

The implementation of interventions to
prevent musculoskeletal injury at work and
the stage of change approach

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Thesis abstract

Background

The targeting of injury prevention advice according to behaviour change principles has been proposed by researchers as a means for improving the effectiveness of advice. However, despite promising results, this has not been adopted by practitioners.

Aims

The aim of this thesis is to review contemporary approaches to the application of the behaviour-change approaches in the development of workplace injury prevention interventions; evaluate the implementation of stage of change based ergonomics advice; evaluate its effectiveness in musculoskeletal injury prevention; and to explore the barriers and facilitators to its adoption by practitioners.

Methods

A mixed methods approach was used, comprising a literature review/discussion paper and three inter-related studies.

Results

Literature review/Discussion paper

The structuring of injury prevention advice according to behaviour change principles has been most frequently applied using the Stage of Change (SOC) framework. However, despite favourable results there is little evidence that this has been adopted by practitioners. The translation of research findings into professional practice has been hindered by a 'research-practice gap' and the need to actively engage practitioners in the research process.

Study 1

The managers of 25 workgroups, across a range of sectors were allocated to receive either standard ergonomics advice or ergonomics advice tailored according to the workgroup SOC profile. Twelve months later managers who had received tailored advice were found to have implemented significantly more recommended changes (IRR = 1.68, 95% CI 1.07-2.63) and more "additional" changes (IRR = 1.90, 95% CI 1.12-3.20). The findings suggest that the

implementation of ergonomics recommendations may be improved by the tailoring of advice according to SOC principles.

Study 2

Injury data on 169 workers (from 21 workgroups) who had been randomly assigned to receive standard ergonomics advice or advice tailored according to the SOC approach was analysed. Workers in receipt of tailored advice were 55% (OR=0.45, 95% CI 0.19-1.08) less likely to report a compensable injury than those in receipt of standard advice. While the effect was not statistically significant at a 0.05 level ($p=0.073$) the observed outcomes support the potential value of the SOC approach when planning injury prevention programs.

Study 3

The barriers and facilitators to the adoption of the SOC approach were investigated in a series of practitioner focus groups and a subsequent survey of members of the Human Factors and Ergonomics Societies of Australia and New Zealand. A proposed SOC assessment tool was presented and its perceived utility critiqued. The results suggest the limited application of a SOC based approach is due to the absence of a suitable tool, the need for training and limited access to research findings.

Conclusion

The SOC approach has been proposed as means to improve the implementation and effectiveness of ergonomics advice. Despite some encouraging results there is little evidence that this has been adopted by practitioners. This translation of research to practice may have been hindered by a lack of engagement with practitioners, and the absence of a suitable assessment tool.

This thesis has addressed these issues in a series of inter-related studies. The outcomes are an improved evidence base for the potential effectiveness of the SOC approach, an investigation of the barriers and facilitators to its adoption by practitioners and their engagement in the development of a draft SOC assessment tool.

Declaration

I certify that this work contains no material which has been accepted for the award of any other degree or diploma in my name, in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. In addition, I certify that no part of this work will, in the future, be used in a submission in my name, for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint-award of this degree.

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Conference presentations resulting from this thesis

1. **Rothmore P**, Aylward P, Karnon J. *Implementing ergonomics interventions – a stage of change approach*. 9th International Conference on the Prevention of Work-Related Musculoskeletal Disorders (PREMUS), Toronto, Canada, June 20-23, 2016.
2. **Rothmore P**, Aylward P, Oakman J, Tappin D, Gray J, Karnon J. *Taking the next step: operationalising a behaviour based approach for musculoskeletal injury prevention interventions*. 9th International Conference on the Prevention of Work-Related Musculoskeletal Disorders (PREMUS), Toronto, Canada, June 20-23, 2016.
3. **Rothmore P**, Aylward P, Karnon J. *Why haven't we solved the MSD problem?* Australian Physiotherapy Association Conference. Gold Coast. Queensland, Australia, October 3-6, 2015. (*Invited Speaker*).
4. **Rothmore P**, Aylward P, Karnon J. *The implementation of ergonomics advice and the stage of change approach*. 9th Triennial Congress of the International Ergonomics Association (IEA), Melbourne, Australia, August 9-14, 2015.
5. **Rothmore P**, Aylward P, Karnon J. *Implementing ergonomics interventions – a behaviour change approach*. 50th Annual Conference of the Human Factors and Ergonomics Society of Australia, Adelaide, Australia, November 17-19, 2014.
6. **Rothmore P**, Aylward P, Karnon J. *Implementation of interventions to prevent musculoskeletal injuries at work – a behaviour change approach*. Australian Physiotherapy Association National Conference, Melbourne, Australia, October 17-20, 2013. (Winner – Best Free Paper, OHS).

