The link between workplace stressors and physical injury: current evidence, prevalence in NSW employees and prevention tools

Research summary

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Centre for WHS

This research summary provides the latest evidence on the link between workplace stressors (covering psychosocial factors) and physical injury/musculoskeletal disorders (MSDs), the current prevalence of MSDs in New South Wales employees, tools available to prevent MSDs and factors to facilitate implementation of tools for businesses. The summary brings together a systematic review on the effects of workplace psychosocial factors and MSDs (led by Professor Carole James, the University of Newcastle), a cross-sectional survey of MSDs in New South Wales employees (led by Professor Maureen Dollard, the University of South Australia), a systematic review of available tools to address MSDs and a qualitative study on barriers/ facilitators to implement tools in NSW businesses (led by Professor Jodi Oakman, La Trobe University).

Background

Musculoskeletal disorders (MSDs), including injury to or disease of the body's musculoskeletal system, are the leading cause of work disability in developed countries that result in billions of dollars of financial losses. In NSW only, data from the State Insurance Regulatory Authority show that workplace MSDs resulted in a loss of $606 million in 2015/16, and $671 million in 2016/17. In the 2017-2022 MSD strategy, NSW government set a target to reduce the incidence rate of claims due to MSDs, and subsequently to materialise a saving of $415 million to NSW businesses by 2022.

The research project on the link between workplace psychosocial factors and MSDs is an important component of the MSD strategy, contributing toward the goal in reducing MSDs among employees in NSW. The project comprises of three complementary studies, which were conducted by three university research partners:

1. A systematic review on the effects of workplace psychosocial factors and MSDs, led by Professor Carole James, the University of Newcastle: This study aimed to systematically collect the latest evidence from longitudinal/follow-up studies estimating the lagged effect of psychosocial risk factors on musculoskeletal problems in industrialised work settings. The study focuses on the peer-reviewed scientific literature pertaining to the nexus between workplace psychosocial factors and MSDs.

2. A cross-sectional survey of MSDs in NSW employees, led by Professor Maureen Dollard, the University of South Australia. The aim of this study was to provide up-to-date prevalence estimates of MSDs among NSW employees in 2020-21 and to estimate the association of workplace psychosocial, physical and demographic factors with MSDs.

3. Systematic reviews of available tools to address MSDs (review 1), barriers and facilitators to implementing tools (review 2) and a qualitative study on barriers/ facilitators to implement tools in NSW businesses, led by Professor Jodi Oakman, La Trobe University. Collectively, these studies aim to identify tools to support comprehensive MSD prevention and to explore barriers and enablers to the implementation of comprehensive MSD prevention tools in a range of industry settings in NSW.

What we found

1. Systematic review of the effects of workplace psychosocial factors and MSDs

From searches in five academic research databases (Medline, Embase, PsychINFO, Scopus and CINAHL) and grey literatures yielding 4,999 research articles, James and colleagues identified 47 relevant studies and included these for analysis. Participants in the included studies were workers employed in a range of industries, with a wide spectrum of physical demands, including healthcare, professional drivers, manufacturing and production, and office workers. There was a large range in sample size (from 53 to 12,714 participants) and the lag-time of follow-ups (from every 14 days for 12 months, to biannual follow-ups for six years).

Low job control, low job decision, low social/co-worker/supervisor support and high job dissatisfaction, high psychological demands, high psychosocial stress were common risk factors for MSDs.

