
  - muscular and vascular disorders (for example, vibration-induced white finger from hand-arm vibration), and
  - soft tissue injuries.
- Musculoskeletal disorders may result from:
  - gradual wear and tear caused by frequent or prolonged periods of performing manual tasks (for example, a store person continually handling stock between deliveries)
  - sudden damage caused by intense or strenuous manual handling or awkward lifts (for example, a labourer lifting a compactor or a glazier lifting a pane of large glass from the ground on to a truck), or
  - direct trauma caused by unexpected events (for example, a store person walking on uneven ground carrying a large heavy carton who trips and falls).

As part of Safe Work New South Wales (Safe Work NSW, 2021):

- Musculoskeletal Disorder risks arise from exposure to physical and/or psychosocial hazards in the workplace. This can be manual tasks that are hazardous, workplace stressors, or slips, trips, and falls on the same level.
- Common examples of musculoskeletal disorders include:
  - carpal tunnel syndrome
  - tendonitis
  - muscle/tendon strain
  - ligament sprain
  - ruptured/herniated disc.
- The economic and human costs of MSDs are unnecessary and preventable. You can use this information to help you understand MSDs and learn how to eliminate or prevent exposure to the risks in your workplace.

Within Comcare (Comcare, 2021):

- Body stressing is a collective term covering a broad range of health problems associated with repetitive and strenuous work.
- Body stressing injuries, or musculoskeletal disorders (MSD), often develop from carrying out hazardous manual tasks.
- Body stressing injuries at work can result from a variety of factors:
  - psychosocial aspects of work – factors such as job demands, control, support and satisfaction, imbalance between effort and reward and monotony of tasks. Financial concerns or relationship issues may also contribute
  - biomechanical – soft tissue damage which may occur through:
    - › direct exposure (blunt trauma or sudden overload), leading to a muscle tear or sprain, or
    - › indirect exposure (repeated light loading), leading to symptoms that may accumulate to cause further degeneration and injury.
- Individual worker characteristics – factors including health problems or out of hours demands.

In Work Safe Victoria (WorkSafe Victoria, 2021):

- MSD means an injury, illness or disease that can arise from hazardous manual handling in the workplace. They can occur suddenly or develop over a period of time. For example, carpel tunnel syndrome is an example of a MSD. MSDs can have significant and long-term impacts on workers' health and can end careers.
- Hazardous manual handling can cause injuries known as musculoskeletal disorders (MSDs). These injuries can be debilitating, long-term and severely affect a person's quality of life. MSDs can include:
  - sprains and strains
  - back injuries
  - soft-tissue injuries to wrists, arms, shoulders, neck, or legs
  - soft-tissue hernias
  - chronic pain.

Appendix 3: International WRMSD and MSD definitions

WRMSDs definitions

CANADA (CCOHS, 2021)

Canadian Centre for Occupational Health and Safety. Work-related Musculoskeletal Disorders (WMSDs):

- "Work-related musculoskeletal disorders (WMSDs) are a group of painful disorders of muscles, tendons, and nerves. Carpal tunnel syndrome, tendonitis, thoracic outlet syndrome, and tension neck syndrome are examples."
- "To develop injury prevention strategies, many health and safety agencies **include only** disorders that develop gradually and are caused by the overuse of the above constituents of the musculoskeletal system. The traumatic injuries of the muscles, tendons, and nerves due to accidents are not considered to be WMSDs or are considered separately. However, there are organisations, such as the European Agency for Safety and Health at Work, that include acute traumas and fractures within the WMSD group."
- "Almost all work requires the use of the arms and hands. Therefore, most WMSD affect the hands, wrists, elbows, neck, and shoulders. Work using the legs can lead to WMSD of the legs, hips, ankles, and feet. Some back problems also result from repetitive activities."
- "WMSDs are very difficult to define within traditional disease classifications. These disorders have received many names, such as:
  - repetitive motion injuries
  - repetitive strain injuries
  - cumulative trauma disorders
  - occupational cervicobrachial disorders
  - overuse syndrome
  - regional musculoskeletal disorders
  - soft tissue disorders."
- WMSDs include three types of injuries:
  - Muscle injury
    - "When muscles contract, they use chemical energy from sugars and produce by-products such as lactic acid which are removed by the blood. A muscle contraction that lasts a long time reduces the blood flow. Consequently, the substances produced by the muscles are not removed fast enough, and they accumulate in the muscles. The accumulation of these substances irritates muscles and causes pain. The severity of the pain depends on the duration of the muscle contractions and the amount of time between activities for the muscles to get rid of those irritating substances."
  - Tendon injury
    - "Tendons consist of numerous bundles of fibres that attach muscles to bones. Tendon disorders related to repetitive or frequent work activities and awkward postures occur in two major categories – tendons with sheaths (Fig. 1), found mainly in the hand and wrist; and tendons without sheaths (Fig. 2), generally found around the shoulder, elbow, and forearm."
    - "The tendons of the hand are encased in sheaths through which the tendon slides."