Peer-reviewed journal articles resulting from this thesis

1. **Rothmore P**, Karnon J, Aylward P. Implementation of interventions to prevent musculoskeletal injury at work – lost in translation? *Physical Therapy Reviews*, 2013: 18(5); 344-349.
2. **Rothmore P**, Aylward P, Karnon J. The implementation of ergonomics advice and the stage of change approach. *Applied Ergonomics*, 2015: 51; 370-376.
3. **Rothmore P**, Aylward P, Gray J, Karnon J. A long-term evaluation of the stage of change approach and compensable injury outcomes – a cluster randomised trial. *Ergonomics*, DOI 10.1080/00140139.2016.1199816.
4. **Rothmore P**, Aylward P, Oakman J, Tappin D, Gray J, Karnon J. The stage of change approach for implementing ergonomics advice – translating research into practice. *Applied Ergonomics*, 2017: 59; 225-233.

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I would also like to thank Professor Dino Pisaniello, who initially set me on this research path when I joined the University of Adelaide in 2009. A final professional thanks must go to my friends and colleagues Dr. Jodi Oakman and Dr. David Tappin. Like me, they both embarked on late career changes from professional practice to academia, and have been generous in their support.

On a personal note, I must thank my wife, Jody Rothmore, and my children, Molly and Eliza. On numerous occasions I have travelled to national and international conferences in order to present the results of my research in order to meet, and seek valuable feedback from professional colleagues. While these trips certainly enhanced my research it also placed an increased burden on them.

While the completion of a PhD signifies the end of a process there is much work still be undertaken in the field of injury prevention. There are numerous strands of research from this PhD I would like to pursue – funding permitting.

List of abbreviations

HFESA	Human Factors and Ergonomics Society of Australia
HFESNZ	Human Factors and Ergonomics Society of New Zealand
MSD/s	Musculoskeletal disorder/s
MSPD	Musculoskeletal pain and discomfort
OHS	Occupational health and safety
SOC	Stage of change
TTM	Transtheoretical model
UK	United Kingdom
USA	United States of America

Chapter 1

Introduction

1.1 Introduction

Work-related musculoskeletal disorders (MSDs) impose significant costs on individuals, industry and society (Vos et al. 2015) and have been a consistent focus of ergonomics interventions (Wells 2009). Despite this, however, the burden remains.

Traditionally, the aetiology of work-related MSDs was primarily attributed to exposure to biomechanical loads which caused tissue damage when the load exceeded the failure tolerance of the exposed tissues. More recently, there has been acknowledgement of the role of non-physical (or psychosocial) factors such as job satisfaction, work demands and work stress which may trigger a work-related MSD via a hormonal response, or increased muscle tension. Consequently, workplace interventions have transitioned from an emphasis on the identification and control of physical risk factors to the inclusion of psychosocial factors and the subsequent development of multi-factorial interventions (Macdonald and Oakman 2015, Silverstein and Clark 2004, Westgaard and Winkel 2011). However, although some successes in the implementation of MSD prevention strategies have been reported (Denis et al. 2008, Palmer et al. 2012, Silverstein and Clark 2004) MSDs remain a significant workplace issue (Wells 2009). Wells (2009) proposed that this limited success may be associated with low rates of implementation, or in other words, there is a gap between the proposed interventions designed by ergonomists and those which are implemented by organisations (Oakman, Rothmore, and Tappin 2016, Rothmore, Karnon and Aylward 2013).

The structuring of injury prevention advice according to behaviour change principles has been proposed as a means of improving the implementation and effectiveness of interventions designed to reduce the burden of musculoskeletal injuries (Haslam 2002, Rothmore, Aylward and Karnon 2015). Integrating a number of theoretical constructs central to change, including Stage of Change (SOC), decisional balance and processes of change, is Prochaska and DiClemente's Transtheoretical Model (TTM) (Prochaska, Prochaska, and Levesque 2001). The first of these, and the central organising construct of the TTM, the SOC framework, has been the most frequently applied method in workplace settings (Rothmore, Karnon and Aylward 2013).