Table 1. Effects of exposure to psychosocial factors in the workplace on development of MSDs

MSD outcome	Psychosocial factors	Increased risk of MSDs*
Neck pain	• Job control (low/medium vs. high) • Job decision (seldom/never vs. often) • Job satisfaction (dissatisfied/very dissatisfied vs. very satisfied) • Psychological demands (high vs. low) • Quantitative demands (high vs. low) • Co-worker support (low vs. high) • Supervisor support (low vs. high) • Role conflict (low vs. high) • Empowering leadership (low vs. high) • Social climate (low vs. high) • Psychological stress (yes vs. no) • Psychological load (high vs. low) • Decision latitude (high vs. low) • Social support (low vs. high)	1.11 – 3.13 times
Shoulder pain	• Psychological load (high vs. low) • Decision latitude (high vs. low) • Social support (low vs. high)	1.93 – 2.19 times
Upper limb, elbow, forearm, hand pain	• Psychological demands (high vs. low) • Decision latitude (high vs. low) • Adverse belief	1.21 – 2.00 times
Back injury	• Co-worker support (poor vs. good)	3.16 times
Low back pain	• Psychological demands (high vs. low) • Skill discretion • Co-worker support (low vs. high) • Supervisor support (low vs. high) • Job satisfaction (dissatisfied/very dissatisfied vs. very satisfied) • Work stressors/detachment • Influence at work (low vs. high) • Possibilities to develop new skills (low vs. high)	1.17 – 6.08 times
Multi-site pain	• Job control (low/medium vs. high) • Job demand (high vs. low)	1.22 – 2.15 times

MSD outcome	Psychosocial factors	Increased risk of MSDs*
	• Emotional demands • Mental demands • Mental strain • Job strain • Efforts • Bullying • Social support	

Note: * range of point estimates of statistically significant associations reported in 47 included studies

Table 1 summarises the increased risk of various MSDs resulted from exposure to psychosocial factors in the workplace. For instance, workers exposed to workplace psychosocial factors would be 1.11 – 3.13 times more likely to develop neck pain, twice more likely to develop shoulder pain, or 1.22 – 2.15 times more likely to develop multi-site pain. There is a bi-directional relationship between psychosocial factors and a range of MSDs. Interventions to enhance psychosocial work environment provide opportunities to reduce the risk of MSD.

In summary, MSDs have a complex, multifactorial aetiology. Psychosocial factors play a role in this relationship, although their magnitude and direction of causal impact is influenced by additional personal and workplace stressors and risks. Opportunities exist to reduce the risk of MSD via improvements to psychosocial workplace factors.

2. The cross-sectional survey of MSDs in NSW employees

Across a sample of 628 NSW employees, one quarter (26%) of respondents reported being in a lot of pain in at least one body area, and only 21% reported no pain in any area. Around 20% of women and 22% of men indicated they had received a lifetime doctor diagnosis of any of the common chronic MSDs, and half (49%) of those reported being in a lot of pain. The most common doctor diagnosed MSD for both men and women was chronic back pain or sciatica (6%) and osteoarthritis in women (6%). Injuries in the past year were reported by 11% (n=70), and of these 31% (n=22) were work related. Around 2.5% of employees had made a worker's compensation claim in the past year.