    - › "The inner walls of the sheaths contain cells that produce a slippery fluid to lubricate the tendon. With repetitive or excessive movement of the hand, the lubrication system may malfunction. It may not produce enough fluid, or it may produce a fluid with poor lubricating qualities. Failure of the lubricating system creates friction between the tendon and its sheath, causing inflammation and swelling of the tendon area. Repeated episodes of inflammation cause fibrous tissue to form. The fibrous tissue thickens the tendon sheath and hinders tendon movement. Inflammation of the tendon sheath is known as tenosynovitis."
    - › "When inflamed, a tendon sheath may swell up with lubricating fluid and cause a bump under the skin. This is referred to as a ganglion cyst."
    - › "Tendons without sheaths are vulnerable to repetitive motions and awkward postures. In fact, when a tendon is repeatedly tensed, some of its fibres can tear apart. The tendon becomes thickened and bumpy, causing inflammation. Tendonitis is the general term indicating inflammation of the tendon. In some cases, such as in the shoulder, tendons pass through a narrow space between bones. A sac called the bursa filled with lubricating fluid is inserted between the tendons and the bones as an anti-friction device. As the tendons become increasingly thickened and bumpy, the bursa is subject to a lot of friction and becomes inflamed. Inflammation of the bursa is known as bursitis.".
- Nerve injury
    - › "Nerves carry signals from the brain to control activities of muscles. They also carry information about temperature, pain, and touch from the body to the brain, and control bodily functions such as sweating and salivation. Nerves are surrounded by muscles, tendons, and ligaments. With repetitive motions and awkward postures, the tissues surrounding nerves become swollen, and squeeze or compress nerves (Fig. 3A, 3B)."
    - › "Compression of a nerve causes muscle weakness, sensations of pins and needles, and numbness. Dryness of skin, and poor circulation to the extremities, may also occur."

UNITED KINGDOM (HSE, 2020)

According to the Health and Safety Executive:

– "Work-related disorders can develop in an occupational setting due to the physical tasks with which individuals carry out their normal work activities. WRMSDs are associated with work patterns that include:
    - fixed or constrained body positions
    - continual repetition of movements
    - force concentrated on small parts of the body such as the hand or wrist
    - a pace of work that does not allow sufficient recovery between movements."

Additionally, workplace psychosocial factors such as organisational culture, the health and safety climate and human factors may create the conditions for WRMSDs to occur. Generally, none of these factors act separately to cause WRMSDs.

EUROPE

According to the European Agency for Safety and Health at Work (Crawford & Davis, 2020):

– "Work-related MSDs affect the back, neck, shoulders, and upper limbs as well as the lower limbs. They cover any damage or disorder of the joints or other tissues. Health problems range from minor aches and pains to more serious medical conditions requiring time off or medical treatment. In more chronic cases, they can even lead to disability and the need to give up work."

According to the European Agency for Safety and Health at Work (EU-OSHA 2020-22 Health Workplaces Campaign):

- "Work-related MSDs were defined as impairments of bodily structures such as muscles, joints, tendons, ligaments, nerves, bones or a localised blood circulation system that are caused or aggravated primarily by the performance of work and by the effects of the immediate environment where the work is carried out" (Nunes & Bush, 2012).

Within the European Foundation for the Improvement of Living and Working Conditions (common definitions used in Belgium and Slovakia (Eurofound Belgium, 2022; Kordosova, 2021)):

- "Work-related MSDs were usually associated to repetitive tasks or to those implying carrying of heavy loads, vibrations, inadequate postures such as in construction, transport, agriculture sectors and, more recently, by caregivers. According to ergonomists, they are "multifactorial in nature. In work environment, these are problems attributable to repetitive work under strict spatio-temporal constraints"(Bourgeois *et al*., 2000). The expert forecast on emerging physical risks related to occupational health and safety strongly agree on the lack of physical activity and on the combined effect of exposure to MSDs risk factors and psychosocial risk factors (such as job insecurity and fear of the future), thus enlarging the target of such diseases."
- "MSDs affect all parts of the body allowing the individual to move and work, with strong interrelations between nervous and muscular systems: back, neck, shoulders, upper and lower limbs. They result from an accumulation of mechanic constraints, repetitive movements, short production cycle, heavy lifting, poorly designed workstations."
- According to the European Working Conditions Observatory (EWCO) 2007 survey (Giaccone, 2007):
  - "According to the definition of the European Agency for Safety and Health at Work (OSHA), work-related MSDs cover a wide range of inflammatory and degenerative diseases of the body's musculoskeletal system. These include:
    - inflammation of the tendons (tendonitis and tenosynovitis), notably in the wrists and forearms, elbows, and shoulders, and in occupations involving prolonged periods of repetitive and static work
    - pain and functional impairment of the muscles (myalgia), occurring predominantly in the shoulder and neck regions, and in occupations involving static positions
    - nerve compression, or entrapment syndromes, occurring particularly in the wrist and forearm
    - degenerative disorders occurring in the spine, generally in the neck or lower back areas, particularly among workers involved in manual handling or heavy physical tasks – such disorders may occur in the hip or knee joints."
  - "These diseases are chronic, and their symptoms may appear after prolonged exposure to work related risk factors, such as awkward postures, repetitive tasks, carrying heavy loads and applying force or pressure."
  - "Despite extensive documentation, some controversy remains as to the true extent of MSDs. This may be related to difficulties in establishing specific diagnoses for many of these disorders: although MSDs often cannot be diagnosed with respect to a clinical pathology, they may still result in physical impairment and disability."