In the SOC framework people progress through five stages when changing behaviour:

1. Pre-contemplation – Not considering changes
2. Contemplation – Considering changes but not yet ready to act
3. Preparation – Intending to make changes in the near future
4. Action – Changes made less than six months ago
5. Maintenance – Changes made more than six months ago and working to consolidate

When the stage is determined, using a series of closed questions, interventions can be tailored to match the distribution of employees across the stages (Prochaska, Prochaska and Levesque 2001).

However, despite some promising results this has not been adopted by practitioners.

Workplace applications of the SOC approach have included interventions to improve the general health of employees (Cole et al. 1998, Del Pozo-Cruz et al. 2013, Grande, Cieslak, and Silva 2016, Hong et al. 2012) or the management (Xu et al. 2007) and prevention of MSDs (Village and Ostry 2010, Whysall, Haslam, and Haslam 2006).

Studies by Cole et al. (1998) and Grande, Cieslak, and Silva (2016) have demonstrated the benefits of a SOC based approach in increasing physical activity in otherwise sedentary workers while Del Polo-Cruz et al. (2013) reported a similar effect for improving exercise compliance in workers with sub-acute low back pain. Similarly, Hong et al. (2012) reported significantly better health outcomes and hearing protection behaviour among employees in more advanced SOC. In the area of MSD management Xu et al. (2007) reported that return-to-work outcomes for injured workers with chronic pain could be predicted from SOC status.

MSD prevention studies which have used this framework have shown its potential benefits by either applying it to pre-existing company plans (Whysall, Haslam and Haslam 2006) or by demonstrating its ability to identify worker readiness to change as a prelude to the development of an intervention (Village and Ostry 2010). While these methods provide a useful demonstration for the potential effectiveness of the SOC approach in the development of workplace interventions they are not reflective of professional practice where consultants are engaged to provide specific advice on changes to the work environment. Consequently, practitioners may not see this approach as being immediately and directly relevant to their own practice.

The relevance of the outcome measures applied – variations in body part discomfort and advancement through the Stages and Change - may also hinder the transferability of the findings into practice. A decrease in self-reported body part discomfort assumes that this is associated with lower rates of injury. Similarly, advancement through the Stages of Change assumes that workers in more advanced stages will be more engaged and, as a result, experience lower rates of injury.

While progression through the Stages of Change may suggest higher levels of awareness and was, in one study (Whysall, Haslam and Haslam 2006), associated with lower levels of self-reported body part discomfort, the association with lower injury rates is equivocal. In fact an Australian study reported that higher levels of self-reported body part discomfort were associated with more advanced Stages of Change (Pisaniello et al. 2011). While this may be due to increased awareness by workers who are experiencing discomfort in that they become more engaged, and cognisant of, the need for change it also indicates the need for more robust and practical outcome measures to demonstrate the effectiveness of behaviour change approaches to injury prevention. In 2015 Doda et al. reported the results of a longitudinal study in Australia in which 25 workgroups were randomly assigned to receive standard or tailored (SOC based) advice. At 12-months follow-up workers in companies which had received tailored advice were 40% less likely to report lower back pain.

Although measures of musculoskeletal pain and discomfort are widely used and reported in the literature their ability to predict future injury is unclear. Their attraction lies chiefly in their ease of collection; the assumed linkages between discomfort, pain and injury; and their widespread use as an outcome measure in ergonomics interventions. While the continuum of discomfort, pain and injury, is appealing these terms have been used both interchangeably in the literature and to describe separate states (Hamberg-van Reenen et al. 2008, Straker 1999). In those studies which have sought to determine the links between these states the results have been equivocal. While some studies have reported the ability of self-reported discomfort to predict future injury others have shown a poor correlation (Macdonald, Evans and Armstrong 2007).

Fundamental to the effectiveness of any intervention is the implementation of the advice received. This is an area where barriers have been reported by both researchers and

practitioners. Practitioners frequently omit an evaluation of their interventions due to a lack of client interest (Whysall, Haslam and Haslam 2004) and competing company priorities often prevent their implementation (Trevelyan and Haslam 2001). Strategies to improve both the monitoring and implementation of advice are therefore needed. Such strategies would have multiple benefits:

- a reduction in the personal costs to injured workers
- a reduction in injury costs to companies
- a reduction in the costs associated with worker's compensation and the monitoring of regulatory compliance to government

Ultimately, the translation of research findings into the professional practice of ergonomists will need an approach which will bridge the researcher-practitioner divide by actively engaging practitioners in research development and the dissemination of findings.