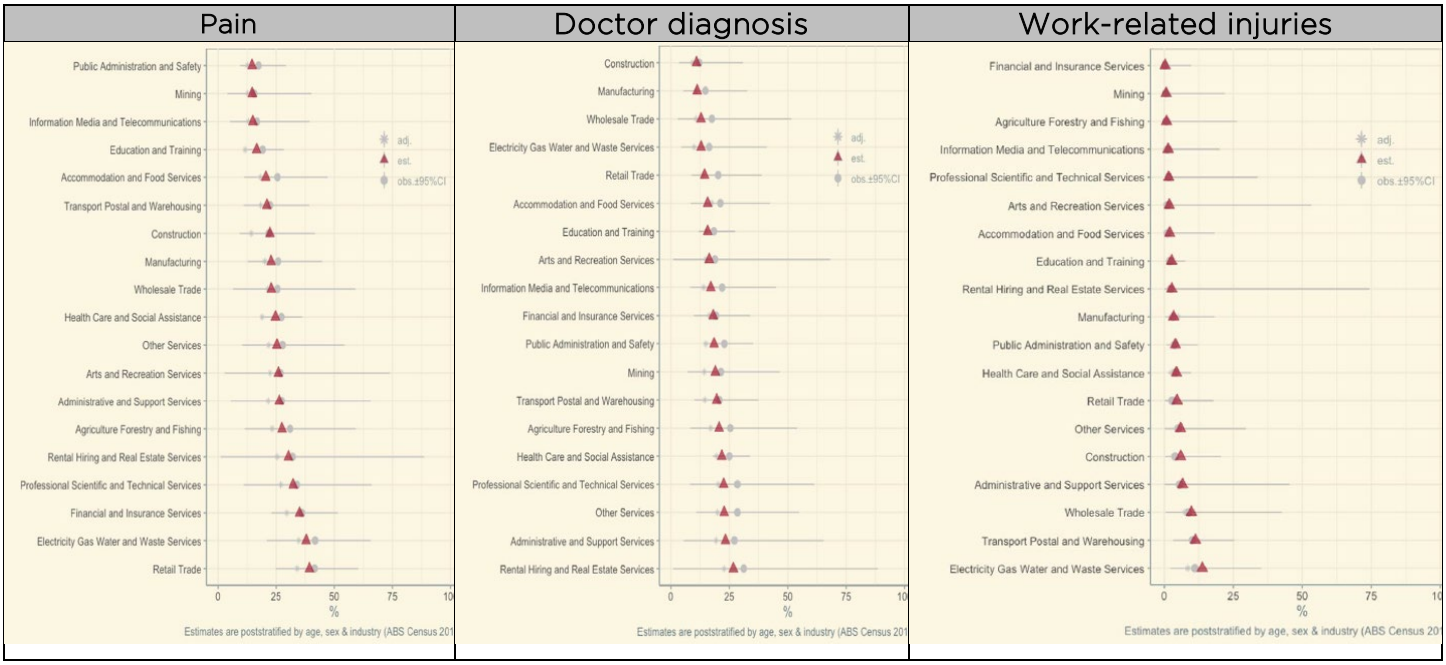
The different methods of assessing MSDs and related symptoms produce different results for both prevalence and risk analysis.

For MSD related pain, NSW industries with the highest estimated prevalence were Retail trade, Electricity/gas/water & waste services (both around 35%), and Financial/insurance, and Professional/scientific & technical services (both 25%+). Fewer than 15% of employees in Public administration, Mining, Information/media & telecommunication, Education & training, and Construction reported high pain levels (see Figure 1).

For doctor diagnosed MSDs, the industry variability in prevalence was lower with no statistically significant differences between them and a range of 10-23% (see Figure 1).

For work related injury in the last 12 months, there was a low prevalence 4% (n=22) and not surprisingly, there were no significant differences between industries, although the prevalence was 10% or higher in Electricity/gas/water & waste services, Transport/postal & warehousing, and Retail trade, and less than 1% in Finance (see Figure 1).

Figure 1. Prevalence estimates of MSD outcomes (pain, doctor diagnosis and work-related injuries) by industry

