

Prevention of work-related musculoskeletal disorders: Development of a toolkit for workplace users.

La Trobe University

Dr Jodi Oakman,
Associate Professor Wendy Macdonald

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Executive Summary

The overall objective of this report is to document a project aimed at reducing the incidence of work-related musculoskeletal disorders (MSDs) by implementing a 'toolkit' designed to support more effective MSD risk control as part of routine risk management procedures in three health-care organisations with high levels of MSD claims.

In a previously reported stage of this work, contemporary research literature and other evidence was reviewed to identify the physical and psychosocial hazards that are most strongly predictive of the risk of work-related musculoskeletal disorders (WMSDs). Current WMSD hazard identification and risk assessment tools and practices that might be suitable for use by non-experts were also reviewed, along with evidence concerning real or perceived barriers to the implementation of WMSD risk assessment and control measures. Findings of that review were reported by Macdonald and Evans (2006).

One of the conclusions of the earlier review was that to achieve significant reductions in current levels of WMSDs, a broader, macro-ergonomics or socio-technical systems approach to WMSD risk management is needed. Until now, the focus of most WMSD or 'manual handling' hazard identification and risk assessment has been on the most easily observable physical demands and associated hazards of work performance (loads/forces, anthropometric mis-matches and postures), with inadequate coverage of a wide range of other hazards and risk factors that can be particularly important in cumulative injuries. A closely related problem lies in the nature of available *methods* for WMSD hazard identification and risk assessment, where a very narrow focus is also evident.

In the current project, three health-care sector organisations agreed to participate, each with significant MSD claims. Following initial discussions with each organisation, occupational groups were selected to be part of the project. One organisation was an ambulance service and only uniformed paramedics were included in the study.

A combination of qualitative and quantitative methods was used in the project. Focus groups with representatives of the target occupational groups within each organisation were held to determine details of potential workplace hazards and related terminology, and then to inform customisation of the previously validated survey. The survey was customised and pilot tested with a small sample and amended as required. In two of the three organisations, paper versions of the survey were used. In the third organisation, an electronic version was used. Data were entered into SPSS, (or extracted, in the case of the online survey) and analysis undertaken using statistical techniques including factor analysis, multivariate regression and multi-level modelling in order to identify the main sources of WMSD risk. Initial feedback to the organisations was provided through a series of participative workshops.

Participants in the workshops involved key organisational stakeholders and the target occupational groups. Engaging people from across the work areas was critical, both to ensure that the interventions were practical and to work consistently with the values and principles that are linked to better MSD risk control outcomes.

The final stage of the project involved development and delivery of the Toolkit for workplaces to use in risk management of their MSDs. It includes guidance on the management procedures that are needed, as well as on particular

hazard identification and risk assessment methods. Its use requires the active involvement of relevant managers, supervisors, workers' Occupational Health and Safety (OHS) representatives and OHS committees. It is therefore important that senior managers are familiar with its content so they can fully support its implementation. The specified management procedures are based on research evidence identifying key requirements for successful MSD risk management. In particular, the following three factors are essential. Further work will be needed to assess the effectiveness of the Toolkit in reducing numbers of MSDs.

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1 Introduction

1.1 Overview of the current study

Currently, risk management procedures for work-related musculoskeletal injuries and disorders (WMSDs) primarily focus on controlling risks arising from manual handling activities. Management of associated psychosocial hazards are rarely a workplace primary consideration. However, it is now well established that psychosocial hazards can strongly influence WMSD risk. Workplace interventions to reduce such risk should aim to be multidisciplinary in its approach and include organisational, technical and personal/individual measures (European Agency for Safety and Health at Work, 2001).

Based on review of research evidence identifying the main causes of WMSDs, we have developed a survey tool that addresses risk from both psychosocial and manual handling hazards (Macdonald & Evans, 2006). The tool has been implemented in two high-risk Australian industry sectors (manufacturing and storage) (Macdonald, Evans, & Armstrong, 2007). Within these two sectors, results confirmed the importance of quantifying workplace psychosocial hazards, since these were found to be strongly predictive of discomfort /pain levels (linked in turn to numbers of MSD claims) and to self-reports of taking time off work due to such pain.

The project reported here modified and implemented this survey tool for the health care sector and then developed a toolkit to support ongoing WMSD risk management. This toolkit includes practical guidance on how to use the tool and interpret findings in relation to potential risk control measures, with links to Research Report # <ISCRR Insert>

additional resources.

1.2 Background

Musculoskeletal disorders (MSDs) are a diverse group of injuries and disorders which in a workplace context are sometimes referred to as repetitive strain injuries, cumulative trauma disorders, or occupational overuse syndrome (Australian Safety and Compensation Council, 2006). According to the World Health Organisation (WHO) (World Health Organisation, 2003):

“Musculoskeletal disorders are the most frequent causes of physical disability, at least in developed countries. As mortality from infectious diseases reduces worldwide, the global population is ageing and the numbers of people in the oldest age groups are increasing. As the prevalence of many musculoskeletal disorders increases with age, the likely result is that there will be a growth in the number of people with chronic disabling disorders.”

Musculoskeletal injuries and disorders constitute Australia’s largest OHS problem, both in overall numbers and compensation costs. A great deal of effort has been directed by governments to reduce their incidence, but results have been disappointing. According to a report on progress in achieving WMSD targets of the National OHS Strategy 2002-2012: “The reduction in the incidence rate of injury and musculoskeletal claims between 2001–02p and 2003–04p was 5.4 per cent, well behind the 8 per cent improvement required at this stage to meet the national target”.(Safe Work Australia, 2010).

WMSD Causes. The first generation of Australian Standards and Codes of Practice related to this type of injury were written during the 1980s and early

1990s, at which time it was accepted that WMSDs stemmed largely or entirely from the performance of physically demanding work, commonly referred to as manual handling. However, research has now established that WMSD risk is *also* strongly influenced by non-physical hazards and that there are multiple pathways via which WMSDs develop, including some physiological components of the 'stress response' (Macdonald, 2004). According to *the European Framework for Psychosocial Risk Management*, they include factors related to: Job content, Workload and work-pace, Work schedule, Control, Organisational culture and function, Interpersonal relationships at work, Role in organisation, Career development, and Home-work interface (Leka & Cox, 2008).

One of the most extensive reviews of research evidence on this topic was by an expert committee of the USA National Research Council and Institute of Medicine (National Research Council, 2001). The committee grouped work-related hazards for MSDs into three categories as described below, and depicted in the conceptual model developed by that committee, shown in Fig. 1. The model shows that hazards within all three categories interact with each other, and affect both processes internal to the individual (*internal* biomechanical loading, physiological responses) and personal outcomes (discomfort, pain, impairment, disability).

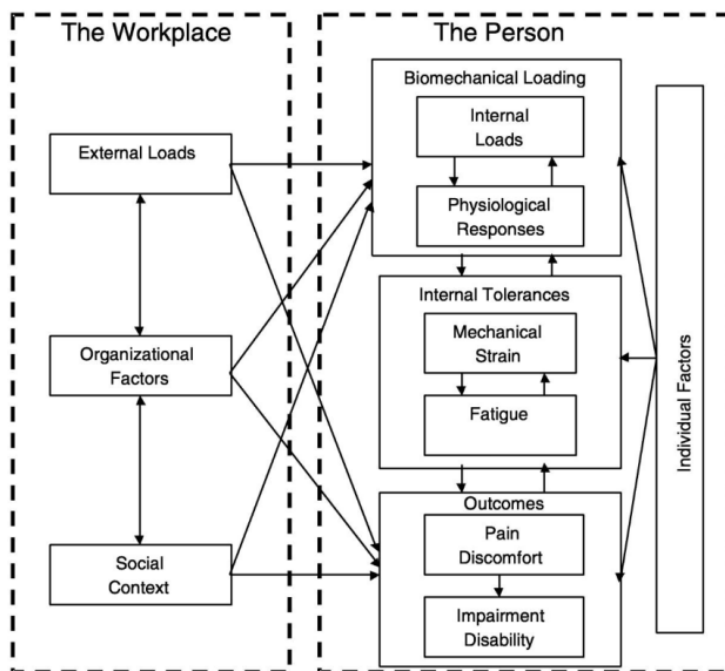


Figure 1. Conceptual model of factors influencing MSD risk (National Research Council, 2001, p. 353)

There is wide variability in the relative influence of the above factors on MSD risk, but the evidence is clear that organisational and psychosocial hazards can have a large impact on risk, often of comparable magnitude with that of physical hazards (Macdonald & Evans, 2006). According to Marras (2008), “epidemiological studies indicate that between 11% and 80% of low-back injuries and 11–95% of extremity injuries, are attributable to workplace physical factors, whereas, between 14% and 63% of injuries to the low back and between 28% and 84% of injuries of the upper extremity are attributable to psychosocial factors ...” (p.16). Some of this variability is undoubtedly due to differences between studies in the particular hazards assessed and the measures used to quantify them. The study reported here aims to quantify the influence on MSD risk of a range of physical and organizational/psychosocial hazards in workplaces using a validated survey tool that will enable

comparisons across several industry sectors.

1.3 What is needed for improved risk management?

The conventional approach to OHS risk management has been to focus on hazard management – identifying hazards, assessing risk from each identified hazard, and taking any necessary steps to control risk from each hazard separately. This approach is appropriate for hazard-specific diseases and disorders such as noise-induced hearing loss, or mesothelioma due to asbestos exposure. However, a more holistic approach is required to achieve effective control of diseases and disorders for which risk is determined by multiple, diverse hazards – as is the case for MSDs. For example, a particular posture might be rated as low risk if considered alone, but the risk could be higher for workers who are chronically fatigued or stressed due to long working hours, tight production schedules with few rest breaks, and perceive unsupportive supervisors. In other words, risk management must be based on assessment of risk from the combined effects of the hazards identified as most relevant in a particular situation, taking into account the hazards' additive and possibly interacting effects.

For the above reasons, a key requirement for effective MSD risk management is a multidisciplinary, holistic approach that assesses and controls risk from the particular combination of workplace causal factors found to be relevant in a given situation. In addition to its basis in research evidence of the causes of work-related MSDs, this requirement was also identified by the *European Agency for Safety and Health at Work (2001)* in a review of research evidence concerning the effectiveness of workplace interventions to reduce MSD risk. *Their report stated that:*

“... interventions that are based on single measures are unlikely to prevent MSDs, but ... a combination of several kinds of interventions (multidisciplinary approach) is needed, including organisational, technical and personal/individual measures. It is not known how such measures should be combined for optimal results.” (p.34)

The report further concluded that: “It is apparent that there is no one simple way to introduce the measures in an individual workplace but that the programmes must be tailored according to local needs. There is some evidence that a participative approach that includes the workers in the intervention process is beneficial.” (p.32)

Benefits of a participative approach in MSD risk management have also been demonstrated in a systematic review evaluating ‘participative ergonomics’ approaches (Cole, 2005). Participative ergonomics has been defined as, “The involvement of people in planning and controlling a significant amount of their own work activities, with sufficient knowledge and power to influence both processes and outcomes in order to achieve desirable goals”(Wilson & Haines, 1997, p. 490).

Its practical manifestation can vary considerably (Haines, Wilson, Vink, & Kongsveld, 2002), but most workplace interventions entail the formation of a project team which includes representatives of all key stakeholders. Clearly, some such process is likely to be necessary in order to customise interventions to local needs and that ‘local needs’ include those of the workers themselves.

1.4 Development of a ‘toolkit’ to support MSD risk management

A review of the methods available for assessing MSD risk concluded that none of the existing tools provided comprehensive coverage of all the main MSD hazards (Macdonald & Evans, 2006). The toolkit developed in this project aims to address this gap.

According the WHO, a toolkit should be practicable and contain user-friendly advice for non-experts to apply in ordinary workplaces without expert assistance, and should include required training or guidance materials. It should explain basic MSD risk management requirements and the general processes to be followed, based on a specified conceptual model grounded in current research evidence.