1.2 Thesis outline

The primary aims of this thesis are to:

- Review contemporary approaches to the application of behaviour-change approaches in the development of workplace injury prevention interventions
- Determine whether the implementation of practitioner advice, by companies, is influenced by the targeting of advice according to the Stage of Change approach
- Determine whether there are any long-term health outcomes associated with the Stage of Change approach in respect to compensable musculoskeletal injuries
- Investigate the barriers and facilitators to the adoption of the Stage of Change approach by practitioners and the potential utility of a Stage of Change tool to encourage this

In order to achieve these aims and to address the research gaps there are four research questions:

Research Question 1: What are the contemporary approaches to the application of behaviour-change methods in the development of workplace injury prevention initiatives?

Research question 2: Is the implementation of practitioner advice, by companies, influenced by the targeting of advice according to a Stage of Change approach?

Research question 3: What are the differences in the long-term health outcomes associated with the Stage of Change approach in respect to compensable musculoskeletal injuries?

Research question 4: What are the barriers and facilitators to the adoption of the Stage of Change approach in the development of musculoskeletal injury prevention interventions by practitioners and what is the potential utility of a Stage of Change assessment tool?

These research questions are addressed in the following five chapters.

Chapter 2 is an introductory literature review/discussion paper on contemporary approaches to behaviour-change based injury prevention initiatives. This chapter was published in a Special Edition of *Physical Therapy Reviews* and addresses the first research question. However given the evolving nature of the field, where relevant new studies have been conducted, these have been included in introductory sections of subsequent chapters here.

Publication details: **Rothmore P**, Karnon J, Aylward P. Implementation of Interventions to Prevent Musculoskeletal Injury at Work – Lost in Translation? *Physical Therapy Reviews*, 2013; 18(5); 344-349.

Chapter 3 describes the application of the Stage of Change framework in the development of workplace injury prevention programs in a manner which reflects professional practice. In doing so, this chapter addresses the second research question.

Publication details: **Rothmore P**, Aylward P, Karnon J. The implementation of ergonomics advice and the stage of change approach. *Applied Ergonomics*, 2015; 51; 370-376.

Chapter 4 presents the results of a long-term follow-up of compensable injuries in workers in companies which received either standard or tailored (SOC based) ergonomics advice. This chapter addresses the third research question.

Publication details: **Rothmore P**, Aylward P, Gray J, Karnon J. A long-term evaluation of the stage of change approach and compensable injury outcomes – a cluster randomised trial. *Ergonomics*, DOI: 10.1080/00140139.2016.1199816.

Chapter 5 synthesises the results of the preceding chapters and translates these into the practice domain. The chapter presents the findings from a series of practitioner focus groups and a subsequent web-based survey of members of the Australian and Zealand Human Factors and Ergonomics Societies of the barriers and facilitators to the adoption of a Stage of Change approach by practitioners. A draft Stage of Change Assessment Tool is presented. This chapter addresses the fourth research question.

Publication details: **Rothmore P**, Aylward P, Oakman J, Tappin D, Gray J, Karnon J. The stage of change approach for implementing ergonomics advice – translating research into practice. *Applied Ergonomics*, 2017: 59; 225-233.

Chapter 6 discusses the implications of the research presented in each of the preceding chapters followed by a discussion of the limitations of this research program and recommendations for future research.

1.3 Referencing in this thesis

Chapters 2-5 are comprised of published, peer-reviewed manuscripts. Accordingly, the references for these chapters are contained in the reproduced manuscripts. For consistency, the references for Chapters 1 and 6 are provided at the end of these chapters.

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Chapter 2

Introductory literature review/discussion paper

Publication: **Rothmore P**, Karnon J, Aylward P. Implementation of interventions to prevent musculoskeletal injury at work – lost in translation? *Physical Therapy Reviews*, 2013: 18(5); 344-349.

2.1 Preface to Chapter 2

Despite increasing awareness of the multi-factorial nature of work-related MSDs, and the design of corresponding interventions, the MSD problem remains. This may be partly attributed to the lack of implementation. Despite the proposition, more than 10 years ago, that the structuring of injury prevention advice in accordance with behaviour change principles may improve its implementation there is little evidence that this approach has been adopted by practitioners. This chapter discusses this issue and serves as an introductory literature review as well as providing a theoretical framework for this thesis. During its development I was invited to submit a discussion paper, on this topic, by the editor of a Special Issue of Physical Therapy reviews, which is reproduced here.

Research Question 1: What are the contemporary approaches to the application of behaviour-change methods in the development of workplace injury prevention initiatives?

2.2 Statement of authorship

Rothmore P, Karnon J, Aylward P. Implementation of Interventions to Prevent Musculoskeletal Injury at Work – Lost in Translation? *Physical Therapy Reviews*, 2013: 18(5); 344-349.