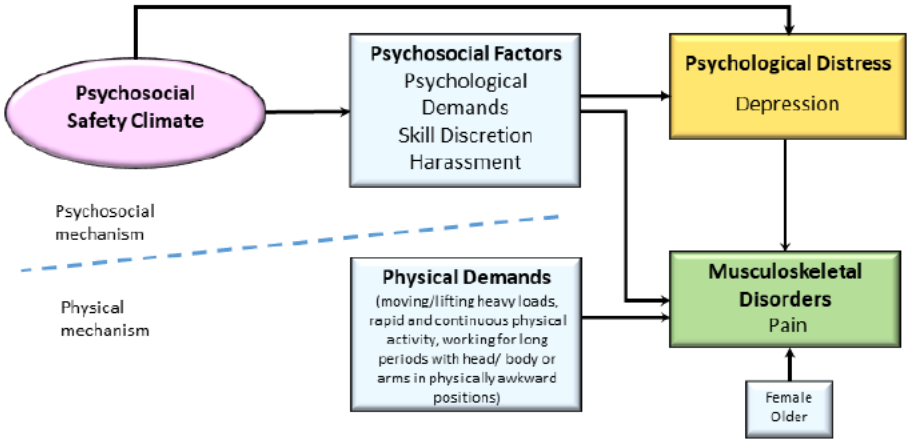


Results from the analyses of cross-sectional sample, it is clear that workplace physical risk factors are associated with MSDs. Psychosocial factors, such as increase in psychological demands (work pressure), workplace harassment, or psychological distress (depression, burnout) are associated with higher prevalence of some types of MSD outcomes, particularly pain. Since poor psychological safety climate (PSC) was related to increase in psychological risk and distress, and sometimes directly related to increased MSDs, there is some support for the proposition that PSC is an indicator of MSDs.

Some demographics factors were also associated with higher prevalence of MSDs: MSD diagnosis was more common among older workers; MSD pain was more common among women workers; and work-related injury were more common among male and low-income workers.

The plausible pathways for MSDs resulting from exposures to physical, psychological and demographic factors are summarised in Figure 2.

Figure 2. Plausible pathways to workplace MSDs



3. *The systematic review of MSD tools, barriers/enablers for tool implementation and the qualitative study*

For the systematic review of MSD tools, Oakman and colleagues conducted searches in four major academic research databases (Web of Science, Medline, ProQuest Central, and PsychInfo). Following removal of duplications and screenings, 548 studies were assessed as relevant for inclusion. Of these, 137 reported on tools covering physical hazards, 254 on psychosocial and 228 covered comprehensive tools (both physical and psychosocial hazards). Some studies reported on more than one type of tool. These reported on 30 physical hazard tools, 35 psychosocial hazard tools, and 16 comprehensive tools. Six additional physical hazard tools were found through the grey literature search. There were 23 studies based in Australia, which represented 15 tools. An interim tool matrix for use in the qualitative study was developed (some examples, see Table 2).

Table 2. Examples of tools in managing MSDs

Tool	Brief description tool	Target body area/work area	Workplace hazards assessed	Focus of assessment
Physical hazard assessment tools (total = 20)				

DMQ (Dutch Musculoskeletal Questionnaire)	For the analysis of musculoskeletal workload, associated hazardous working conditions and symptom	Whole body	Force, Repetition, Environmental Factor	Task
Psychosocial hazard assessment tools (total = 4)				
COPSOQ (Copenhagen Psychosocial Questionnaire)	Survey tool to assess a variety of comprehensive set of psychosocial factors for risk assessment at work, involving participation of workers	Stress	Demands, Work Pace Stress, Support, Recognition, Sense of community, Work engagement, Job Satisfaction, Work life interface, Trust, Bullying and Harassment	Organisational Job
Physical and Psychosocial (comprehensive) hazard assessment tools (total = 3)				
APHIRM A Participative Hazard Identification Risk Management Toolkit	A comprehensive tool which assesses physical and psychosocial hazards at work	Workplace environment and whole body	Physical Demands Psychosocial Demands (drawn from COPSOQ and WOAQ	Organisational Job

In reviewing current evidence of barriers and facilitators to the use of comprehensive tools in managing MSDs in the workplace, researchers also conducted searches in the following databases: Medline, Embase, PsychInfo, CINAHL and Proquest Central. Twenty-nine relevant studies were located. Studies involved tools that were implemented in at least nine industry sectors – some studies did not specify the industry sector. The most frequently reported sectors were Healthcare & Social Assistance (12 studies), Manufacturing (seven), and Construction (six). The studies covered a wide range of MSD risk management tools: ten studies looked at comprehensive tools (targeting both physical & psychosocial factors), 14 examined non-comprehensive tools (targeting only physical factors), and five included both types of tools (comprehensive and physical). There were no tools that only targeted psychosocial factors. Each of the reported barriers and facilitators were grouped into the relevant work-systems category: external factors, workplace environment, work organisation & job design, task & equipment, and workers' personal characteristics. Analysis of the data revealed the work organisation & job design level as having the highest number of reported barriers. The main barriers in this level were related to lack of management commitment, counterproductive management attitudes, and high costs.