In Finland (Stavrou, 2007) there is no official definition of WR-MSD. However, "occupational health researchers (for example in Finnish Institute of Occupational Health) distinguish WR-MSDs according to how important agent work is as a cause of disorder. At least three major groups can be found:

- "Narrow definition (occupational diseases): a repetitive strain injury which is a work-related, non-physiological disorder, such as tenosynovitis and epicondylitis, following from repetitive work or abnormal working positions (as explained already in the report)."
- "Broad definition (WHO 85 definition): Besides occupational diseases and WR-MSDs of occupational origin only also MSDs which are partly caused by work are defined to be WR-MSDs. Also, MSDs which are worsened by work are included. Diseases which are linked to social behaviour or habits characteristic to certain occupation are contained as well (cf. smoking among restaurant workers)."
- "Third definition: This is unofficial and used mainly for research purposes. It is wider than the definition of occupational disease but narrower than the broad definition above. The MSDs which have a significant origin (the level of occupational origin is not necessarily defined but can be, for example, approximately 50 per cent depending on research focus) in work are included."

Note: In statistics on occupational diseases, an MSD is defined as a repetitive strain injury which is a work-related, non-physiological disorder, such as tenosynovitis and epicondylitis, following from repetitive work or abnormal working positions (Stavrou, 2007).

"Backaches are not included in statistics on occupational diseases because the established insurance practice is limited to disorders mainly occurring in upper extremities. However, there are exceptions like cases of peroneal nerve paralysis which are included in the statistics. The consequence from the insurance regulations is that the significance of various types of aches in the back, neck or shoulders cannot be estimated from statistics on occupational diseases. These are defined as being work-related MSDs which either have their origin in work or are worsened by work" (Stavrou, 2007).

Norway has no official definition of WR-MSDs (Eurofound Norway, 2007). The most widespread definition is:

- "Work-related musculoskeletal disorders include pain, symptoms or reduced function located to bones, joints, muscles, tendons, or nerves entirely or partly related to factors in the work environment."

In the Netherlands (Douwes, 2007) there is no official definition of WR-MSD. Mainly the following terms and definitions are being used:

- "(Work related) Musculoskeletal disorders or complaints (MSD) to indicate all disorders or complaints of the musculoskeletal system, including the back and upper limb."
- "Repetitive Strain Injuries (RSI) refers to complaints with respect to neck, shoulder, arm or hand. Since approximately two years scientists proposed to replace RSI by 'Complaints of Arm, Neck and Shoulder (CANS; Karels, 2003)', to indicate specific or a-specific complaints and disorders in these regions, that have not been caused by an acute trauma or systematic disorder. RSI and CANS do not include back and lower limb disorders". Another alternative term that is sometimes used is 'disorders of the musculoskeletal system upper extremities' (Dutch abbreviation ABBE)."

"Spain lacks an official definition of WR-MSDs (Corral, 2022). Nevertheless, it is possible to provide a broad definition stated by the Ministry of Labour and Social Affairs in agreement with private (for example, The Spanish Confederation of Business Organisations and The Spanish Confederation of Small and Medium Enterprises, as well as the main Spanish labour unions: CCOO, UGT, ELA, and CIG) and public authorities (the Spanish Ministry of Labour and Social Affairs)":

- "Musculoskeletal Disorders are injuries of muscles, tendons and nerves that affect hands, wrists, elbows, or shoulders. They may also affect knees and feet if work task demands long kneeled-down periods, or to operate with pedals. MSDs are known under several names depending on the different alterations, for example, Tenosynovitis, Tendinitis, carpal tunnel syndrome, Bursitis, Epicondylitis, and others".

For Germany (Eurofound Germany, 2022), the Hauptverband der gewerblichen Berufsgenossenschaften (HVBG) is the national statutory insurance organisation for compensation of occupational diseases and accidents. Occupational diseases are laid down in the Occupational Diseases Ordinance (Berufskrankheiten-Verordnung). In the attachment of this Order recognised MSDs are listed under '2 Diseases caused by physical effects'.