Paul Rothmore (Candidate)

Conceptualised and initiated the review, conducted literature search, wrote the manuscript and acted as corresponding author.

Signed: Date: *September 22, 2016*

Jonathan Karnon

My contribution to this paper involved manuscript evaluation. I give consent for Paul Rothmore to present this paper for examination towards the Doctor of Philosophy.

Signed: Date: *September 22, 2016*

Paul Aylward

My contribution to this paper involved manuscript evaluation. I give consent for Paul Rothmore to present this paper for examination towards the Doctor of Philosophy.

Signed: Date: *September 22, 2016*

Rothmore, P., Karnon, J. & Aylward, P. (2013). Implementation of interventions to prevent musculoskeletal injury at work – lost in translation?
Physical Therapy Reviews, 18(5), 344-349.

NOTE:

This publication is included on pages 13 - 18 in the print copy of the thesis held in the University of Adelaide Library.

It is also available online to authorised users at:

<http://dx.doi.org/10.1179/1743288X13Y.0000000092>

Chapter 3

The implementation of ergonomics advice and the stage of change approach

Publication: **Rothmore P**, Aylward P, Karnon J. The implementation of ergonomics advice and the stage of change approach. *Applied Ergonomics*, 2015: 51; 370-376.

3.1 Preface to Chapter 3

Chapter 2 has provided an overview and discussion on contemporary approaches to the application of behaviour-change theory in the development of workplace injury prevention programs. While the Stage of Change framework has been proposed - and trialled - with some positive outcomes in workplace settings it has not been translated into practice. This is, in part, due to its method of application.

This chapter describes the application of the Stage of Change framework in the development of workplace injury prevention programs in a manner which reflects professional practice. In doing so, this chapter will address the second research question of this thesis:

Research question 2: Is the implementation of practitioner advice, by companies, influenced by the targeting of advice according to a Stage of Change approach?

3.2 Statement of authorship

Rothmore P, Aylward P, Karnon J. The implementation of ergonomics advice and the stage of change approach. *Applied Ergonomics*, 2015: 51; 370-376.

Paul Rothmore (Candidate)

Conceptualised the project, collected and analysed the quantitative and qualitative data, wrote the manuscript and acted as corresponding author.

Signed: Date: *September 22, 2016*

Paul Aylward

My contribution to this paper involved assisting with qualitative data analysis and manuscript evaluation. I give consent for Paul Rothmore to present this paper for examination towards the Doctor of Philosophy.

Signed: Date: *September 22, 2016*

Jonathan Karnon

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The implementation of ergonomics advice and the stage of change approach



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ABSTRACT

This paper investigates the implementation of injury prevention advice tailored according to the Stage of Change (SOC) approach. The managers of 25 workgroups, drawn from medium to large companies across a wide range of occupational sectors were allocated to receive either standard ergonomics advice or ergonomics advice tailored according to the workgroup SOC. Twelve months after the advice was provided, semi-structured interviews were conducted with each manager. In a multivariate model, managers who had received tailored advice were found to have implemented significantly more of the recommended changes (IRR = 1.68, 95% CI 1.07–2.63) and more “additional” changes (IRR = 1.90, 95% CI 1.12–3.20). Qualitative analysis identified that the key barriers and facilitators to the implementation of changes were largely related to worker resistance to change and the attitudes of senior managers towards health and safety. The findings from this study suggest that the implementation of ergonomics recommendations may be improved by the tailoring of advice according to SOC principles.

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1. Introduction

1.1. The implementation of practitioner advice

In professional practice ergonomics and injury prevention advice commonly comprises a series of recommended changes to work systems, the work environment and individual work practices (Rothmore et al., 2013). However, even when actively sought, this advice may not be fully implemented or simply ignored (Trevelyan and Haslam, 2001). Compounding this is the absence of routine evaluation by ergonomics consultants of the implementation and effectiveness of the advice provided (Whysall et al., 2004).

The paucity of evaluation to explore the implementation of ergonomics advice provided by professional ergonomics consultants has been primarily related to client/company disinterest due to the associated costs, but also in part, due to the consultants' views that requests for evaluation might indicate a lack of confidence in the effectiveness of the interventions they had proposed (Whysall et al., 2004). Reasons for the lack of implementation of advice may include issues of cost, concerns over effectiveness, a lack of

understanding of company priorities on the part of the consultant engaged or simply a lack of “desire” on the part of the company to introduce change (Trevelyan and Haslam, 2001). These factors suggest the need for consultants to frame their advice in a manner which will maximise its potential adoption (Rothmore et al., 2013).