Among the most important intended users of such a toolkit are people in emerging economies and developing nations, and those in small and medium enterprises. The toolkit should assist such users to work through the full risk management cycle within their own workplaces, as shown in Figure 2. It can be seen there that worker involvement is central to the risk management process, which is consistent with a ‘participative ergonomics’ approach and the need for customization of interventions as discussed above. Fig. 2 also specifies the importance of leadership engagement, based on research evidence from many sources concerning requirements for effective OHS interventions.



Figure 2. The WHO risk management framework for use in toolkits. (From a WHO network draft document)

1.5 Objectives and Specific Aims

The overarching aim of our research is to reduce the incidence of work-related musculoskeletal disorders by developing more effective risk management procedures. Specific aims of the project reported here were to:

- (1) Customise our validated WMSD risk assessment survey tool for use with selected high-risk groups in the healthcare sector.
- (2) Apply the customised survey within at least three participating workplaces, and use the findings within each workplace to collaboratively develop customised sets of potential risk control interventions
- (3) Based on evidence from all participating workplaces and on research literature, formulate a 'toolkit' to promote more effective WMSD risk management in participating workplaces.
- (4) Investigate the degree to which results can be generalized to other industry sectors, by determining the extent of variation in factors driving WMSD risk for occupational groups in this project versus groups previously studied in Research Report # <ISCRR Insert>

Melbourne manufacturing and storage workplaces.

2 Methodology

The first part of this project was to recruit partners within the healthcare sector. Two large health networks were approached and agreed to participate in the project. The third organisation, an ambulance service approached La Trobe University to discuss management of MSDs and subsequently agreed to participate in the project.

2.1 Preliminary data collection

Key aims during this preliminary phase of data collection and planning were to establish which occupational groups would be included in the study. Both Organisations 1 and 2 wanted to include occupational groups that had received less focus on MSDs than some of the clinical groups such as nursing (see Table 1). Allied health was included in both sites initially; however, at Organisation 2 they were excluded from later stages due to issues concerning the timing of the survey. In Organisation 3, only uniformed paramedics were included in the study. In this stage, planning for the timing of focus groups and method of survey delivery was also undertaken.

Table 1. Occupational groups participating in the project

	Organisation 1	Organisation 2	Organisation 3
Occupational Group	Allied Health	Allied Health	Paramedics
	Food Services	Food Services	
	Personal Services Assistants (PSAs)	Clinical Services Assistants (CSAs)	

Sterilising Process
Services (SPS)

Environmental
Services

2.2 Focus Groups

In order to customise the previously validated WMSD risk assessment survey tool for use in the health care sector, focus groups were conducted with representatives from the participating occupation groups (see Table 2). The primary aim of the focus groups was to elicit details of potential workplace hazards and related terminology to inform the process of customisation. Thematic analysis of the focus groups was undertaken and the results used to customise the survey tool.

Focus group prompts related to:

- Factors influencing Job satisfaction/dissatisfaction
- Workload
- Physical and mental demands of the job
- Amount of control at work
- Support (e.g. equipment, accessing information, work procedures, teammates, supervisors, management)
- Performance feedback
- Job security

Table 2. Focus group numbers

	Organisation 1	Organisation 2	Organisation 3
	PSAs: 13	CSAs: 5	Rural: 3
	Food services: 7	Food Services: 5	Metro: 8
	Allied health: 6	Environmental Services: 4	
		SPS: 12	
Total	n=26	n=26	n=11

2.3 Questionnaire

Using the results from the focus groups, some modifications were made to the previously used survey. Items identified as not relevant were deleted and in areas identified as important, additional constructs were added. For example, job security was an issue in manufacturing and warehousing but this was not identified as an issue at all in health. The item was deleted from the survey for this sector.

The conceptual model which the original survey tool was developed from is shown in Figure 3. This model identifies two broad categories of hazard or risk sources 1) hazardous workplace and personal conditions and (2) hazardous person states, particularly fatigue and stress. This model supports the need for a broad risk management approach that covers all of these categories as discussed previously.

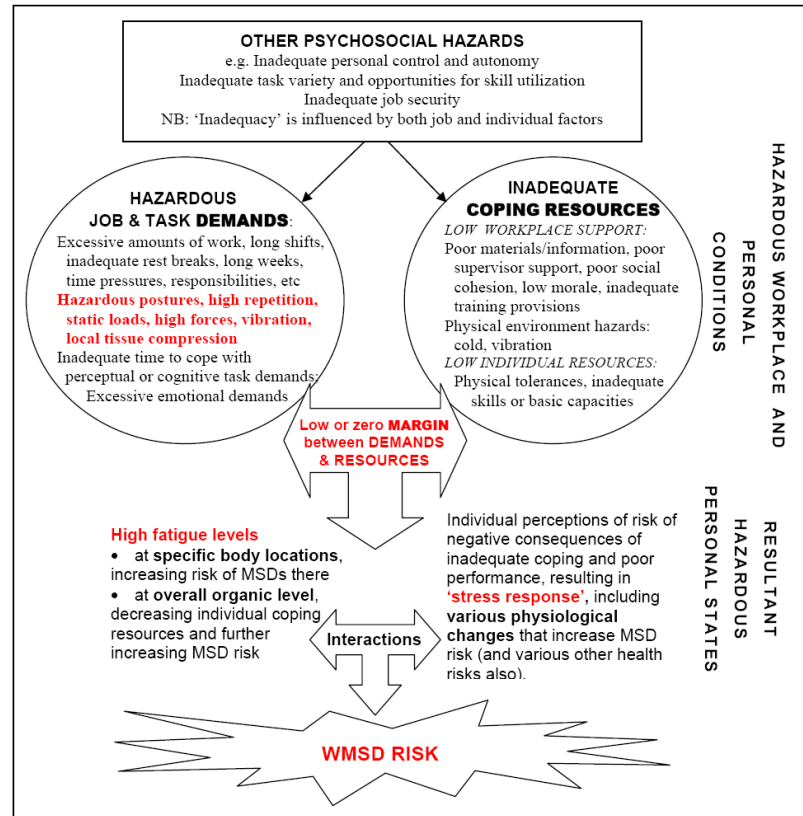


Figure 3. The conceptual model of work-related hazards for musculoskeletal disorders that was used in developing questionnaire content. (Reproduced from Macdonald & Evans, 2006, p.24,

2.3.1 Questionnaire content

The questionnaire content included the following:

Demographic information

- Age, gender, employment duration in current job, overall hours worked, any primary carer responsibilities

Physical hazards

This was a 12-item scale: *In your job here ..., how much of the time do you: do very repetitive work, lift things that are moderately (or very) heavy etc.*

Items covered a range of physical work demands covering cumulative and over exertion type hazards. Response categories were *never, rarely, sometimes, often* and *almost all of the time*.

Psychosocial hazards

Several different sections of the questionnaire addressed these hazards, the Work Organisation Assessment Questionnaire (WOAQ) was used (Griffiths, Cox, Karanikja, Khan, & Tomas, 2006), two items were removed relating to work-life balance as this was asked elsewhere, this left 26 items from a possible 28 items. Other constructs relating to, workload, role conflict, and influence were adopted from the Copenhagen Psychosocial Questionnaire (Kristensen, Hannerz, Hogh, & Borg, 2005).

Hazardous personal states

Exhaustion scale was used from the General Well-Being Questionnaire (Cox & Griffiths, 2005).

Discomfort/pain rating (both frequency and severity) recorded separately for five body regions (see Figure 4). Frequency was recorded on a scale of 0-4 (*never to almost always*) and severity from 1-3 (*mild, moderate or severe*). Scores were calculated for each region by multiplying the frequency and severity. These scores were then added together to form an overall score out of a possible 60. This score is used as a proxy for WMSD risk, and has been validated as an indicator in a previous project (Macdonald, et al., 2007).

Other single item measures included Job satisfaction, Work life balance and general health.


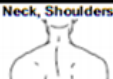


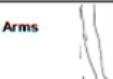

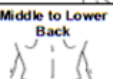
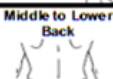
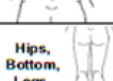
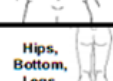
HOW OFTEN						For each body area where there's been some discomfort or pain (i.e. marked as '1' or higher) circle a number below to show HOW BAD		
	Never	Occasionally	Sometimes	Often	Almost always			
 Neck, Shoulders	0	1	2	3	4	 Neck, Shoulders	Mild 1 Moderate 2 Severe discomfort 3	
 Hands, Fingers	0	1	2	3	4	 Hands, Fingers	Mild 1 Moderate 2 Severe discomfort 3	
 Arms	0	1	2	3	4	 Arms	Mild 1 Moderate 2 Severe discomfort 3	
 Middle to Lower Back	0	1	2	3	4	 Middle to Lower Back	Mild 1 Moderate 2 Severe discomfort 3	
 Hips, Bottom, Legs, Feet	0	1	2	3	4	 Hips, Bottom, Legs, Feet	Mild 1 Moderate 2 Severe discomfort 3	

Figure 4. Rating scales used to create a Discomfort/Pain score out of 60

2.3.2 Data collection procedure

Employees within the occupational groups involved in the project were invited to complete the questionnaire that was provided with their pay packet.

Accompanying each survey was a sealed envelope with instructions on the location of a box for the return of completed questionnaires. Participants were assured of their anonymity. The OHS team at the respective organisations collected the boxes and then gave the sealed envelopes to a member of the research team.

A member of the research team visited Organisations 1 and 2 at various times to assist employees who had literacy problems. In these cases the researcher was available to clarify any questions or conduct the survey as a structured

interview. Completion time of the survey ranged from 15 minutes to over half an hour.

In Organisation 3, an electronic version of the survey was used. An email with information about the project and a link to the survey was sent to all paramedics (paid and volunteers) inviting them to participate in the project. Regular reminders were sent out via email and text message. Participants were able to anonymously complete the questionnaire and log back in using a randomly generated code to identify their survey if they were unable to complete the questions in one sitting.

2.3.3 Justification of final analysis strategy

Preliminary analysis was undertaken prior to determining the final modelling strategy that is presented in this report. All data analysis was undertaken using SPSS statistical package. Many of the variables were highly correlated with WOAQ and as a result inclusion in regression analyses resulted in models that were not useful in explaining the outcome variables of Discomfort and Lost time (see Appendix 1). One of the key goals of this project is to produce a toolkit that workplaces can utilise as part of their risk management of MSDs. The inclusion of a survey tool that is useful in predicting hazards and risk related to MSDs is a key part of that strategy. Following preliminary analysis and based on the conceptual framework discussed in section one, an analysis strategy was determined that used WOAQ as a measure of psychosocial hazards. Other psychosocial measures are not presented in this report. Other demographic variables were also analysed for their contribution to the final model and only the final results were included in this report.

Independent factors that were determined following preliminary analyses were: age, gender, Job satisfaction, Work-life balance, WOAQ, Physical hazards and Exhaustion.

Dependent variables were: Discomfort Score and Lost-time. Dummy variables representing jobs at the different organisations were also used in preliminary analysis to determine any Occupational Groups effects; however, in all cases these did not significantly contribute to final models and so were excluded from the final analysis.

To determine a model of Discomfort Score (MSD risk), a hierarchical approach was adopted to determine the contribution of independent variables. Once this was established, a final model was produced with the strongest contributors to Discomfort Score. This is in keeping with the overarching aim of this project, which is to determine a useful set of measures that organisations can use to determine a risk management approach to reduce MSDs. Logistic regression analyses were undertaken to develop a model of predictors of Lost Time. The same ethos as outlined above was applied to this model.

2.4 Workshop

In order to design effective interventions to address the key risk factors identified through the survey results, workshops were conducted in Organisations 1 and 2. Participants in the workshops involved key organisational stakeholders and the target occupational groups. Engaging people from across the work areas was critical, both to ensure that the interventions were practical and to work consistently with the values and principles that are linked to better MSD risk control outcomes, namely

communication, consultation and job control. By developing interventions in a way that is consistent with these values and principles, the design process has established a basis for working on risk controls that is more likely to lead to effective outcomes.

The method used was based on a process developed by Shaw and Blewett, called *Future Inquiry* (2008). This method adapts existing participative planning techniques, building on appreciative inquiry and future search methodologies (Weisbord & Janoff, 2000; Whitney & Cooperrider, 1998).