- "2101: diseases of tendosynovitis of the tendosynovitis glide tissue as well as of tendon and muscle base (Recognition: 1.8.1952); Note: ... that have forced the omission of all activities, that are responsible for the occurrence, the worsening or cause respectively can cause the reappearance of the disease."
- "2102: meniscus injuries after several years of continuous or frequent repeating activities causing more than average strain for the knee joint (Recognition: 1.8.1952)."
- "2103: diseases caused by vibrations due to work with compressed air tools or tools or machines with similar effects (Recognition: 1.1.1920)."
- "2104: blood circulation disorders at hands related to vibration (Recognition: 1.1.1977); Note: ... that have forced to omission of all activities, that are responsible for the occurrence, the worsening or cause respectively can cause the reappearance of the disease."
- "2105: chronic disorders of the synovial bursa caused by constant pressure (Recognition: 1.8.1952)."
- "2106: pressure strain on nerves (pressure paralysis) (Recognition: 1.8.1952)."
- "2107: demolition fracture of the vertebra furtherance (Abrißbrüche der Wirbelfortsätze) (Recognition: 1.8.1952)."
- "2108: intervertebral disc related disorders of the lower back (lumbar vertebra) after many years of lifting or carrying of heavy weights or of activities in extreme bend of the body (Recognition: 1.1.1993); Note: ... that have forced the omission of all activities, that are responsible for the occurrence, the worsening or cause respectively can cause the reappearance of the disease."
- "2109: intervertebral disc related disorders of the cervical vertebra after many years of carrying heavy weights on the shoulder (Recognition: 1.1.1993); Note: ... that have forced the omission of all activities, that are responsible for the occurrence, the worsening or cause respectively can cause the reappearance of the disease."
- "2110: intervertebral disc related disorders of the lower back (lumbar vertebra) after many years of predominant vertical strain of body vibration while seated (Recognition: 1.1.1993); Note: ... that have forced the omission of all activities, that are responsible for the occurrence, the worsening or cause respectively can cause the reappearance of the disease (Eurofound Germany, 2022)."

In Denmark (Eurofound Denmark, 2022) there is no straightforward official definition of work-related musculoskeletal disorders. Instead, musculoskeletal disorders are "operationally defined, and further assessment of the individual disease is done with regard to the List of Occupational Diseases and the Workers' Compensation Act setting out general principles potentially covering all types of occupational injuries".

In Greece (Giaccone, 2007) the following definition was proposed:

- "Musculoskeletal Disorders cover a broad range of disorders affecting workers' health. Their main manifestations involve injuries due to repetitive strain on all the sections of the spinal column (neck, back, lumbar region) as well as disorders of the musculoskeletal system of the upper and lower extremities including the shoulders, wrists, elbows, and knees. Similarly, based on a special publication by the Ministry of Labour (2000), musculoskeletal disorders are disorders displayed by the muscles, tendons, fascia, nerves, and bones (including the neck, the upper and lower extremities, and the lower back (lumbar region). In this context the best-known musculoskeletal disorders are cervical syndrome, lumbago, tendonitis, and carpal tunnel syndrome".

ASIA

Within China (Jia *et al*., 2021):

- "The epidemiological characteristics of WMSDs in key industries in China from January 2018 to June 2020 were investigated in this study. With an estimated sample size of 60,000 it was the largest population survey on WMSDs in China."
- "WMSDs are not included in the list of statutory occupational diseases in China. Rather, it is only perceived as work-related diseases, so there is no legal basis for preventing and controlling WMSDs among occupational groups. In 2019, China put forward in the Healthy China Action (2019–2030) that the prevention and control of WMSDs should be included in the national health action goal. Therefore, a large sample of people in key industries in different regions of China were investigated and studied to determine the prevalence and distribution characteristics of WMSDs in key industries of China and explore related epidemiological characteristics (Jia *et al*., 2021)."

MSD definitions

UNITED STATES

Within the U.S Bureau of Labor Statistics (U.S. Bureau of Labor Statistics, 2020):

- "Musculoskeletal disorders (MSDs), sometimes called "ergonomic injuries", occur when the body uses muscles, tendons, and ligaments to perform tasks, often times in awkward positions or in frequent activities which over time can create pain and injury. Overexertion and repetitive motion are the primary causes of these injuries."
- "Examples of the nature of the injury or illness may include pinched nerves, carpal or tarsal tunnel syndrome, and other connective tissue disorders, resulting from overexertion or bodily reaction, among others. A full definition of MSDs can be found here: Occupational Safety and Health definitions."