1.2. Behaviour change methods

Injury prevention advice typically proposes changes to the work environment, work systems and individual work practices (Rothmore et al., 2013). Such changes inevitably involve a change in behaviour.

Various methods have been proposed to improve the implementation and effectiveness of ergonomics advice according to behaviour change principles (DeJoy, 1996; Haslam, 2002; Urlings et al., 1990). The most frequently applied of the behaviour change methods in workplace settings has been Prochaska and DiClemente's Stage of Change (SOC) framework (Barrett et al., 2005; Prochaska et al., 2001; Village and Ostry, 2010; Whysall et al., 2006a, 2006b) in which readiness to change is assessed using a short series of closed questions after which they are assigned to one of five stages:

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1. Pre-contemplation (unaware or unconcerned about workplace hazards)
2. Contemplation (considering change but not yet ready to act)
3. Preparation (intend to change in the near future)
4. Action (made changes in the previous 6 months)
5. Maintenance (made changes and are working to consolidate gains and avoid relapse)

Advice is then tailored, according to the stage of change, in order to improve receptiveness. For example, while those in the more advanced stages will benefit from practical information on how to make, or maintain change, those in the earlier stages will benefit from information on the risks and hazards linked with their current behaviour and actions, which may encourage progression onto later stages.

The SOC approach has been evaluated by measuring progression through the various stages of change, post-intervention, assuming that those in more advanced stages will be more “risk aware” and therefore adopt less risky behaviour (Barrett et al., 2005; Whysall et al., 2006b). Other measures have included changes in self-reported body part discomfort or safety culture as indicators of effectiveness (Whysall et al., 2006b).

In their study of workplace interventions using the SOC approach, Whysall et al. (2006b) reported that organisations in receipt of SOC-based ergonomics advice were significantly more effective in promoting risk awareness and desired safety behaviour among their workers. Significant reductions in worker self-reported body part discomfort were also reported. These health benefits and risk awareness changes were maintained at 15 and 20 months post-intervention (Shaw et al., 2007).

Potential barriers to the implementation of advice exist not only at the consultant/client interface but also at the manager/worker level. When Whysall et al. (2006a) interviewed company managers who were responsible for implementing workplace changes designed to reduce the incidence of musculoskeletal disorders the strongest reported barriers included: resistance to change by employees; difficulties in gaining senior manager authorisation for change; and managers' attitudes to health and safety in general. While the tailoring of advice according to the SOC approach may be effective in overcoming resistance to change, empirical evidence, while encouraging, is limited.

Using a mixed methods approach the aims of this study were:

- To determine whether the rate of implementation of ergonomics and injury prevention advice provided to companies could be improved if it was tailored according stage of change principles, and
- To identify the barriers and facilitators experienced by managers in the implementation of the proposed changes

2. Methods

2.1. Sample

Purposive sampling was used to select medium-large organisations from industry groups in South Australia known to be at high risk of musculoskeletal injury according to statistical data from the State's Workers' Compensation Authority. These organisations were contacted via e-mail or telephone. Each participating organisation was asked to recruit 10 to 20 of its own employees (on a voluntary basis) who performed substantially similar tasks, were members of the same identifiable workgroup and were employed on an ongoing basis. Participating companies were classified for industry sector based on the Australian and New Zealand Industrial Classification system (Australian Bureau of Statistics, 2002).

Company size was determined based on the Australian Bureau of Statistics definitions of – medium (more than 20 but less than 200 employees), and large (more than 200 employees). Twenty-five workgroups (comprising a total of 343 workers) from a variety of industry sectors were recruited (Table 1).

2.2. Procedure

All members of the workgroups completed an individual, short questionnaire to identify their ‘Stage of Change’. Each of the participating companies was subsequently visited by the same ergonomist in a 2–3 h site visit. Based on direct observation, and informal discussions with employees, a report was prepared for the company managers detailing the observations made and suggested improvements/solutions.

Approximately equal numbers of workgroups were then randomly assigned to either the “standard” or “tailored” arm of the study. Randomisation was conducted by an independent researcher using a randomising function in Microsoft Excel.

At the time of the worksite visit and the development of the recommendations both the ergonomist and company managers were blind to the allocation of each workgroup. During the implementation of the intervention, however, blinding was not possible.