In this project, the method was modified to fit the time constraints, and the agenda included the following:

The past - Outlining the findings of the project on the risk factors for MSDs in the relevant work areas.

The present – Identifying the important trends in the internal and external operating environment that impact on preventing MSDs in the relevant work areas, and what was being done about them. Importantly, this session also identified what could be done about these trends that were not currently being addressed.

The future – Designing an ideal future for preventing MSDs and preparing a road map for how to get there. A range of effective interventions was identified in this session and the first steps to implement these interventions were determined. Individuals prepared to take responsibility for these first steps were identified and charged with taking the relevant actions.

During the workshops, participants engaged in various activities, sometimes with peers from their own occupational group, sometimes in mixed groups from their work areas. In all workshops, insightful and constructive debates

took place with many participants commenting on the energy and quality of the discussions.

Risk control development was based on results from the survey using WOAQ and the physical scales as a basis for discussion. Results for each occupational group were provided separately (for examples see Table 5 and 13). WOAQ items were ordered and then colour coded to facilitate discussions about what was good in the organisation and what were the key issues that needed to be resolved.

3 Results

Results for the three participating organisations are presented separately, followed by a section comparing the reported results with those of a previous project. A brief discussion relating to each organisation is undertaken at the conclusion of each set of results.

3.1 Organisation 1

Organisation 1 was a large hospital network. There were 260 respondents representing a 37% response rate. Eight respondents were excluded due to missing data, leaving 252 cases available for further analysis. Respondent characteristics are outlined in Table 3 below. Respondents comprised 122 PSAs, 44 Food Services and 86 Allied Health employees.

Table 3. Participant characteristics for Organisation 1

Measure	
Age (years)	44.2 (19-71)
Gender	79.8% female (n=201) 17.1% male (n=43) 3.2% not specified (n=8)
Has dependents	27.4% yes (n=69) 67.9% no (n=171) 4.8% not specified (n=8)
Length of service (years)	7 years

3.1.1 Physical Hazards

Scale reliability for this 12-item scale was good (Cronbach's alpha = .84), mean score 2.73. Responses to this scale are shown in Table 4. Responses categories have been combined to show *never/rarely* and *often/always*.

Table 4. Reported exposure in the Physical scale (Organisation 1)

	Never/Rarely (%)	Often/Always (%)
Body bent forward	40.0	54.4
Gripping objects	19.6	58.2
Repetitive work	26.7	44.6
Squat or kneel while you work	25.6	40.4
Forceful pushing or pulling	29.1	37.4
Heavy lifting or carrying	34.0	30.4
Twisted or awkward postures	38.2	29.1
Precise movements	44.4	25.6
Standing in one position	61.4	14.8
Getting out of breath	60.6	12.0
Sitting still, with little or no moving	70.3	10.8
Arms raised above shoulder level	61.6	10.0

3.1.2 Psychosocial Hazards

A WOAQ score (mean of all item ratings) was created for later use in regression analysis. The scale had high reliability (Cronbach's $\alpha = .94$), the mean item score was 3.12. Table 5 shows the responses to WOAQ. Response categories *major/slight* and *good/very good* have been combined. Items in green show the top five positively rated items and those in orange show the bottom five rated items. The colour coding was used in the workshops described earlier to prioritise items from which risk controls could be developed.

3.1.3 Hazardous Personal States

The reported incidence of *“any discomfort or pain towards the end of your overall working day/night”* in the last six months (yes or no) was 85%. The overall Discomfort Score calculated (see section 2.3.1) was 12.4 (Range 0-46).

‘Exhaustion’ score (10-item scale)

The reliability score for this scale was good (Cronbach's $\alpha = .87$), the mean score was 1.47.

Job satisfaction (single-item scale)

This was a single-item measure (five –point scale from 1-5). 8.3% were *dissatisfied* or *very dissatisfied*, 5.2% were *neutral*, and 55.7% were *satisfied* and 30.8% were *highly satisfied*.

Satisfaction with balance between home life and work (single-item scale)

This was a five-point scale from 1-5. 15.9% of respondents were either

dissatisfied or very dissatisfied; 7.1% were neutral, 56% were satisfied, and 21% were very satisfied.

General Health (single-item scale)

The responses in this five-point scale were: 0.4% *poor*, 4.8% *fair*, 31% *good*, 48% *very good*, and 14.3% *excellent*.

3.1.4 Outcome measures

Zero order correlations (Spearman's rho) between independent variables and lost time and Discomfort Score are shown in in Table 6. Discomfort Score was associated with all variables except for gender.

Lost time was negatively associated with Discomfort Score, Age, and Physical Work at $p < .01$ and positively with WOAQ. To a smaller degree, Lost time was positively associated with Job satisfaction ($p < .05$).

Significant relationships were found between WOAQ and Physical demands and also, between WOAQ and the Exhaustion, Job satisfaction and Work life balance (to a lesser degree) scales at the $p < .01$ level. The high level of correlation between these scales is due to the degree of overlap between WOAQ and the concepts these other scales are measuring. Regression analysis has been undertaken with, and then without these measures included to find the most parsimonious model; however, WOAQ is preferred as a measure due to its comprehensive coverage of psychosocial hazards in the workplace and as a means for identifying specific workplace hazards.

Table 5. WOAQ responses for Organisation 1

Organisation 1	Average score (1=major problem 5=very good)	% Respondents saying "major/slight problem"	% Respondents saying very good/good
How you get on with your co-workers (personally/socially)	3.9	11.1	65.4
How well you work with your co-workers (as a team)	3.8	16.3	61.9
Support from supervisor	3.3	30.6	52.3
Sufficient training for this job	3.4	18.3	46.5
Communication with supervisor	3.4	23.8	46.0
Flexibility of working hours	3.3	20.3	38.5
Amount of variety in the work you do	3.4	21.1	45.3
Opportunities to use your skills	3.3	21.1	43.6
Clear company objectives, values, procedures	3.2	22.3	40.4
Exposure to physical danger	3.1	26.2	27.4
Health and Safety at work	3.2	27.4	40.5
Clear roles & responsibilities	3.3	27.5	44.8
Clear reporting lines	3.1	30.9	36.1
Your status / recognition in the company	3.0	30.9	32.5
Feedback on your performance	3.0	32.5	36.9
Work stations and work space	3.0	33.7	28.5
Opportunities for learning new skills	3.0	34.1	35.3
Appreciation or recognition by supervisors	3.0	36.1	40.1
Facilities for taking breaks	3.1	36.8	39.5
Work surroundings (noise, light etc)	3.0	37.3	36.1
Equipment, tools, I.T. or software	2.9	40.2	29.1
Consultation about changes in your job	2.8	40.4	26.5
Pace of work	2.9	42.5	30.5
Senior management attitudes	2.8	44.1	31.7
Your workload	2.7	44.8	23.8
Opportunities for promotion	2.4	53.2	15.9

Table 6. Bivariate correlation coefficients for variables included in regression analyses (Organisation 1)

	1	2	3	4	5	6	7	8
1. Lost Time								
2. Discomfort Score	-.423**							
3. Age	-.224**	.213**						
4. Gender	-.010	-.067	.028					
5. WOAQ	.217**	-.409**	-.148*	.053				
6. Physical	-.226**	.502**	.153*	.044	-.420**			
7. Exhaustion	-.048	.380**	-.114	.000	-.428**	.289**		
8. Job satisfaction	.155*	-.290**	-.152*	.014	.501**	-.234**	-.322**	
9. Work life balance	.008	-.215**	-.050	.020	.320**	-.171*	-.409**	.463**

** Correlation significant at the 0.01 level

*Correlation significant at the 0.05 level

3.1.5 Predictors of Discomfort Score

Hierarchical multiple regression analysis was undertaken to identify the main predictors of the Discomfort Score for all respondents and is shown in Table 7.

Overall model statistics showed that the model significantly predicted Discomfort Score, $F(8,172)=13.92$, $p=.000$. Stepwise model results for the Discomfort regression analysis are shown in Table 7. The overall model explained 36% of the variance in Discomfort Score (see Table 8). Age contributed 7.8%% of the variance, with WOAQ and Physical Work contributing 26.7% of the variance in Discomfort Score. The variables Job satisfaction and Work-life Balance did not make a significant contribution to the overall model. The addition of dummy variables for Occupational groups found that only AH contributed significantly but slightly to the overall model adding only 2.6% to the final model.

Table 7. Hierarchical multiple regression of Discomfort Score on independent variables (Organisation 1)

	B	S.E.	Beta	t	Sig,	sr ²
Age	.216	.058	.268	3.722	.000	.268
Gender	-2.499	2.052	-.088	-1.218	.225	-.088
(Constant)	6.573	3.559		1.847	.066	
Age	.149	.050	.185	2.991	.003	.182
Gender	-2.667	1.745	-.094	-1.529	.128	-.093
Physical Work	6.805	1.088	.420	6.253	.000	.381
WOAQ	-2.909	1.046	-.186	-2.781	.006	-.170
(Constant)	-.230	5.923		-.039	.969	
Age	.139	.050	.172	2.788	.006	.168
Gender	-2.565	1.726	-.090	-1.486	.139	-.090
Physical Work	6.815	1.077	.420	6.329	.000	.382
WOAQ	-1.799	1.136	-.115	-1.584	.115	-.096
Job satisfaction	-1.402	.834	-.121	-1.682	.094	-.101
Work life balance	-.752	.681	-.073	-1.103	.272	-.067
(Constant)	5.155	6.264		.823	.412	
Age	.052	.059	.064	.884	.378	.052
Gender	-2.511	1.702	-.088	-1.476	.142	-.088
Physical Work	6.137	1.091	.378	5.627	.000	.334
WOAQ	-1.899	1.122	-.122	-1.693	.092	-.101
Job satisfaction	-.973	.836	-.084	-1.165	.246	-.069
Work life balance	-1.086	.682	-.106	-1.591	.113	-.095
Dummy AH	-4.305	1.712	-.202	-2.515	.013	-.149
Dummy FS	.485	1.732	.018	.280	.780	.017
(Constant)	12.222	6.695		1.825	.070	

Table 8. Model results for Discomfort Score regression

Model	R ²	Adj. R ²	R ² Change	F Change	Sig. F Change
1 –Age and Gender	.078	.068	.078	7.576	.001
2 –WOAQ and Physical	.345	.330	.267	35.835	.000
3-Job Sat & Work-Life Balance	.367	.345	.021	2.951	.055
4-Occupational groups	.393	.365	.026	3.739	.026

As expected, because of the strong correlations between some predictors (see Table 6), some of the individual variables in the above model failed to reach significance. These weaker predictors were eliminated from the final analyses to achieve a more parsimonious model (see Table 9). As discussed previously, this is in line with the ultimate aim of this project, which is to produce a key set of measures that organisations can utilise to identify hazards from which appropriate risk controls can be developed.

In the final model for Discomfort Score, $F(3,194) = 48.316$, $p=.000$; 32.6% (Adjusted R²) of the variance was explained by WOAQ and Physical Work. The size and direction of the relationship suggest that Physical Work is a stronger predictor of Discomfort Score than WOAQ with Beta scores of .44 and .22 respectively.

Table 9. Final Discomfort regression (Organisation 1)

	B	S.E.	Beta	t	p.	sr ²
Physical Work	7.176	1.064	.443	6.744	.000	.396
WOAQ	-3.407	1.014	-.221	-3.359	.001	-.197
(Constant)	4.027	5.237		.769	.443	

3.1.6 Predictors of lost time

Only respondents who had reported ever having some discomfort or pain in the past six months were asked the question: *Have you ever taken any time off work because of your discomfort or pain?* Of those respondents who were asked this question, 34.1% responded yes they had taken time as result of their discomfort/pain.

Significant correlations (Spearman's rho) were found between Lost time and age, WOAQ, Physical Work, and Discomfort Score ($p < 0.001$). Lost time and Job satisfaction were also significantly correlated but at $p < 0.05$ level. Table 11 shows correlations between Lost time and other variables.