According to the National Institute for Occupational Safety and Health (NIOSH), Musculoskeletal Health Program (NIOSH, 2019):

- "MSDs are soft-tissue injuries caused by sudden or sustained exposure to repetitive motion, force, vibration, and awkward positions. These disorders can affect the muscles, nerves, tendons, joints, and cartilage in your upper and lower limbs, neck, and lower back. The NIOSH Musculoskeletal Health Cross-Sector Program works with outside partners in industry, labor, trade associations, professional organizations, and academia to prevent work-related musculoskeletal disorders (MSDs)."

CANADA

In the Workplace Safety & Prevention Services (WSPS, 2021):

- "MSDs are injuries that affect muscles, tendons, ligaments, and nerves. Injuries can develop when the same muscles are used repetitively, or for a long time without adequate rest. This type of injury increases if the force exerted is high and/or the job requires awkward posture. Some examples of MSDs include back pain, carpal tunnel syndrome, tendonitis, and tenosynovitis."
- "MSDs do not include musculoskeletal injuries or disorders that are the direct result of a traumatic event, such as a fall, being struck by or against an object, being caught in or on something, a vehicle collision, or workplace violence."

UNITED KINGDOM

According to the Health and Safety Executive (HSE, 2020):

- "Musculoskeletal disorders can affect muscles, joints, and tendons in all parts of the body. Most WRMSDs develop over time. They can be episodic or chronic in duration and can also result from injury sustained in a work-related accident. Additionally, they can progress from mild to severe disorders. These disorders are seldom life threatening but they impair the quality of life of a large proportion of the adult population."

For the National Health Service (NHS) (NHS, 2021):

- "Musculoskeletal (MSK) conditions affect the joints, bones, and muscles, and also include rarer autoimmune diseases and back pain. More years are lived with musculoskeletal disability than any other long-term condition."

For the Public Health England (GOV.UK) (Public Health England, 2021):

- "MSK conditions are a group of conditions that affect the bones, joints, muscles, and spine, and are a common cause of severe long-term pain and physical disability. There are 3 groups of MSK conditions:
  - inflammatory conditions, for example, rheumatoid arthritis
  - conditions of MSK pain, for example, osteoarthritis and back pain
  - osteoporosis and fragility fractures, for example, a fracture after a fall from standing height".
- "While life expectancy has risen, many people are living longer in poorer health – particularly those in more deprived parts of the country. The older a person is, the more likely they are to experience chronic diseases and disabilities such as poor musculoskeletal health."

EUROPE

According to the European Agency for Safety and Health at Work (EU-OSHA 2020-22 Health Workplaces Campaign) (Crawford & Davis, 2020):

- "Often MSDs are broken down by the site of pain and discomfort. For example:
  - back pain (which can be low back pain, upper back pain, or neck pain) in which the source of problems is around the spine and supporting muscles and ligaments
  - upper limb disorders, usually including the shoulders, upper arms, forearms, hand, or wrist, and
  - lower limb pain, including the hips, legs, knees, ankles, and feet."
- "Upper limb disorders are often misleadingly called repetitive strain injuries. There are many suggested causes of upper limb disorders. Although repetition is one of these, it is by no means the only one and often not a causative factor at all."

- "European Working Conditions Observatory (EWCO) 2007 survey (Giaccone, 2007):
  - "Musculoskeletal disorders (MSDs) are characterised by pain and loss of physical function in the body, which limits a person's activities and restricts their participation in society."

According to the World Health Organization (WHO) (WHO, 2022).

- "Musculoskeletal conditions are typically characterised by pain (often persistent) and limitations in mobility, dexterity, and overall level of functioning, reducing people's ability to work. Musculoskeletal conditions include conditions that affect:
  - joints, such as osteoarthritis, rheumatoid arthritis, psoriatic arthritis, gout, ankylosing spondylitis
  - bones, such as osteoporosis, osteopenia and associated fragility fractures, traumatic fractures
  - muscles, such as sarcopenia
  - the spine, such as back and neck pain
  - multiple body areas or systems, such as regional and widespread pain disorders and inflammatory diseases such as connective tissue diseases and vasculitis that have musculoskeletal manifestations, for example systemic lupus erythematosus (WHO, 2022)."
- "Musculoskeletal conditions are also the highest contributor to the global need for rehabilitation. They are among the largest contributors to the need for rehabilitation services among children and account for approximately two-thirds of all adults in need of rehabilitation" (WHO, 2022)."

According Stavrou (2007), there is no official definition of MSDs in Cyprus. However, the European WRMSD definition is used:

- "Musculoskeletal disorders cover a broad range of illnesses, including disorders of the bones, joints, tendons, muscles and nerves controlling the muscular system. It is now widely known that risks capable of causing musculoskeletal disorders cause physical strain and put workers' musculoskeletal systems in danger of injury or disorder." (Stavrou, 2007).