Those organisations in the “standard” group received a report with suggested control measures which were based on ergonomics principles. Organisations in the “tailored” group received a report with suggested control measures, also based on ergonomics principles, but prioritised according to the workgroup SOC profile. Where the SOC differed within a workgroup the recommended changes took account of the distribution of the workers' identified stage and included recommendations relevant to each stage present in the workgroup. These were discussed at the follow-up visit in the context of the SOC profile of the workgroup. The managers to whom the recommendations were provided were then responsible for the selection and implementation of the changes. This allowed for the provision of intervention advice at the workgroup level, with the additional benefit of preserving individual confidentiality.

A report template was developed and standardised for both the standard and tailored recommendations. These were submitted for peer review by an academic with expertise in the development of ergonomics recommendations and subsequently modified, based on feedback received, prior to their use. The following format was used for each report:

Background Information - This included the demographics of those staff who were interviewed and any other sources of information which were used in the development of the recommended changes (e.g. company job dictionaries).

Tasks observed - This comprised a list of tasks which were directly observed and those which were simulated.

Observations and Recommendations - These were subdivided into categories of known risk factors for musculoskeletal injury (Bernard, 1997) – i.e. postures, forces, repetitive movement, work organisation, the work environment and any other relevant observations.

Recommendations - These included both higher order (i.e. the introduction of engineering solutions to eliminate the risks observed) and lower order control measures (i.e. the introduction of administrative changes to reduce workplace exposure when elimination was not possible).

Standard Guidance Material – Copies of guidance material published by the State Regulatory Authority relevant to any of the recommendations made was included.

Table 1

Descriptive statistics of industry sector, nature of work and organisation size, according to the Australian and New Zealand Standard Industrial Classification (ANZSIC) and the Australian Bureau of Statistics (ABS) and manager characteristics, including age, experience and control of OHS budget.

Standard/Tailored	Industry sector	Nature of work	Workgroup size (n)	Workload ^a	Organisation size	Manager		
						Age (years)	Experience (years)	Control of OHS budget
Standard	Healthcare/Social Assistance	Nursing	10	M	Large	57	0.66	x
Standard	Professional, Scientific, Technical	Technical services	15	L	Medium	38	4	x
Standard	Public Administration & Safety	Outdoor maintenance	19	M	Large	54	20	✓
Standard	Manufacturing	Sheet steel	14	M	Large	46	3	x
Standard	Healthcare/Social Assistance	Charity collection	11	M	Large	41	3	✓
Standard	Manufacturing	Foundry	10	L	Large	50	11	x
Standard	Mining	Call centre	18	S	Large	53	8	x
Standard	Mining	Warehouse	10	M	Large	44	3	✓
Standard	Healthcare/Social Assistance	Disability services	14	M	Medium	47	0.33	✓
Standard	Manufacturing	Air-cond. maker	12	M	Large	48	5	x
Standard	Manufacturing	Snack foods	9 ^b	L	Large	32	1.8	✓
Standard	Manufacturing	Snack foods	9 ^b	L	Large	32	1.8	✓
Standard	Retail	Retail	14	L	Large	57	10	x
Tailored	Other Services	Laundry	20	M	Large	61	2.5	✓
Tailored	Manufacturing	Food manufacturer	19	M	Large	36	2	✓
Tailored	Healthcare/Social Assistance	Hospital orderlies	12	M	Large	57	0.66	x
Tailored	Healthcare/Social Assistance	Hospital services	15	M	Large	52	1.5	x
Tailored	Public Administration & Safety	Outdoor maintenance	16	M	Med.	59	2.5	x
Tailored	Public Administration & Safety	Library	15	S	Medium	59	2.5	x
Tailored	Manufacturing	Optical lenses	13	L	Medium	35	2	✓
Tailored	Other Services	Transport	19	M	Large	30	2.5	✓
Tailored	Manufacturing	Packaging	15	M	Large	44	2	✓
Tailored	Retail	Retail	13	L	Large	62	4	✓
Tailored	Manufacturing	Foundry	8 ^b	M	Large	50	11	x
Tailored	Professional, Scientific, Technical	Technical Services	13	S	Medium	38	3	x

^a Workload was categorized, according to the Dictionary of Occupational Titles, into Sedentary (S), Light (L) or Medium (M).

^b Where the workgroup size is less than 10 this is due to the unavailability of individual workers during the company visits.

Those organisations in the tailored intervention group also received explanatory notes on the SOC rationale and the workgroup SOC distribution as justification for the “tailored” recommendations. Due to the complexity of the SOC information, a follow-up visit to company managers responsible for the implementation of tailored advice was undertaken in order to explain the rationale for the SOC approach.