In the final stage, Oakman and colleagues conducted a qualitative study by interviewing industry stakeholders to explore barriers and enablers to the implementation of comprehensive MSD prevention tools in a range of NSW industry settings. Twenty-nine interviews were conducted with WHS professionals from six industry sectors: manufacturing, health & social assistance, public

administration, construction, agriculture, and transport/postal & warehousing. The majority of participants (n=27) had a formal WHS qualification. Participants reported a range of barriers to effectively managing MSD risk. The majority of barriers were located in the organisational level of the workplace system model. Most of the MSD risk management strategies currently utilised by participants were focussed at the individual and equipment/task levels of the workplace system. All participants were aware of at least one validated tool from the tool matrix (from SR1), however only nine participants were currently using a validated tool in their workplace. Reported reasons for poor uptake of validated tools were related to 1) perceived deficits of the tools, or 2) barriers to implementation (mostly organisational level barriers).

Following the stakeholder interviews, the interim tool matrix was refined (which included the addition of a psychosocial tool identified through the interviews) to include only validated tools that were accessible (online tools or downloadable & includes instructions or guidance for use) and able to be used by workplace practitioners (see Appendix A).

Why this matter

Findings from our research projects show clear impact of workplace factors on MSDs and that some risks identified are preventable or modifiable, action should be taken to target these. Physical demands should be reduced or controlled. Action should be taken to improve Psychosocial Safety Climate, improve skill discretion, reduce harassment and reduce work pressure.

Work health and safety regulators and organisations should consider plans to implement control strategies for physical and psychosocial risks identified, ultimately to reduce the significant burden of MSDs. Organisations need to be aware of tools and how to access them before they can benefit from improvements to existing tools. To ensure the effective implementation of comprehensive MSD risk management tools, it is essential that the organisational barriers are addressed. In addition, the uptake of validated comprehensive tools and strategies could be improved with greater promotion by the Regulator and Industry Associations.

Appendix A. Tools for assessment of workplace physical and psychosocial hazards

Tool	Brief description tool	Method	Target body area/work area	Workplace hazards assessed	Focus of assessment (organisation, job, task, individual level)
Physical hazard assessment tools: Whole body					
Borg RPE (Rated Perceived Exertion Scale)	Assesses exertion used in manual handling and physically active work.	Survey	Whole body	Effort	Task
DMQ (Dutch Musculoskeletal Questionnaire)	For the analysis of musculoskeletal workload, associated hazardous working conditions and symptom	Survey	Whole body	Force, Repetition, Environmental Factor	Task
KIM (Key Indicator Methods)	Assess risks involved in manual handling of loads	Observational	Whole body	Force, Posture, Duration, Working Conditions	Task
MAC tool (Manual handling assessment charts)	Assessment tool for lifting and lowering, carrying and team handling	Observational	Whole body	Posture, Repetition, Speed, Vibration, Environmental Factor	Task
MAnTRA (Manual Tasks Risk Assessment Tool)	Assesses exposure to musculoskeletal risk factors associated with manual tasks in the workplace	Observational/ Participative	Whole body	Posture, Force, Repetition, Speed, Duration, Vibration	Task
NIOSH LE (National Institute of Occupational Safety & Health Lifting Equation)	Assesses manual handling risks associated with lifting and lowering	Observational	Whole body	Posture, Duration, Repetition, Force, Vibration	Task
OWAS (Ovako Working Posture Analysing System)	Evaluation of postural load during work	Observational	Whole body	Posture, Duration, Repetition	Task
PERFORM (Participative Ergonomics for Manual Tasks)	Simplified manual task risk management program	Observational/ Participative	Whole body	Posture, Force, Repetition, Duration, Vibration	Task
RAMP (Risk Assessment & Management Tool)	Assessment and management of physical risks in physical jobs (not including people)	Observational	Whole body	Force, Frequency, Posture, Repetition,	Task