Appendix 4: References

ACC. (2009). *Preventing and managing discomfort, pain and injury. Guidelines for in and around the workplace*. Accident Compensation Corporation.

ACC. (2020). *Workplace injury prevention grants. Applicant guidelines*. Accident Compensation Corporation.

ACC. (2021). *Injuries we cover*. Accident Compensation Corporation. www.acc.co.nz/im-injured/what-we-cover/injuries-we-cover

ACC and Department of Labour. (2001). *Code of practice for manual handling*. Occupational Safety and Health Service, Accident Compensation Corporation, & Department of Labour. worksafe.govt.nz/topic-and-industry/manual-handling/preventing-manual-handling-injuries-acop

ACC and Department of Labour. (2010). *Guidelines for using computers. Preventing and managing discomfort, pain and injury*. Accident Compensation Corporation and Department of Labour. worksafe.govt.nz/topic-and-industry/work-related-health/musculoskeletal-disorders/ergonomics/safely-using-computers-at-work

ACC and WorkSafe NZ. (2016). *Harm reduction action plan*. Accident Compensation Corporation and WorkSafe NZ. worksafe.govt.nz/about-us/who-we-are/our-priorities/our-plan

ASCC. (2008). *Type of occurence classification system*. Australian Safety and Compensation Council Canberra Australia. www.safeworkaustralia.gov.au/resources-and-publications/guidance-materials/type-occurrence-classification-system-toocs-3rd-edition-may-2008

Barton, J. (2021). *Work-Related Musculoskeletal Disorders: Pūmahara Report [Unpublished report]*. WorkSafe NZ.

Basham, M. (2019). *Body stressing insights report Part 1 Insights report*. Accident Compensation Corporation.

Boocock, M., Ashby, L., & Trevelyan, F. (2018). *A review of international programmes for the prevention and management of musculoskeletal disorders*. Health and Rehabilitation Research Institute Centre for Occupational Health & Safety Research. Auckland University of Technology.

Boocock, M., Collier, J. M. K., McNair, P. J., Simmonds, M., Larmer, P. J., & Armstrong, B. (2009). A framework for the classification and diagnosis of work-related upper extremity conditions: Systematic review. *Seminars in Arthritis and Rheumatism, 38*(4), 296-311. https://pubmed.ncbi.nlm.nih.gov/18280546

Bourgeois, F., Lemarchand, C., Hubault, F., Brun, C., Polin, A., & Faucheux, J. M. (2000). TMS et travail, quand la santé interroge l'organisation. *Éditions de l'ANACT Lyon*.

Briggs, A. M., Woolf, A. D., Dreinhöfer, K., Homb, N., Hoy, D., Kopansky-Giles, D., Åkesson, K., & March, L. (2018). Reducing the global burden of musculoskeletal conditions. *Bulletin of the World Health Organization, 96*(5), 366-368.

Cassin, Z. (2018). *Body stressing injuries. Musculoskeletal and connective tissue injuries (from physical trauma, lifting, carrying or straining, twisting, or repetitive movements) [Unpublished report]*. Tenzing Limited.

CCOHS. (2021). *OSH answers fact sheets. Work-related musculoskeletal disorders (WMSDs) risk factors*. Canadian Centre for Occupational Health and Safety. www.ccohs.ca/oshanswers/ergonomics/risk.html

Comcare. (2021). *Physical hazards*. www.comcare.gov.au/safe-healthy-work/prevent-harm/physical-hazards

Corral, I. (2022). *Managing musculoskeletal disorders – Spain*. European

Foundation for the Improvement of Living and Working Conditions. www.eurofound.europa.eu/de/publications/report/2007/managing-musculoskeletal-disorders-spain

Crawford, J. O., & Davis, A. (2020). *Work-related musculoskeletal disorders: Why are they still so prevalent? Evidence from a literature review*. European Agency for Health and Safety at Work (EU-OSHA). https://osha.europa.eu/en/publications/work-related-musculoskeletal-disorders-why-are-they-still-so-prevalent-evidence-literature-review

Department of Mines Industry Regulation and Safety. (2021). *Introduction to manual tasks*. Government of Western Australia. www.commerce.wa.gov.au/worksafe/introduction-manual-tasks

Douwes, M. (2007). *Managing musculoskeletal disorders – Netherlands*. European Foundation for the Improvement of Living and Working Conditions. www.eurofound.europa.eu/publications/report/2007/managing-musculoskeletal-disorders-the-netherlands

Eurofound Belgium. (2022). *Managing musculoskeletal disorders – Belgium*. European Foundation for the Improvement of Living and Working Conditions. www.eurofound.europa.eu/de/publications/report/2007/managing-musculoskeletal-disorders-belgium

Eurofound Denmark. (2022). *Managing musculoskeletal disorders – Denmark*. European Foundation for the Improvement of Living and Working Conditions. www.eurofound.europa.eu/de/publications/report/2007/managing-musculoskeletal-disorders-denmark