A sequential Logistic regression analysis was performed (see Table 12). Age and Gender were entered in the first step, Discomfort Score, WOAQ and Physical Work in the second, and Exhaustion, Job satisfaction and Work life balance in the final step. The overall model was significant ($\chi^2 (8, N = 220) = 36.204, p = .000$; Cox and Snell -Nagelkerke $R^2 = .188-.259$). The overall percentage of cases correctly classified was 71.3%. The only significant predictor of Lost Time was Discomfort score (Odds Ratio of .908, $p = 0.000$). Those who reported higher levels of Discomfort were more likely to have taken time off work, though the prediction is not very strong.

Table 10. Logistic regression model for self-reported Lost time due to WMSD symptoms (Organisation 1)

	B	S.E.	Wald	Sig.	Odds Ratio	C.I.	
Age	-.011	.015	.518	.472	.989	.960	1.019
Gender	-.059	.495	.014	.904	.942	.357	2.487
Discomfort Score	-.097	.024	15.609	.000	.908	.866	.953
WOAQ	.221	.324	.467	.495	1.248	.661	2.354
Physical Work	-.122	.361	.114	.735	.885	.437	1.795
Exhaustion	.069	.040	3.007	.083	1.071	.991	1.158
Job satisfaction	.125	.241	.268	.605	1.133	.706	1.816
Work life balance	-.186	.215	.746	.388	.830	.545	1.266
Constant	1.366	2.050	.444	.505	3.918		

A model including only the predictors discomfort, WOAQ and Physical Work was run to explore whether this improved model fit, but no significant difference was found between the two models (χ^2 (3, N= 215)=38.605, $p=.000$). Only the full model is presented.

3.1.7 Discussion of results from Organisation 1

In organisation 1, WOAQ and Physical Work were significant predictors of respondents who reported discomfort/pain levels. Approximately a third of the variability in discomfort levels is predicted by WOAQ and Physical Work. Physical Work is a stronger predictor than WOAQ. For Lost time, higher levels of discomfort were more likely to result in a person taking time off work.

3.2 Organisation 2

Organisation 2 was a large hospital network. Respondent characteristics are outlined in the table below. Responses from 160 employees were collected for the survey. Nine were removed due to missing data, leaving 151 cases for analysis. Overall response rate was 32%. Responses were as follows: 22 Clinical assistants, 54 Food services, 34 Environmental services, 42 SPS employees.

Table 11. Respondent characteristics (Organisation 2)

Measure	
Age (years)	46.2 (23-74)
Gender	51.7% Female (n=78) 44.4% Male (n=67) 4% not specified (n=6)
Has dependents	32.5% yes (n=49) 62.9% no (n=95) 4.6%missing (n=7)
Length of service (years)	7

3.2.1 Physical Hazards

Scale reliability for this 12-item scale was good (Cronbach's alpha = .83), mean score 3.12. Responses are shown in Table 12. Response categories have been combined and are shown as *never/rarely* and *often/always*.

Table 12. Reported exposure in the Physical demands scale for Organisation 2

	Never/Rarely (%)	Often/Always (%)
Repetitive work	14.4	59.9
Heavy lifting or carrying	15.1	64.5
Forceful pushing or pulling	9.2	59.3
Twisted or awkward postures	17.8	63.1
Squat or kneel while you work	27.6	60.6
Standing in one position	51.3	42.1
Sitting still, with little or no moving	77.7	21.1
Body bent forward	25.0	65.2
Arms raised above shoulder level	40.8	46.7
Getting out of breath	46.1	43.5
Gripping objects	13.8	55.3
Precise movements	27.6	63.1

3.2.2 Psychosocial Hazards

A WOAQ score (mean of all item ratings) was created for use in later regression analyses. The mean item score was 2.85; scale reliability was very good (Cronbach's alpha = .96). Table 13 shows response to the WOAQ questionnaire. Green indicates the items that were viewed most favourably, with orange indicating the items that were scored as problematic.

Table 13. WOAQ responses for Organisation 2

Organisation 2	Average score (1=major problem 5=very good)	% Respondents saying "major/slight problem"	% Respondents saying very good/good
How you get on with your co-workers (personally/socially)	3.7	17.1	59.2
How well you work with your co- workers (as a team)	3.5	22.7	54.5
Support from supervisor	3.0	38.8	40.1
Communication with supervisor	3.1	33.6	39.5
Clear roles and responsibilities	3.0	31.6	35.6
Flexibility of working hours	3.0	28.9	30.9
Clear reporting lines	2.9	30.9	27.7
Clear company objectives, values, procedures	2.9	35.5	31.6
Facilities for taking breaks (<i>places for breaks, meals</i>)	3.0	35.6	34.9
Opportunities to use your skills	2.8	36.8	23.7
Feedback on your performance	2.9	38.2	33.6
Sufficient training for this job	2.8	38.2	32.2
Your status / recognition in the company	2.8	38.2	29.7
Work stations and work space	2.8	38.8	24.3
Amount of variety in the work you do	2.8	39.5	29.6
Pace of work	2.8	40.1	34.9
Appreciation or recognition of your efforts by supervisors	2.8	40.1	29.6
Equipment, tools, I.T. or software	2.7	40.8	23.7
Exposure to physical danger	2.8	42.1	26.4
Consultation about changes in your job	2.7	43.4	25.7
Senior management attitudes	2.8	44.1	32.9
Opportunities for learning new skills	2.7	45.4	25.0
Health and Safety at work	2.7	48.7	30.9
Work surroundings (noise, light, etc.)	2.7	48.7	24.3
Your workload	2.4	53.3	21.1
Opportunities for promotion	2.2	62.6	11.8

3.2.3 Hazardous Personal States

Body part Discomfort/pain scores

The reported incidence of “any discomfort or pain towards the end of your overall working day/night in the last six months (yes or no) was 84%. The overall Discomfort Score was 17.3 (Range 0-55).

‘Exhaustion’ score (10-item scale)

The reliability score for this scale was good (Cronbach’s alpha = .903), the mean item score was 1.52.

Job satisfaction (single-item scale)

This was single item measure (five –point scale from 1-5). 21.7% were *dissatisfied* or *very dissatisfied*, 14% were *neutral*, and 55.4% were *satisfied* and 9.6% were *highly satisfied*.

Satisfaction with balance between home life and work (single-item scale)

This was a five-point scale from 1-5. 21.6% of respondents were either *dissatisfied* or *very dissatisfied*; 10.8% were *neutral*, 54.4% were *satisfied*, and 13.3% were *very satisfied*.

General health (single-item scale)

The responses to this five-point scale were: 14.5% *poor/fair*, 43.7% *good*, 29.8% *very good*, and 11.34% *excellent*.

3.2.4 Outcome measures

Zero order correlations (Spearman's rho) between independent variables and lost time and Discomfort Score are shown in Table 14. Discomfort Score was associated with WOAQ, Physical Work and Exhaustion. Due to the high correlation between Exhaustion and WOAQ (.546, $p < .01$), it was excluded from further regression analysis in order to obtain a more meaningful predictive model. This has been discussed elsewhere in this report.

Lost Time and Discomfort Score were associated ($p < .01$). At $p < .05$, Lost Time was also associated with WOAQ, Exhaustion and Job satisfaction.

Table 14. Bivariate correlation coefficients (Organisation 2)

	1	2	3	4	5	6	7	8
1. Lost Time								
2. Discomfort Score	-.375**							
3. Age	-.025	.101						
4. Gender	-.025	-.163	-.211*					
5. WOAQ	.215*	-.302**	-.011	.169				
6. Physical Work	-.147	.436**	.124	-.291**	-.447**			
7. Exhaustion	-.202*	.392**	-.079	-.094	-.546**	.322**		
8. Job satisfaction	.198*	-.148	-.026	.089	.466**	-.232**	-.349**	
9. Work life balance	.146	-.140	-.024	.011	.323**	-.180*	-.213*	.615**

** Correlation significant at the 0.01 level

*Correlation significant at the 0.05 level

3.2.5 Predictors of Discomfort Score

In the final model for Discomfort Score, $F(6,113) = 7.065$, $p = .000$; 23.9% (Adjusted R^2) of the variance was explained by WOAQ and Physical Work (see Table 15). Age and Gender contributed 3.7 % of the variance, although gender did not reach significance. The variables Job satisfaction and Work-life

Balance did not make a significant contribution to the overall model. The addition of dummy variables for Occupational groups did not contribute significantly to the overall model and so have been excluded from further analyses.

Table 15. Discomfort Score regression coefficients (Organisation 2)

	B	S.E.	Beta	<i>t</i>	Sig.	sr ²
Age	.179	.112	.148	1.603	.112	.147
Gender	-4.012	2.513	-.147	-1.597	.113	-.146
(Constant)	17.774	7.081		2.510	.013	
Age	.165	.100	.137	1.660	.100	.153
Gender	-.580	2.314	-.021	-.251	.802	-.023
Physical Work	6.343	1.918	.301	3.307	.001	.295
WOAQ	-4.681	1.595	-.262	-2.935	.004	-.264
(Constant)	5.830	10.783		.541	.590	
Age	.162	.100	.134	1.621	.108	.151
Gender	-.738	2.325	-.027	-.317	.752	-.030
Physical Work	6.366	1.924	.302	3.309	.001	.297
WOAQ	-4.883	1.745	-.274	-2.798	.006	-.255
Job satisfaction	1.269	1.308	.110	.970	.334	.091
Work life balance	-1.583	1.463	-.116	-1.083	.281	-.101
(Constant)	7.782	11.194		.695	.488	

Table 16. Models results for Discomfort Score regression

Model	R ²	Adj. R ²	R ² Change	F Change	Sig. F Change
1 –Age and Gender	.053	.037	.053	3.275	.041
2 –WOAQ and Physical	.264	.239	.211	16.516	.000
3-Job sat & Work-Life Balance	.273	.234	.008	.659	.519

3.2.6 Predictors of lost time

Only respondents who had reported ever having some discomfort or pain in the past six months were asked this question. Of those respondents who had reported having pain and discomfort, 44.4% responded yes they had taken time off work.

Table 17. Logistic regression for Lost Time (Organisation 2)

	B	S.E.	Wald	Sig.	Odds Ratio	C.I.
Age	.006	.020	.094	.759	1.006	.967 1.047
Gender	-.566	.453	1.560	.212	.568	.234 1.380
Discomfort Score	-.098	.024	16.520	.000	.907	.865 .951
WOAQ	.298	.385	.598	.439	1.347	.633 2.865
Physical Work	.425	.405	1.100	.294	1.529	.691 3.383
Exhaustion	.034	.035	.963	.327	1.035	.966 1.108
Job satisfaction	.344	.269	1.642	.200	1.411	.833 2.390
Work life balance	-.013	.298	.002	.965	.987	.551 1.769
Constant	-1.463	2.430	.363	.547	.231	

Although the resultant model (see Table 17) to predict whether or not individual report having taken time off due to their symptoms was statistically significant (χ^2 (8, $N=128$) = 31.150, $p=.000$; Cox and Snell- Nagelkerke $R^2 = .237-.316$; 71.3% correctly classified), only Discomfort Score significantly predicted this outcome. The addition of Occupational groups as dummy variables did not contribute significantly to the model and have not been included in the final model.

A model with Discomfort Score, WOAQ and Physical work was performed to assess if this was more predictive of Lost Time. Model fit was not improved by the removal of the other variables and was not significantly different to the full

model presented in Table 19. Model statistics were $\chi^2(3, N=128) = 19.20, p=.000$.

3.2.7 Discussion of results from Organisation 2

In organisation 2, WOAQ and Physical Work were significant predictors of respondents who reported discomfort levels. Although physical work made a slightly stronger contribution to the overall model, Beta scores for WOAQ (-.262) and Physical Work (.301) indicated the difference between the contributions of each was small. The implication for workplace risk management is that the focus of identification and risk control needs to address psychosocial and physical hazards to effectively reduce reported discomfort levels.

For the outcome of Lost Time, the only significant predictor was higher reported discomfort levels; thus reinforcing the importance of reducing discomfort levels through improved management of MSD risk.

3.3 Organisation 3

Organisation 3 was an ambulance service. Respondent characteristics are outlined in the Table 18. There were 978 responses; as only 33 volunteers responded, a decision was made to exclude these cases from the initial data analysis. 945 responses were included in the final analysis reported here. The response rate was 37.8%.