				Duration	
REBA (Rapid Entire Body Assessment Tool)	Assesses postures to estimate work-related whole-body risk	Observational	Whole body	Posture, Force, Repetition	Task
ROSA (Rapid Office Strain Assessment)	Posture checklist to quantify office work environment risks	Observational	Whole body	Posture, Duration	Task
3DSSPP (3D Static Strength Prediction Program (Michigan University)	Software program to evaluate the physical demands of the job	Observational	Whole body	Posture, Force	Task
Wearable technology	Wearable technology to measure workers movement/activity in the work environment	Objective	Whole body	Posture	Individual
Physical hazard assessment tools: Upper Limb					
ART (Assessment of repetitive tasks)	Assessment of repetitive tasks involving the upper limb	Observational	Upper limb	Force, Posture, Repetition, Duration, Speed	Task
COSI (Composite Strain Index)	Method to quantify biomechanical stressors for complex tasks (task level)	Observational	Upper limb	Force, Posture, Repetition, Duration	Task
CUSI (Cumulative Strain Index)	Method which integrates biomechanical stressors from different tasks to quantify exposure for a whole workday (job level)	Observational	Upper limb	Force, Posture, Repetition, Duration	Job
JSI (Job Strain Index)	Estimates injury risk to wrist and hands	Observational	Upper limb	Force, Posture, Repetition, Duration, Speed	Task
OCRA (Occupational Repetitive Actions Method)	Estimates risk to the upper extremities for repetitive work,	Observational	Upper limb	Force, Posture, Repetition, Duration	Task
RULA (Rapid Upper Limb Assessment Tool)	Assessment of postures to estimate work-related upper limb disorder risk	Observational	Upper limb	Force, Posture, Repetition	Task
ULRA (Upper Limb Risk Assessment)	Assessment of the upper limb load and the risk of developing MSDs	Observational	Upper limb	Force, Posture, Repetition, Duration	Task
Psychosocial hazard assessment tools					
COPSOQ (Copenhagen Psychosocial Questionnaire)	Survey tool to assess a variety of comprehensive set of psychosocial factors for risk assessment at work, involving participation of workers	Survey	Stress	Demands Work Pace Stress Influence Support Recognition Sense of community Work engagement Job Satisfaction Work life interface Trust Bullying and Harassment	Organisational Job

				Burnout	
ERI (Effort Reward Imbalance questionnaire)	Survey tool to measure effort, reward and over commitment at work	Survey	Stress	Rewards Effort Overcommitment	Organisational Job
HSE Stress Indicator Tool	Assesses primary stressors associated with work related stress	Survey	Stress	Demands Control Support Relationships Role Organisational change	Organisational Job
People at work	Measures to identify risks to psychological health and safety	Survey	Stress	Emotional demand Role ambiguity Role conflict Role overload Conflict Job control Support Recognition Bullying/Violence Reward/Recognition Change consultation	Organisational Job
Physical and Psychosocial (comprehensive) hazard assessment tools					
APHIRM A Participative Hazard Identification Risk Management Toolkit	A comprehensive tool which assesses physical and psychosocial hazards at work	Survey Participative	Workplace environment and whole body	Physical Demands Psychosocial Demands (drawn from COPSOQ and WOAQ	Organisational Job
NASA TLX (NASA Task Load Index)	Workload assessment tool across a number of domains	Survey	Workplace environment	Mental Demands Physical Demands Effort Temporal demands Performance Frustration	Job
QEC (Quick Exposure Checklist)	Assesses a range of workplace physical and psychosocial hazards	Observational Participative	Whole body	Force, Duration, Posture, Repetition, Vibration, Work Pace, Speed	Job

D= Duration; Dem = Demands E = Effort; EF = Environmental Factors; F = Force; Fr= Frequency; P= Posture; R= Repetition; S = Speed; St= Stress; V= Vibration; WP= Work pace; WC= Working conditions; PD= physical demands; PsychD= Psychosocial demands; MD= Mental demands.