Eurofound Germany. (2022). *Managing musculoskeletal disorders – Germany*. European Foundation for the Improvement of Living and Working Conditions,. www.eurofound.europa.eu/de/publications/report/2007/managing-musculoskeletal-disorder-germany

Eurofound Norway. (2007). *Managing musculoskeletal disorders – Norway*. European Foundation for the Improvement of Living and Working Conditions. Retrieved 18/01/22 from www.eurofound.europa.eu/de/publications/report/2007/managing-musculoskeletal-disorders-norway

Forcier, L., & Kuorinka, I. (2006). Work-Related Musculoskeletal Disorders (WMSD): A Brief Overview. In W. Karwowski (Ed.), *International Encyclopedia of Ergonomics and Human Factors* (1 ed.). CRC Press Taylor & Francis.

Giaccone, M. (2007). *Managing musculoskeletal disorders – Greece*. www.eurofound.europa.eu/sites/default/files/ef_files/docs/ewco/tn0611018s/tn0611018s.pdf

Grant, K. A., & Habes, D. J. (2006). Surveillance for work-related musculoskeletal disorders. In W. Karwowski (Ed.), *International Encyclopedia of Ergonomics and Human Factors*. CRC Press Taylor & Francis.

Hagberg, M., Violante, F. S., Bonfiglioli, R., Descatha, A., Gold, J., Evanoff, B., & Sluiter, J. K. (2012). Prevention of musculoskeletal disorders in workers: classification and health surveillance–statements of the Scientific Committee on Musculoskeletal Disorders of the International Commission on Occupational Health. *BMC musculoskeletal disorders, 13*(1), 1-6. https://pubmed.ncbi.nlm.nih.gov/22721454

HSE. (2020). Work related musculoskeletal disorder statistics (WRMSDs) in Great Britain, 2020. www.hse.gov.uk/statistics/causdis/msd.pdf

James, S. L., Abate, D., Abate, K. H., Abay, S. M., Abbafati, C., Abbasi, N., Abbastabar, H., Abd-Allah, F., Abdela, J., & Abdelalim, A. (2018). Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet, 392*(10159), 1789-1858.

Jia, N., Zhang, H., Ling, R., Liu, Y., Li, G., Ren, Z., Yin, Y., Shao, H., Zhang, H., Qiu, B., Zhang, M., Wang, D., Zeng, Q., Wang, R., Chen, J., Zhang, D., Mei, L., Liu, Y., & Liu, J., ... Wang, Z. (2021). Epidemiological Data of Work-Related Musculoskeletal Disorders – China, 2018-2020. *China CDC Weekly, 3*(18), 383-389.

Kordosova, M. (2021). Managing musculoskeletal disorders – Slovakia. European Foundation for the Improvement of Living and Working Conditions. Retrieved 10/12/2021 from https://www.eurofound.europa.eu/publications/report/2007/managing-musculoskeletal-disorders-slovakia

Lehto, A. (2022). *Managing musculoskeletal disorders – Finland*. European Foundation for the Improvement of Living and Working Conditions. www.eurofound.europa.eu/publications/report/2007/managing-musculoskeletal-disorders-finland

NHS. (2021). *Musculoskeletal conditions*. National Health Service U.K. www.england.nhs.uk/ourwork/clinical-policy/ltc/our-work-on-long-term-conditions/musculoskeletal

NIOSH. (2019). Musculoskeletal Health Program. Retrieved Dec 06 2021, from www.cdc.gov/niosh/programs/msd/default.html

Nunes, I., & Bush, P. (2012). Work-Related Musculoskeletal Disorders Assessment and Prevention. In I. L. Nunes (Ed.), *Ergonomics: A Systems Approach*. https://doi.org/10.5772/37229

Oakman, J., Clune, S., & Stuckey, R. (2019). *Work-related musculoskeletal disorders in Australia, 2019*. Canberra: SafeWork Australia.

Public Health England. (2021). Guidance Musculoskeletal health: applying All Our Health.

Russo, F., Di Tecco, C., Fontana, L., Adamo, G., Papale, A., Denaro, V., & Iavicoli, S. (2020). Prevalence of work related musculoskeletal disorders in Italian workers: is there an underestimation of the related occupational risk factors? *BMC musculoskeletal disorders, 21*(1), 738. https://doi.org/10.1186/s12891-020-03742-z

Safe Work Australia. (2021). *Lifting, pushing and pulling (manual tasks)*. www.safeworkaustralia.gov.au/safety-topic/hazards/lifting-pushing-and-pulling-manual-tasks

Safe Work NSW. (2021). *Musculoskeletal disorders (MSD)*. www.safework.nsw.gov.au/resource-library/musculoskeletal-disorder/msd