Table 18. Respondent characteristics (Organisation 3)

Measure	
Age (years)	40.15 (21-65)
Gender	34.1% Female (n=322) 65.9% Male (n=623)
Has dependents	33.135 yes (n=33.3) 66.6% no (n=629)
Length of service (years)	12.3 years (.8-46)

3.3.1 Physical Hazards

Scale reliability for this 12-item scale was good (Cronbach's alpha = .94), 3.44 was the mean score. Responses are shown in Table 19. Responses categories have been combined and are shown as never/rarely and often always.

Table 19. Reported exposure in the Physical scale for Organisation 3.

	Never/Rarely (%)	Often/Always (%)
Repetitive work	52.4	22.6
Heavy lifting or carrying	4.1	80.2
Forceful pushing or pulling	3.6	82.8
Twisted or awkward postures	4.5	86.9
Squat or kneel while you work	3.5	85.2
Standing in one position	42.4	26.9
Sitting still, with little or no moving	38.7	27.1
Body bent forward	4.6	64.8
Arms raised above shoulder level	52.5	10.1
Getting out of breath	56.9	6.8
Gripping objects	4.4	77.6
Precise movements	5.0	76.7

3.3.2 Psychosocial Hazards

A WOAQ score (mean of all item ratings) was created for use in later regression analyses. The mean item score was 2.52; scale reliability was very good (Cronbach's alpha = .94). Table 20 shows the responses to the WOAQ questionnaire. Green indicates the items that were viewed most favourably, with orange indicating the problematic items. The colour coding was undertaken to assist the organisation in visualising their key issues, it is not a statistical determination.

3.3.3 Hazardous Personal States

The reported incidence of “*any discomfort or pain towards the end of your overall working day/night*” in the last six months (yes or no) was 84.9%. The overall Discomfort Score calculated (see section 2.3.1) was 12.59 (Range 0-55).

‘Exhaustion’ score (10-item scale)

The reliability score for this scale was good (Cronbach's alpha = .903), the mean item score was 1.75.

Job satisfaction (single-item scale)

This was a single-item measure (five –point scale from 1-5). 26.5% were *dissatisfied* or *very dissatisfied*, 22.8% were *neutral*, and 43.7% were *satisfied* and 7.0% were *highly satisfied*.

Satisfaction with balance between home life and work (single-item scale)

This was a five-point scale from 1-5. 50.6% of respondents were either dissatisfied or very dissatisfied, 46.5 % were satisfied, and 3.7% were very

satisfied

General health (single-item scale)

The categories in this five-point scale were: poor, fair, good, very good, and excellent. Responses were 17.3% *poor/fair*, 37.5% *good*, 36.1% *very good*, and 9% *excellent*.

3.4 Outcome measures

Discomfort Score was significantly correlated with Lost time, Age, Physical Work, WOAQ, Exhaustion, Job satisfaction and Work life balance ($p < .001$), but not with gender. It should be noted though that these correlations are all less than 0.30, with the exception of Discomfort Score (see Table 21).

Lost Time was significantly correlated with Discomfort Score, Age, WOAQ, Exhaustion, Job satisfaction and Work life balance ($p < .001$) and less strongly correlated with Physical Work (.088, $p < 0.05$).

Table 20. WOAQ responses (Organisation 3)

Organisation 3	Average score (1=major problem/ 5=very good)	% Respondents saying "major/slight problem"	% Respondents saying good/very good"
How you get on with your co-workers (personally/socially)	3.97	6.1	70
How well you work with your co-workers (as a team)	3.88	9.3	66.9
Amount of variety in the work you do	3.23	21.3	38.4
Support from supervisor	2.97	40.0	36.5
Clear roles and responsibilities	3.05	29.6	33.3
Communication with supervisor	2.95	36.9	31.9
Opportunities to use your skills	2.76	39.7	24.1
Your workload	2.21	45.8	15.6
Clear reporting lines	2.64	46.2	19.2
Work surroundings (noise, light, etc.)	2.73	47.8	26.3
Feedback on your performance	2.5	51.6	19.2
Facilities for taking breaks	2.57	54.6	26.3
Clear company objectives, values, procedures	2.35	57.2	12.3
Pace of work	2.40	57.8	19.5
Your status / recognition in the company	2.26	58.5	12.9
Work stations and work space	2.36	59.8	14.6
Opportunities for learning new skills	2.34	60.4	16.7
Sufficient training for this job	2.37	62.8	19.1
Opportunities for promotion	2.14	64.2	8.0
Equipment, tools, I.T. or software	2.30	64.9	13.4
Appreciation or recognition by supervisor	2.18	65.2	14.6
Health and Safety at work	2.33	65.8	15.6
Exposure to physical danger	2.32	67.8	11.2
Consultation about changes in your job	20.3	71.6	10.5
Senior management attitudes	1.88	78.4	10.8
Flexibility of working hours	1.78	78.7	8.1

Table 21. Bivariate correlation coefficients (Organisation 3)

	1	2	3	4	5	6	7	8
1. Lost Time								
2. Discomfort Score	-.330**							
3. Age	-.173**	.154**						
4. Gender	-.041	-.036	.478**					
5. WOAQ	.271**	-.365**	-.148**	-.142**				
6. Physical Work	-.088*	.303**	-.288**	-.216**	-.232**			
7. Exhaustion	-.113**	.319**	-.081*	-.077*	-.344**	.229**		
8. Job satisfaction	.202**	-.310**	-.117**	-.175**	.585**	-.145**	-.346**	
9. Work life balance	.168**	-.272**	-.015	-.075*	.482**	-.186**	-.366**	.530**

** Correlation significant at the 0.01 level

*Correlation significant at the 0.05 level

3.4.1 Predictors of Discomfort Score

Overall model statistics showed that the model significantly predicted Discomfort Score, $F(7,779)=46.67$, $p=.000$. Stepwise model results for the Discomfort regression analysis are shown in Table 22. The overall model explained 29.4% of the variance in Discomfort Score (see Table 23). Age and gender contributed just 3% of the variance, with WOAQ and Physical Work contributed 20.8% of the variance in Discomfort Score. The variables Job satisfaction and Exhaustion made small but significant contributions to the overall model (see Table 25).

Table 22. Discomfort Score regression coefficients (Organisation 3)

		B	S.E.	Beta	t	Sig.	sr ²
1	Age	.153	.031	.198	4.949	.000	.174
	Gender	-1.987	.695	-.115	-2.860	.004	-.101
	(Constant)	12.019	1.247		9.641	.000	
2	Age	.200	.028	.260	7.028	.000	.219
	Gender	-1.929	.624	-.111	-3.093	.002	-.096
	Physical Work	5.663	.604	.325	9.381	.000	.293
	WOAQ	-3.485	.456	-.255	-7.645	.000	-.239
	(Constant)	-3.485	.456	-.255	-7.645	.000	
3	Age	.213	.027	.276	7.731	.000	.232
	Gender	-2.081	.605	-.120	-3.441	.001	-.103
	Physical Work	5.045	.585	.290	8.617	.000	.258
	WOAQ	-1.294	.534	-.095	-2.422	.016	-.073
	Exhaustion	.251	.045	.189	5.545	.000	.166
	Job satisfaction	-1.204	.321	-.150	-3.748	.000	-.112
	Work life balance	-.259	.267	-.036	-.971	.332	-.029
	(Constant)	-4.701	3.479		-1.351	.177	

Table 23. Model results for Discomfort regression (Organisation 3)

	R	R ²	Adjusted R ²	R ² Change	F Change	Sig. F Change
1 –Age and Gender	.175	.031	.028	.031	12.397	.000
2 –WOAQ and Physical	.489	.239	.235	.208	106.917	.000
3-Job Sat/ Work-Life Balance/Exhaustion	.548	.300	.294	.061	22.654	.000

To maintain consistency with previous organisations, a model was run with the strongest predictors, WOAQ and Physical Work (see Table 24). The model was significant $F(2,786)=93.511$, $p=.000$. R^2 was .192 and Adjusted R^2 was .190. Beta values for Physical Work and WOAQ were .262 and -.292 respectively; indicating that their contribution to the final model was similar.

Table 24. Final Discomfort regression (Organisation 3)

	B	S.E.	Beta	t	Sig.	sr ²
Physical Work	4.551	.576	.262	7.903	.000	.253
WOAQ	-3.980	.452	-.292	-8.815	.000	-.283
(Constant)	8.698	2.545		3.418	.000	

3.4.2 Predictors of lost time

Only respondents who had reported ever having some discomfort or pain in the past six months were asked about taking time off as a result. Of those respondents who reported having discomfort or pain, 59.6% responded that this had resulted in taking time off work.

Table 25. Logistic regression model for self-report lost time due to WMSD symptoms (Organisation 3)

	B	S.E.	Wald	Sig.	Odds Ratio	C.I.
Age	-.026	.009	8.135	.004	.975	.958 .992
Gender	.197	.191	1.060	.303	1.217	.837 1.770
Discomfort Score	-.074	.013	34.419	.000	.929	.907 .952
WOAQ	.601	.169	12.614	.000	1.824	1.309 2.542
Physical Work	.027	.193	.019	.889	1.027	.704 1.500
Exhaustion	.019	.015	1.676	.195	1.019	.990 1.049
Job satisfaction	.063	.103	.368	.544	1.065	.870 1.303
Work life balance	.064	.083	.587	.444	1.066	.906 1.254
Constant	-.979	1.084	.816	.366	.376	

The resultant model for Lost time due to reported MSD symptoms was statistically significant, (Chi-square 125.08 $p = 0.0$; Cox and Snell -Nagelkerke $R^2 = .140 - .195$); 68.4% correctly classified. The logistic regression is shown in Table 25. The results show that Age, WOAQ and Discomfort Scores are

significant predictors of Lost time. Older age, higher levels of discomfort and lower WOAQ scores are more likely to result in people taking time off work.

WOAQ is twice as important in determining lost time in comparison to Discomfort levels, which is important in terms of workplace management of MSD risk.

Table 26. Final Lost Time logistic regression (Organisation 3)

	B	S.E.	Wald	Sig.	Odds Ratio	C.I.	
Discomfort	-.080	.012	45.716	.000	.923	.902	.945
WOAQ	.693	.140	24.371	.000	1.999	1.518	2.632
Physical Work	.239	.176	1.847	.174	1.271	.900	1.795
Constant	-1.830	.754	5.888	.015	.160		

In Table 26 a model with three key predictors of Lost time is reported. It was statistically significant, (Chi-square 110.54, $p = .000$; Cox and Snell R^2 -Nagelkerke $R^2 = .13-.17$).

3.4.3 Discussion of results from Organisation 3

In organisation 3, Age, Discomfort Score and WOAQ were significant predictors of respondents who reported having discomfort. Higher age, increased physical work and a worse psychosocial environment were indicative of higher levels of discomfort. Beta scores for WOAQ (-.292) and Physical Work (.262) indicates that both factors are similar in importance in their contribution to Discomfort Levels. The implication for workplace risk management is that the focus of identification and risk control should incorporate both psychosocial and physical hazards to reduce reported discomfort levels.

WOAQ and Discomfort Scores were significant predictors of whether someone who had reported having discomfort or pain would take time off work as a result. It is noteworthy that Physical work was not a significant predictor of whether someone would take time off work despite the physical nature of the work undertaken in this particular organisation.

3.5 Summary of results for all organisations

Table 27 and 28 show the workplace predictors for each of the organisations for Discomfort Score and Lost time respectively. Although some other factors were significant in predicting discomfort, this table highlights those factors that an organisation can control (age and gender are not hazards that can be controlled at the workplace level).

Table 27. Significant workplace predictors of Discomfort Score: all organisations (Beta scores)

Organisation 1	Organisation 2	Organisation 3
Physical Work (.44)	Physical Work (.30)	Physical Work (.262)
WOAQ (.22)	WOAQ (.26)	WOAQ (-.292)

Table 28. Significant predictors of Lost Time: all organisations (Odds Ratio)

Organisation 1	Organisation 2	Organisation 3
Discomfort (.91)	Discomfort (.91)	Discomfort (.98)
		WOAQ (1.82)

3.6 Previous work

In order to address the fourth aim of this study, which was to investigate the degree to which results can be generalized to other industry sectors, multilevel modelling was undertaken. The extent of variation in factors driving WMSD risk for occupational groups in this project versus groups previously studied in Melbourne manufacturing and storage workplaces was examined, although at this stage the numbers are too small to draw firm conclusions, some general observations can be made.