Safiri, S., Kolahi, A., Cross, M., Hill, C., Smith, E., Carson-Chahhoud, K., Mansournia, M. A., Almasi-Hashiani, A., Ashrafi-Asgarabad, A., Kaufman, J., Sepidarkish, M., Shakouri, S. K., Hoy, D., Woolf, A. D., March, L., Collins, G., & Buchbinder, R. (2021). Prevalence, deaths, and disability-adjusted life years due to musculoskeletal disorders for 195 countries and territories 1990–2017. *Arthritis & Rheumatology, 73*(4), 702-714. https://doi.org/https://doi.org/10.1002/art.41571

Silverstein, B. (2006). Work-Related Musculoskeletal Disorders (WMSD): General Issues. In W. Karwowski (Ed.), *International Encyclopedia of Ergonomics and Human Factors*. (Vol. 1). CRC Press Taylor & Francis.

Stavrou, P. (2007). *Managing musculoskeletal disorders – Cyprus*. www.eurofound.europa.eu/publications/report/2007/managing-musculoskeletal-disorders-cyprus

Tappin, D., Bentley, T., Ashby, L., Tedestedt-George, C., & Tedestedt, R. (2021). Identifying measures to reduce musculoskeletal disorder risks in residential construction: findings from interviews with 61 builders in Christchurch, Wellington and Auckland. Healthy Work Group Massey University. https://secure.chasnz.org/downloads/Identifying_Measures_to_Reduce_Musculoskeletal_Disorder_Risks_in_Residential_Construction_Massey_University_2014.pdf

Trembearth, D., & Crawford, J. O. (2021). Work-related musculoskeletal disorders. Core body of knowledge for the generalist OHS professional. 2nd Edition. In Australian Institute of Health & Safety (Ed.), *The Core Body of Knowledge for Generalist OHS Professionals*. AIHS. www.ohsbok.org.au

U.S. Bureau of Labor Statistics. (2020). Fact Sheet | Occupational injuries and illnesses resulting in musculoskeletal disorders (MSDs) | May 2020. www.bls.gov/iif/oshwc/case/msds.htm

WHO. (2022). *Musculoskeletal conditions*. World Health Organization. www.who.int/news-room/fact-sheets/detail/musculoskeletal-conditions

WorkSafe New Zealand. (2019). New Zealand Health and Safety at Work Strategy. Outcomes dashboard. worksafe.govt.nz/about-us/corporate-publications/other-publications

WorkSafe New Zealand. (2021a). *Data centre*. WorkSafe New Zealand. Retrieved 03/12/2021 from https://data.worksafe.govt.nz

WorkSafe New Zealand. (2021b). *Vibration*. Retrieved 12/01/2022 from worksafe.govt.nz/topic-and-industry/vibration

WorkSafe New Zealand. (2021c). *What are musculoskeletal disorders?* WorkSafe New Zealand. Retrieved 03/12/2021 from worksafe.govt.nz/topic-and-industry/work-related-health/musculoskeletal-disorders/what-are-musculoskeletal-disorders

WorkSafe New Zealand. (2021d). *Work-related health estimates and burden of harm*. WorkSafe New Zealand. worksafe.govt.nz/topic-and-industry/work-related-health/work-related-health-estimates-and-burden-of-harm

WorkSafe New Zealand (2022e). *Defining MSDs and WRMSDs*. [Prepared by Kolose, S., Matulino, C., Edwin, M., Hunter, L., and Buckley, K.]. WorkSafe New Zealand.

WorkSafe Queensland. (2021). *Musculoskeletal disorders frequently asked questions*. worksafe.qld.gov.au/safety-and-prevention/hazards/hazardous-manual-tasks/musculoskeletal-disorders-frequently-asked-questions

WorkSafe Victoria. (2021). *Construction safety focus: Preventing musculoskeletal disorders*. worksafe.vic.gov.au/resources/construction-safety-focus-preventing-musculoskeletal-disorders

WSPS. (2021). Musculoskeletal Disorders (MSD). Retrieved 07 December 2021, from www.wsps.ca/resource-hub/articles/musculoskeletal-disorders-msd

Notes

Disclaimer

WorkSafe New Zealand has made every effort to ensure the information contained in this publication is reliable, but makes no guarantee of its completeness.

It should not be used as a substitute for legislation or legal advice. WorkSafe is not responsible for the results of any action taken on the basis of information in this document, or for any errors or omissions.

ISBN 978-1-99-105701-3 (online)

Published: November 2022

PO Box 165, Wellington 6140, New Zealand

worksafe.govt.nz

WSNZ_4406_NOV 22

ISBN 978-1-99-105701-3 (online)

WORKSAFE
Mahi Haumaru Aotearoa

Level 6, 86 Customhouse Quay
PO Box 165, Wellington 6140
0800 030 040 worksafe.govt.nz