Preliminary modelling indicates that the predictors of MSD risk across different sectors are similar although their relative importance may differ. For example, it was found that psychosocial factors were of greater importance in predicting discomfort scores in manufacturing and logistics compared to the health care sector. It is the intention that this work will be developed further as more organisations and different sectors are engaged in future projects.

4 Discussion

Consistent with work previously undertaken in manufacturing and logistics (Macdonald, et al., 2007), this study has demonstrated the important role of psychosocial hazards in predicting discomfort score or MSD risk (as has previously been discussed). This finding was consistent across the three organisations included in this study. In two of the three sites, the overall contribution of psychosocial hazards to MSD risk was similar to that of physical hazards.

These findings support the need to change the way that WMSDs are managed in the workplace. with at least equal focus on addressing psychosocial hazards at the workplace level. A large body of evidence now exists which supports this need for a change in risk management. Despite this, organisations have been slow to address these issues and as a result, MSD claim numbers are not decreasing in significant numbers. Two key reasons may explain this lack of acceptance. The first may be a lack of understanding of the pathway between psychosocial hazards and injury development, particularly when outcome is a physical presentation. The second reason is that although an understanding of this relationship exists it may be perceived as too difficult to develop risk controls for psychosocial hazards.

To support this need for change, a central tenet of this study was to develop a Toolkit, suitable for use in workplaces by personnel with minimal training. A key part of this Toolkit is the need to assess, on a regular basis, the MSD risk associated with a range of psychosocial and physical hazards. By including this approach into already existing risk management frameworks utilised by workplaces, it is anticipated it will make any change easier to implement, and subsequent development of controls will follow as a matter of course.

However, whether this approach is successful will require further work to evaluate the effectiveness of the implementation of the Toolkit and interventions developed as part of this process. This requires a long-term commitment from organisations and longitudinal analysis as part of this change in risk management.

5 Project outputs

5.1 Toolkit

This toolkit is intended for workplace use in reducing MSD risk. Its recommendations are based on current evidence identifying the key requirements for successful MSD risk management. It includes guidance on the kinds of general management processes that should be followed, as well as on particular hazard identification and risk assessment methods. The Toolkit is contained in Appendix 2.

Database

In order to facilitate on-going hazard surveillance, one of the aims of this project was to develop a database for organisations to identify key hazards and risk in relation to their personnel. It is envisaged that workplaces will be able to, with some initial assistance, survey their workers and generate some basic reports that will provide them with an indication on what their key issues are.

Using the results from the project reported here and previous work undertaken by the Centre, a core set of measures has been determined which can be supplemented by additional constructs with some tailoring of the database if needed. This database is in draft form at this stage and forms part of the Toolkit.

6 Summary of Findings

The project had four key aims, each of which has been addressed and is outlined in this section. The previously validated WMSD risk assessment survey too was customised and applied in three health-care sector organisations. Results were then used to collaboratively develop a customised set of potential risk control interventions.

Using evidence from all participating workplaces and on research literature, a Toolkit was formulated to promote more effective WMSD risk management in participating workplaces. Some preliminary work on investigating the degree to which results can be generalized to other industry sectors, by determining the extent of variation in factors driving WMSD risk for occupational groups in this project versus groups previously studied in Melbourne manufacturing and storage workplaces was undertaken and will be expanded with the continuation of this research program.

7 Next steps

The current project was aimed at developing a toolkit for use in workplaces to reduce the risk of MSDs. This aim has been achieved. However, evaluation of the implementation of this Toolkit is needed to ascertain its effectiveness in reducing MSDs. To achieve this, longitudinal research is needed with organisations committed to the implementation and evaluation of the Toolkit. In particular, organisations need to be committed to addressing identified hazards and risks in relation to MSDs to achieve significant reduction in numbers and severity of MSDs. It is the plan of the research team to seek further funding to further the work undertaken in this project.

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Appendix 1: Bivariate Correlations

Bivariate correlations for preliminary analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Job Satisfaction														
2. Worklife Balance	.532**													
3. Control	.215**	.196**												
4. WQOAQ	.521**	.364**	.402**											
5. Workmate	.372**	.223**	.233**	.564**										
6. Teamwork	.404**	.298**	.223**	.538**	.608**									
7. Informed	.316**	.218**	.360**	.650**	.430**	.418**								
8. Workfast	-.183**	-.290**	-.234**	-.294**	-.139**	-.124*	-.161**							
9. Workload	-.310**	-.381**	-.264**	-.511**	-.214**	-.331**	-.412**	.528**						
10. Role clarity	-.400**	-.259**	-.274**	-.512**	-.444**	-.449**	-.475**	.284**	.423**					
11. Physical	-.329**	-.242**	-.244**	-.489**	-.254**	-.312**	-.386**	.279**	.387**	.358**				
12. Influence	0.08	.110*	.236**	.122*	0.07	.168**	.139**	-0.02	.119*	0.01	-0.09			
13. Exhaustion	-.330**	-.351**	-.125*	-.460**	-.304**	-.284**	-.340**	.230**	.392**	.380**	.311**	-0.05		
14. Discomfort	-.312**	-.245**	-.177**	-.394**	-.264**	-.315**	-.360**	.232**	.316**	.414**	.542**	0.02	.426**	
15. Lost Time	.244**	0.09	.125*	.264**	.155**	.150**	.169**	-.205**	-.179**	-.300**	-.263**	-0.05	-.135*	-.446**

Appendix 2: MSDs Risk Management Toolkit

MSDs RISK MANAGEMENT TOOLKIT

for workplace use in preventing
musculoskeletal disorders (MSDs)

AMENDED DRAFT 1

MAY 7 2012

Centre for Ergonomics & Human Factors

School of Public Health and Human Biosciences



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1. INTRODUCTION

1.1 What are MSDs?

Musculoskeletal injuries and disorders (MSDs) are a diverse group of conditions. Some appear quite suddenly following a particular event such as handling a heavy load, while others appear to develop *cumulatively* over time. However, distinctions between sudden onset or ‘acute’ injury and cumulatively developing injury can be misleading because *cumulative* injury – of the back, for example – can lower the threshold for *acute* back injury. In other words, a person who develops some cumulative injury, not necessarily severe enough to be diagnosed as an MSD, is more likely to suffer an acute injury.

From a practical viewpoint, the work-related hazards causing acute MSDs are a subset of those causing cumulative MSDs, so workplace management strategies targeting cumulative MSDs will also cover acute ones.¹ Popular labels for cumulative MSDs include repetitive strain injury (RSI), cumulative trauma disorder (CTD) and occupational overuse syndrome (OOS).

1.2 Goal of MSD risk management

MSDs include many different clinical diagnoses, but the reliability or consistency of such diagnoses is poor, and in a workplace context the specific diagnosis has few if any practical implications for preventative risk management. In 2012 the International Commission on Occupational Health released a consensus document, based on extensive discussions among occupational physicians and occupational health researchers specialising in MSDs, which stated that at workplace level the goal of risk management should simply be *to prevent or reduce musculoskeletal discomfort that is at risk of worsening with work activities, and that affects work ability or quality of life*.

That is, the experts agreed that regardless of the clinical diagnosis, the focus of MSD risk management in the workplace should be on reducing levels of musculoskeletal discomfort and pain.

¹ Exceptions to this are injuries or disorders arising directly from sudden events such as falls, vehicle collisions, violence, etc. This toolkit does not deal with MSD risk from those kinds of discrete events.

1.3 Use of the toolkit

This version of the toolkit is intended for use in medium to large Australian work organisations. Its users are expected to include a wide range of workplace stakeholders who do not necessarily have any OHS expertise.

To achieve the intended outcomes, use of the toolkit will require active involvement of managers, supervisors, workers' OHS representatives and OHS committees. It is therefore important for *senior* managers to be familiar with its contents so that they can support its implementation most effectively.

1.4 Overview of toolkit contents

Toolkit contents are based on research evidence identifying key requirements for successful MSD risk management. The following three factors have been shown to be particularly important.

- ***A multi-pronged approach ...*** dealing with risk from psychosocial hazards as well as from manual handling hazards.
- ***Participation by workers and their representatives, along with other stakeholders including supervisors and key managers.*** Workers themselves are the best source of information about the hazards of their jobs, and about possible ways of reducing risk from these hazards. Also, when people are involved in a meaningful way throughout the risk management process, the changes necessary to control risk will be better accepted and implemented more effectively.
- ***Commitment by senior management*** ... ensuring that people have the necessary time to participate in the process, and that risk control interventions are implemented to the full extent that is reasonably practicable.

Following this Introduction, Section 2 outlines current evidence establishing the work-related causes of MSDs, and explains what is meant by 'psychosocial' hazards.

Section 3 is the most important part of the toolkit because it outlines the workplace actions needed to manage MSD risk more effectively. The risk management process is broken into the following stages.

- Getting started
- MSD risk and hazard assessment
- Develop lists of risk control options
- Develop an action plan

- Implement the plan
- Review and evaluate risk management procedures
- Another MSD risk and assessment – evaluate previous plan and commence next cycle.

DRAFT

2. RATIONALE FOR THIS APPROACH TO MSD RISK MANAGEMENT

2.1 Aims of MSD risk management

Many people experience aches and pains – some more often than others. Some people take time off work to help manage their pain, and some of them may be medically diagnosed with an MSD. A relatively small number of people with diagnosed MSDs submit a workers' compensation claim. In this context, what can be achieved by workplace management of MSD risk?

Section 1.2 above explained why the main focus of workplace risk management should be on reducing levels of musculoskeletal discomfort and pain. However, workplace managers are concerned also with minimising costs related to MSDs. Taking account of both these goals, it is proposed that *the aims of MSD risk management at workplace level are:*

- *First and foremost ...* to prevent MSDs developing or being made worse as a result of people's work. Success in achieving this can be assessed most effectively by monitoring musculoskeletal discomfort or pain levels
- *Second ...* to minimise time lost from work due to MSD-related pain. Success here will be indicated by levels of absenteeism or sick leave, although these indicators are affected by many other factors so are of limited use in MSD risk management.
- *Third ...* to minimise numbers of workers' compensation claims for MSDs.

2.2 Work-related causes of MSDs

In Australian workplaces, most people are aware of the risks of 'hazardous manual handling'. They might have used some kind of checklist to identify manual handling hazards, and they know some of the ways to reduce MSD risk – for example by adjusting workstation height to a better level, or using a better chair, or not repeatedly lifting heavy loads, and so on. In many workplaces, the worst of such hazards have already been eliminated or significantly reduced.

Why, then, do Australian workplaces still produce so many musculoskeletal disorders (MSDs)? The answer to that question is clear, based on a large amount of research in countries throughout the world, including Australia. It has now been clearly established that 'manual handling' is not the *only* cause of MSDs ... in fact sometimes it's not even the *main* cause.

MSDs can be caused by hazardous manual handling, but they can *also* be caused by ‘psychosocial’ hazards arising from *how work is organised* and *how people are managed*.² This means that senior management has a key role to play in the risk management process, along with line managers and supervisors.

Some people find it hard to believe that *psychosocial* hazards could affect risk of *physical* health problems such as MSDs. The extent to which psychosocial hazards affect risk is variable, but usually very substantial. A recent review of evidence from a large number of research studies found that psychosocial hazards were responsible for between 14% and 63% of risk to the back, and for MSDs of the upper body and arms they accounted for 28% to 84% of risk. Research in Australian workplaces has demonstrated a similar situation.

Diagram 1. Both physical (manual handling) hazards and psychosocial hazards increase MSD risk by contributing to cumulative micro-level damage to musculoskeletal tissues.

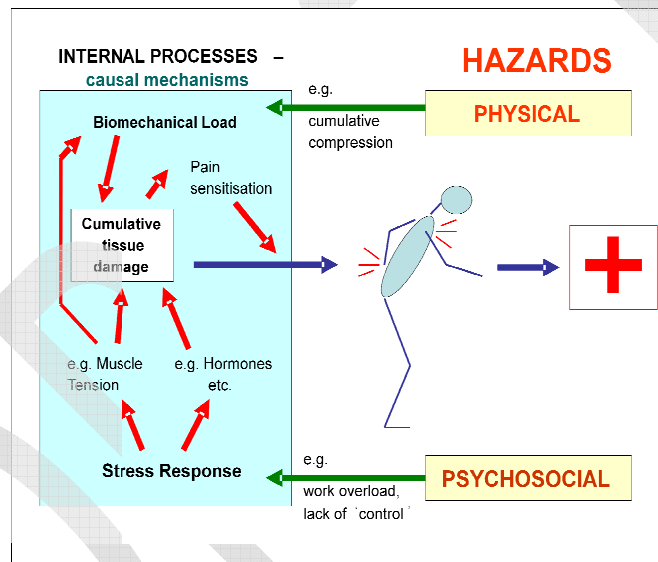


Diagram 1 depicts various processes within the body (shown on the left) which cause cumulative damage to the internal structures of muscles and connective tissues. As this damage accumulates, vulnerability to sprains and strains increases and development of an MSD is more likely.

The internal processes causing cumulative tissue damage are influenced by physical *fatigue* and by psychological *stress*, and both of these are in turn influenced by workplace hazards (in combination with individual factors). When significant numbers of workers are chronically fatigued or stressed they will be at increased risk of MSDs (and some other OHS problems also). The

² Psychosocial hazards are described in section 2.3(b).

important task for workplace managers is to identify and control the work-related hazards that are the source of this risk.

2.3 Types of workplace MSD hazards

(a) Manual handling hazards

The physical demands of task performance are usually the most obvious work-related cause of MSDs. Hazards of this type are task-specific, stemming from the design of people's workstations and tools, and from the characteristics of things that have to be 'handled' such as their size, weight and shape. Related physical hazards include vibration (e.g. from a hand tool affecting the hand and/or arm, or a vehicle causing whole-body vibration), and environmental factors such as low temperatures.

(b) Psychosocial hazards

There are two sub-groups of psychosocial hazards. The first of these are sometimes called *organisational* hazards. Many are the direct responsibility of managers and supervisors because they arise from how work is organised and how work tasks are combined to create whole jobs. Some of the most common are:

- excessively high workloads
- excessively high work rates
- excessively long working hours
- inadequate rest breaks
- night shifts, poorly designed rosters
- inadequate personal control of how work is done, pace of work, own work environment, etc
- lack of variety in the work – repetitious and boring
- conflicting work demands – e.g. work targets are achievable only if people work *fast*, while at the same time high *quality* is demanded.

Some of the above hazards (e.g. long working hours, high work rates) also increase exposures to manual handling hazards.

The second sub-group of psychosocial hazards stem from the *social (and physical) context* of work. These have some overlap with the group above, and again managers and supervisors play a key role in creating – or avoiding – such hazards. It is important to understand that these are primarily about workers' *perceptions* ... although of course perceptions will be strongly influenced by objective reality.

Psychosocial hazards of this kind include:

Relationships / Communications with management: Clear roles and responsibilities; Support from line managers/supervisors; Feedback on performance; Appreciation of people's efforts from line managers/supervisors; Senior management attitudes; Clear reporting line(s); Communication with line managers/supervisors; Status/recognition of individuals within the organisation; Clear company objectives, values and procedures.

Being valued: Consultation about job changes; Adequacy of training; Amount of variety in the work within a job; Opportunities for promotion; Opportunities for learning new skills; Opportunities for people to use their skills; Flexibility of working hours

Relationship with colleagues: How well people work together as a team; How well people get on together socially and personally

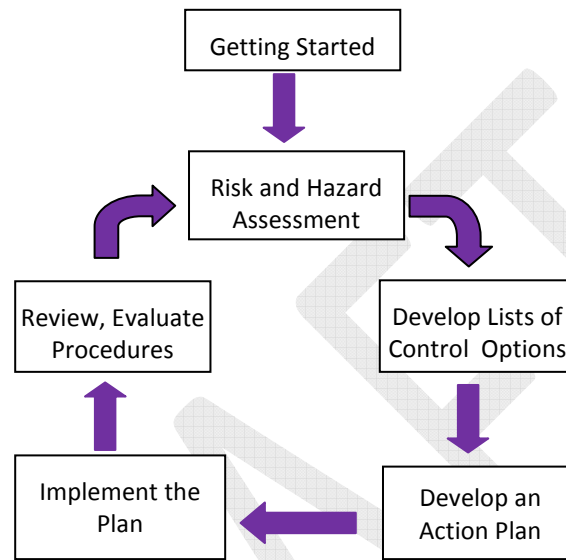
Safety Culture: e.g. occupational targets conflict with OHS requirements, staffing levels sufficient in relation to workload; reported problems are dealt with promptly; supervisors and managers place a high value on OHS relative to 'getting the job done'.

Clearly, management of risk from psychosocial hazards should be part of the normal workplace procedures used to control MSD risk. Further information on work-related MSDs and their risk management is available in Appendix A.

3. MSDs RISK MANAGEMENT FRAMEWORK

This framework is based on one developed by the World Health Organisation network of Collaborating Centres in Occupational Health for use in various workplace risk management toolkits. Its incorporates a modified version of the conventional Plan-Do-Check-Act risk management cycle.

Diagram 2. MSDs risk management framework.



3.1 Getting started

(a) Form an MSDs risk management team.

Since this toolkit is intended for use in medium to large Australian work organisations, it is assumed that procedures to ensure compliance with regulatory requirements are already in place, and that there is at least one staff member responsible for OHS matters.

If there is no existing MSDs risk management team (i.e. a group responsible only or primarily for managing MSD risk), such a team needs to be formed.

The initial team members should include:

- staff with existing OHS responsibilities
- representatives of senior management
- health and safety reps
- union reps where appropriate
- representatives of each of the organisation's main job types and departments.

The team needs to:

- discuss and agree on basic administrative tasks that will need to be performed
- decide who will be responsible for each of these tasks
- identify required resources
- obtain any required management approvals related to the above.

(b) Collate and review available information on MSD risk.

The team's next task is to collate existing information about MSD risk throughout the organisation. This should include:

- data from MSD-related incident reports. Where are incidents occurring? Are they clustered in some jobs or departments?)
- MSD-related claims data. Are these from jobs or departments where incident reports tend to cluster?
- information from assessments of 'hazardous manual handling' (assumed to have been previously conducted and documented). What jobs are these tasks a part of? Are there other jobs that include 'hazardous manual handling'? Hazardous manual tasks are defined in Victoria's Manual Handling Code of Practice as those entailing one or more of:
 - Repetitive or sustained application of force
 - Sustained application of force
 - Repetitive or sustained awkward posture
 - Sustained awkward postures
 - Repetitive or sustained movement
 - Application of high force
 - Exposure to sustained vibration
 - Handling of live people or animals
 - Handling of loads that are unstable, unbalanced or difficult to hold.

Apart from the tasks for which there are MSD risk assessment reports, are there other tasks that have one or more of the above characteristics?

(c) Define the initial scope of MSD risk and hazard assessment

Now the team needs to decide whether to confine the first assessment of MSD risk and hazards to selected groups identified as high risk, or to assess risk more broadly throughout the organisation.

Usually, MSD risk is assessed only for those workers considered to be performing 'hazardous manual handling' tasks, and jobs that include any hazardous manual handling should certainly be

included. However that strategy can result in missing jobs with a substantial MSD risk that do *not* including hazardous manual handling. An example of such a job would be one requiring emotionally difficult interactions with the public, particularly when the work is performed in a seated position for extended periods.

To avoid missing some high risk jobs, it is best to include as many jobs and departments as possible. However the team will need to take account also of practical constraints such as staff availability, any scheduled changes to work procedures or workplaces, and so on.

If it is not possible to include everyone, choice of the jobs and departments to be assessed should be based on all of the above kinds of data and information.

3.2 MSD risk and hazard assessment

This assessment is needed because data from incident reports, injury claims and assessments of 'hazardous' manual handling tasks provide a very incomplete assessment of MSD risk within the organisation. A more reliable and valid risk indicator can be obtained from staff survey ratings of discomfort/pain.

(a) Staff survey

MSD risk assessment survey module (Tool A, listed at the end of this document). Staff are asked to rate the frequency and severity of musculoskeletal discomfort and pain (if any) for each of five body regions, and also to identify their job and department (selecting from pre-specified options). From these ratings, discomfort/pain scores for each of the specified set of jobs and departments are produced (see below).

MSD Hazard assessment survey module (Tool B, listed at the end of this document). Staff ratings are used to score the severity of all relevant hazards – both manual handling and psychosocial. **Tool B** includes the core content of this survey module, along with questions identifying details of job and employment conditions, and basic demographic information.

Online versions of both the above survey modules are available for use where practicable. This enables data to be automatically extracted and entered into a data analysis and reporting software package;³ instructions for its use are in **Tool C** (listed at the end of this document). Manual data entry from paper-based surveys is also possible.

³ Available from La Trobe University; contact j.oakman@latrobe.edu.au

(b) Workshops to customise the psychosocial hazard component of the survey

Survey items assessing manual handling hazards are applicable in all contexts. However, the core set of survey items assessing psychosocial hazards might need some adaptation so that it is most relevant and useful to the organisation.

Small groups of people (e.g. 3 to 8 or so) who are familiar with the jobs and departments in question need to discuss the relevance and meaning of each type of psychosocial hazard for the target groups of survey respondents. The wording of some items might need amendment, and some new items might be suggested for inclusion. The amended survey should be trialled with people representative of the target groups, before finalising its content.⁴

(c) Recruit survey participants

The survey is anonymous and its completion is voluntary. Flyers telling people about the survey will be needed. They should include information about:

- Purpose of the survey – how the information will be used
- Responses are anonymous; important for everyone to participate
- Supported by both management and union(s)
- How to access the survey on line ... times set aside for completing it (whatever is applicable).

The information needs to be widely distributed over a period of several weeks (to catch people who might be on leave initially), and people on all shifts should be included. Information might be distributed with pay slips, and discussed briefly at staff meetings. Reminder notices might be needed – perhaps via emails to all staff.

It is extremely important to obtain responses from a high proportion of the target group (at least 60% and preferably a lot higher). To achieve this, support from supervisors, from higher management, and where applicable from unions is likely to be essential, and the team should do everything possible to achieve this.

It will be worth identifying a range of strategies to motivate staff to complete the survey. In some cases it will be necessary to arrange for staff to be released from their normal work (for around 20 minutes) so that they are free to complete it. In some contexts it can be helpful to have information and follow-up reminders provided to people by their union as well as by management.

⁴ Development of more detailed guidelines to support this process is planned for the next stage of this research.

(d) Information generated by the survey

Pre-programmed components of the software package generate average discomfort/pain scores for each of the specified set of jobs and departments. This information can identify 'hot spots' within the organisation where average discomfort/pain scores are highest.

The software also produces scores on each different type of manual handling hazard and each different type of psychosocial hazard, showing level of severity for each, and it identifies the types of hazard that are most closely linked to MSD risk in each job/department, based on correlations between discomfort/pain scores and each of the hazard scores. This information provides a good basis for identifying and prioritising potential strategies for reducing risk from the hazards identified as most important.

Additional manual (non-automated) analyses of the survey data are also possible.

3.3 Develop lists of risk control options

Information from the survey is now presented back to stakeholders. It will probably be best to have an initial meeting of all key stakeholders, in which survey results are discussed, focusing on work-related factors that seem likely to be creating the particular hazards identified, and some initial ideas for potential control measures.

This meeting should also decide on the sub-groups that would be most appropriate to develop and finalise proposals for a set of specific risk control actions. These will probably need to focus separately on each particular job that was surveyed. Some of the issues to be dealt with are outlined below, separately for manual handling hazards and psychosocial hazards.

(a) Manual handling hazards

Identify specific causes

Looking at hazard scores for the job in question:

- Identify the hazards with (a) the strongest links to Discomfort/Pain score, and (b) any other hazards with high (bad) scores. Make a list of these.
- Taking each of these hazards separately, identify likely explanations for the hazard scores, in terms of specific work tasks and working conditions of the people doing that job. List these likely causes.

At this stage it might be useful to have photos or videos of people performing some of the hazardous tasks identified.

Identify possible solutions, risk control options

For each of the likely causes (identified above), brainstorm risk control options ... potential design changes to work methods, equipment, etc that would reduce risk. In brainstorming ideas for design changes, use the 12 manual handling survey items as a checklist of features that might need improvement.

Make a list of possible risk control options, and then discuss how they should be prioritised. In doing this, take account of:

- Survey hazard score and its link to discomfort/pain score
- Which hazards are ‘the worst’ ... e.g. most annoying, most difficult to tolerate
- Which hazards have practicable and acceptable controls options
- Which control options will be most effective in reducing risk
- Which control options will be most practicable to implement (consider technical difficulty, resources required, etc).
- Whether the control option might create, or worsen, any psychosocial hazard (review the list of these).

Evaluating alternative risk control options for manual handling hazards

In some situations it might be helpful to evaluate some alternative risk control options. This might entail comparison of the current way of performing a task with a proposed different way, or comparison of several alternative new prototypes.

In cases such as those, an ergonomics hazard assessment method could be used. Two that are suitable for use by non-experts – provided two or three people are prepared to read and thoroughly understand related documentation – are ManTRA or the QEC. Instructions for their use and links to further information on each are in **Tool D** at the end of this document. Alternatively, a specialist ergonomist could be employed to undertake the evaluation.

(a) Psychosocial hazards

Identify specific causes

Looking at hazard scores for the job in question:

- Identify the hazards with (a) the strongest links to Discomfort/Pain score, and (b) any other hazards with high (bad) scores. Make a list of these.
- Taking each of these hazards separately, identify likely explanations for the hazard scores, in terms of how work is organised and how people are managed in the job/department under

review. In doing this, use **Tool E** *Ideas on how to control risk from psychosocial hazards*, listed at the end of this document. List these likely causes.

Identify possible solutions, risk control options

For each of the likely causes (identified above), brainstorm risk control options. In doing this, **Tool E** will again be helpful.

Make a list of possible risk control options. At this stage it might be useful to obtain assistance from people with expertise relevant to the kinds of control options being considered.

Having obtained all necessary information, then discuss how the control options should be prioritised. In doing this, take account of:

- Survey hazard score and its link to discomfort/pain score
- Which hazards are ‘the worst’ ... e.g. most annoying, most difficult to tolerate
- Which hazards have practicable and acceptable controls options
- Which control options will be most effective in reducing risk
- Which control options will be most practicable to implement (consider technical difficulty, resources required, etc).
- Whether the control option might create, or worsen, any other kind of manual handling or psychosocial hazard (review lists of these).

3.4 Develop an action plan

Lists of control options developed by each sub-group are presented back to the full risk management team for discussion and further prioritisation. On this basis, a detailed action plan is formulated, with estimated costs and proposed milestones, for final management approval.

This stage may be time-consuming, since it is likely to require detailed planning and then the integrate of this plan with other organisational plans and operating systems. It is important that feedback on progress is regularly provided to all employees involved in the process, including all of the groups targeted by the MSDs risk and hazard assessment survey.

The action plan should include communication procedures so that everyone will be kept informed of progress during the implementation period.

3.5 Implement the plan

Success of the implementation will be very dependent on:

(a) senior management commitment and resourcing

(b) personal commitment of key team members to 'drive' and follow through the necessary actions over an extended period

(c) full participation by workers (or their representatives) affected by the implementation.

It is likely that some aspects of the plan will need to be changed or at least 'fine tuned' to maximise its effectiveness. Feedback and suggestions from those most affected will be centrally important in this process, which should continue as long as needed. Changes that are not immediately possible should be put on the agenda for future consideration.

Progress of the implementation should be monitored in relation to previously agreed plan milestones, with regular feedback to all team members as well as to the survey target groups.

3.6 Review and evaluate risk management procedures

Before commencing the next risk management cycle, the risk management team may need to review its own membership and operating procedures, and consider whether any changes might be beneficial.

It should also prepare a report summarising the steps taken and outcomes achieved during the last cycle of risk management procedures.

3.7 Another MSD risk and hazard assessment (start of next cycle)

Administer the risk and hazard assessment survey again (see 3.2 above). This time the results can be used to evaluate effectiveness of the risk control interventions implemented as part of the previous plan.

Identify what worked and what did not. Have the changes implemented as part of the previous risk management cycle eliminated or reduced previous 'hot spots' as indicated by discomfort/pain scores in those jobs/departments? Are there new 'hot spots'?

Have hazard levels been reduced by the changes implemented? How have hazard patterns changed – have levels risen anywhere?

Proceed through the cycle again.

LIST OF TOOLS

- A. MSD Risk Assessment Survey Module**
- B. MSD Hazard Assessment Survey Module**
- C. Data Analysis & Reporting Software Package: Instructions for Use**
- D. Task Analysis Methods for Assessing Severity of Manual Handling Hazards – ManTRA, and the QEC**
- E. Ideas on How to Control Risk from Psychosocial Hazards**

APPENDIX A

Further Information on Work-Related MSDs and their Risk Management

Prevention of work-related musculoskeletal disorders: Development of a toolkit for workplace users

Purpose of research

The primary goal of this project was to extend development of a more effective procedure for workplace management of MSD risk, including formulation of a risk management 'toolkit' for workplace users to reduce the incidence of work-related musculoskeletal disorders (WMSDs) by developing more effective risk management procedures. Currently, WMSD risk assessment methods focus almost entirely on physical hazards related to manual handling, with relatively little attention to psychosocial hazards. However, it is now well established that psychosocial hazards can strongly influence WMSD risk and that workplace interventions to reduce such risk should use a multidisciplinary approach which tackles both manual handling and psychosocial hazards.

Translation of this evidence into practice is very limited. The evidence-based Toolkit formulated in this project facilitates that process. It provides information about basic MSD risk management requirements, the general processes to be followed, and a number of specific risk management tools. Its use is expected to support a sustainable process of routine MSD risk management in workplaces such as those participating in the current project.

Implications for WorkSafe

If MSD risk is to be substantially reduced beyond current levels, management of risk from psychosocial hazards needs to be integrated with, and given equal weight, to management of risk from manual handling hazards. This has implications for the structure and content of Worksafe guidance materials (both online and hardcopy).

To support more effective MSD risk management at workplace level there is a need for further workplace-based research to customize and implement the Toolkit within the broader management systems of participating organizations, and to evaluate its effectiveness in reducing MSD risk.

Project aims

- (1) Customise our previously validated WMSD risk assessment survey tool for use with selected high-risk groups in the healthcare sector
- (2) Apply the customised survey within at least three participating workplaces, and use findings within each workplace to collaboratively develop customized sets of potential risk control interventions
- (3) Based on evidence from all participating workplaces and on research literature, formulate a 'toolkit' to promote more effective WMSD risk management in participating workplaces.
- (4) Investigate the degree to which results can be generalised to other industry sectors, by determining the extent of variation in factors driving WMSD risk for occupational groups in this project versus groups previously studied in Melbourne manufacturing and storage workplaces.

Methods

A combination of qualitative and quantitative methods was used. Data from the three health-care organisations that participated in the project were analysed separately. Finally, multi-level analysis was undertaken to determine differences between industry sectors separately from those between workplaces, using data from both the present study and a previous one in the manufacturing and logistics sectors. Results below are from the present three organizations.

Characteristics of respondents in the three healthcare organisations are shown in Table 1.

Table 1. Respondent Characteristics.

	Organisation 1	Organisation 2	Organisation 3
Responses	n=254 (38%)	n=160 (32%)	n=957 (32%)
Mean age	44.2 years (19-71)	46.2 years (23-74)	40.3 years (20-65)
Mean time in job	7 years	11 years	12 years
Any Discomfort	85% yes	84% yes	84% yes
Mean discomfort score/ 60	12.4 (range 0-46)	17.3 (range 0-55)	14.9 (range 0-55)

Within each of the three organisations, focus groups with representatives of the target occupational groups were held to determine details of potential workplace hazards and related terminology, for use in customising the previously validated survey. The modified survey was then pilot tested with a small sample. In two of the three organisations, paper versions of the survey were used. A web-based survey was used in the third organisation. Data were entered into SPSS (or extracted, in the case of the online survey), and analysis was undertaken using statistical techniques including factor analysis and multivariate regression. Finally, multi-level modelling was used to pursue Aim (4) of the project.

The main sources of WMSD risk were determined and initial feedback provided to the organisations through participative workshops. Participants in the workshops included key organisational stakeholders and representatives of each of the target occupational groups. Engaging people from across the work areas was critical, both to ensure that the interventions were practical and were able to be implemented.

The final stage of the project involved development and delivery of the Toolkit to each of the three organizations, for their future use in MSD risk management.

Research findings

In all three health care sector organisations, both psychosocial and physical hazard scores were independently predictive of the discomfort/pain scores that provided an index of MSD risk, and discomfort/pain score was in turn predictive of staff taking time off work. In one of the three organizations, psychosocial hazard score also predicted the probability of time being lost from work due to discomfort/pain, independently from the level of discomfort/pain.

These results confirm that workplace risk management of MSDs must include assessment and control of psychosocial hazards alongside management of manual handling hazards. This will be most effective when assessment of all types of hazard is integrated within a coherent set of MSD risk management practices. The Toolkit developed as part of this project is intended to address this need, and to promote more effective workplace management of MSD risk in a way that is sustainable independent of expert support.

The toolkit includes guidance on required management procedures, as well as on particular hazard identification and risk assessment methods. Its use requires the active involvement of relevant managers, supervisors, workers' OHS representatives and OHS committees. The specified management procedures are based on research evidence identifying key requirements for

successful MSD risk management. Particularly important requirements are: a high level of management commitment; multidimensional risk control interventions; and a participative approach involving workers. Further work will be needed to assess the effectiveness of the Toolkit in reducing MSD rates.

In order to facilitate ongoing risk and hazard surveillance, a software package which automates a basic set of data analysis and reporting procedures was developed for inclusion in the Toolkit. It is envisaged that workplaces using this toolkit will regularly survey their workers and generate basic reports that will identify the main hazards requiring attention. It also provides guidance on how to develop and implement risk controls. Using the results from the project reported here and from previous project a core set of measures has been determined which can be supplemented by additional constructs with some tailoring of the database if needed. Currently the software package for this database is in draft form.

The final aim of this project was to investigate the degree to which results can be generalized to other industry sectors, using data from a previous project undertaken in manufacturing and logistics along with data from the present three organisations. Preliminary modeling indicates that the predictors of MSD risk across different sectors are similar, although their relative importance may differ. For example, psychosocial factors were of greater importance in predicting discomfort scores in manufacturing and logistics compared to the health-care sector. This modeling will be developed further as this work is undertaken in different sectors.

Research conclusions

The findings from this project demonstrate the need for a major change in the way that MSDs are managed in the workplace. Effective MSD risk management must address both psychosocial and physical hazards in a fully integrated way that involves substantial worker participation. This will require the focus of analysis to be on whole jobs rather than just on specific work tasks. To support achievement of this goal in ordinary workplaces without specialist support, a Toolkit has been developed. This now needs to be implemented in a range of workplaces so that its effectiveness in reducing MSD risk can be evaluated.

Authors

Dr. Jodi Oakman, Senior Lecturer, Centre for Ergonomics and Human Factors La Trobe University
Associate Professor Wendy Macdonald, Centre for Ergonomics and Human Factors, La Trobe University

Where can I get further information?

For copies a one page summary and the full report, contact:
Institute for Safety, Compensation and Recovery Research
Phone: +613 9097 0610, Email: info@iscrr.com.au

Accompanying documents to this report

Prevention of work-related musculoskeletal disorders: Development of a toolkit for workplace users

Report No. 0512-025-R1A – 1 page summary
Report No. 0512-025-R1C – Full Report