All managers (tailored and standard) were interviewed 12 months later to discuss the following issues (as piloted with a non-study workplace manager):

- Changes implemented, including the number, type and timing of any recommended changes which were implemented as well as any other workplace changes which had been introduced
- Changes planned but not yet implemented
- Barriers and facilitators experienced by the manager in the implementation of workplace changes
- Budgeting questions including the method of budgeting for OHS initiatives within the company and the level of manager discretionary budgetary control

2.3. Analysis

This study adopted a “mixed-methods” approach.

Quantitative data were entered in Statistical Package for the Social Sciences (SPSS) Version 20[®]. The outcome variables included the total number, type, and timing of recommended changes that were implemented, and the number and type of “additional” changes implemented by the organisations. The changes implemented were dichotomised into higher order or lower order solutions. Higher order solutions included elimination or engineering

strategies. Lower order solutions included such actions as the provision of training programs and the introduction of job rotation. The timing of the introduced changes was dichotomised into either “less than 6 months” or “6–12 months” following receipt of the report.

Initial, bivariate analyses using independent samples t-tests were conducted for each outcome variable to identify an intervention effect. Despite the randomisation of companies to the standard and tailored approaches, there remained potentially important differences in the characteristics of the companies in the two groups. Poisson regression models were fitted for each outcome variable, including a binary intervention variable (i.e. Standard or Tailored), and variables representing workload, company size, manager age/experience and budgetary control of the manager to control for potential confounding factors. In the final models statistical significance was defined as a two-tailed p-value of 0.05 or less. Group allocation (i.e. Standard or Tailored) was included in all the final models. The resultant incident rate ratios (IRR) are interpreted as the ratio of uptake in the tailored group relative to the standard group.

This study also adopted a thematic analysis of the qualitative data obtained within a realist epistemological position. Whilst the coding of the data was conducted inductively this was focused at what has been described as the semantic level (Braun and Clarke, 2006) across the whole data set with the transcribed responses of each interview being read, re-read and coded openly and independently by two members of the research team. Open coding was conducted through identifying and labelling each discrete incident, idea or concept expressed during the interview. Where labels coincided, this allowed comparison between transcripts. Conceptual labels were grouped together to develop themes which were compared between researchers. Definitions

were discussed in relation to the original data and refined. Relationships between themes were also explored, discussed and interpreted.

3. Results

3.1. Companies

Table 1 presents descriptive statistics for industry sector, nature of work, company size, and manager characteristics. Small companies (those with less than 20 employees) did not participate in this study.

3.2. Managers

Table 1 presents descriptive statistics for the participating workplace managers' age, experience and whether they had control of an OHS budget. The average age of the managers interviewed was 47.68 years (ranging from 32 to 62 years). The average length of tenure in their current position was 4.31 years (ranging from 0.33 to 20 years). There were no significant differences in the age, experience or level of personal control of the OHS budget between the managers in the standard or tailored groups.

3.3. Changes implemented – bivariate

From Table 2 it can be seen that there were no significant differences in the number, or nature, of the recommended changes proposed. There were, however, significant differences between the companies. Those in receipt of tailored advice implemented 2.95 more recommended changes (95% CI 0.21–5.69) – primarily driven by the implementation of 1.92 more lower order changes (95% CI 0.28–3.57). They also introduced 1.56 more additional (non-recommended changes) (95% CI 0.05–3.08) and 4.51 more total (i.e. recommended and additional) changes (95% CI 1.59–7.43).

3.4. Changes planned – bivariate

There were no significant differences between the companies in receipt of standard or tailored advice in the planning of future changes.

3.5. Changes implemented - multivariate

Poisson regression models, to control for manager and organisational characteristics, were developed for each of the outcome variables of interest.

Table 3 shows that managers in receipt of tailored advice introduced significantly more recommended changes (IRR = 1.68, 95% CI 1.07–2.63), more additional changes (IRR = 1.90, 95% CI 1.12–3.20) and more total changes (recommended + additional) (IRR = 2.09, 95% CI 1.43–3.10).

There was no significant difference in the implementation of higher order changes between the two groups, however, those in receipt of tailored advice implemented significantly more lower order recommended changes (IRR = 2.06, 95% CI 1.08–3.91). Managers in receipt of tailored advice implemented significantly more of the recommended higher order controls (IRR = 3.25, 95% CI 1.14–10.80) between 6 and 12 months following the receipt of the advice and significantly more additional lower order controls (IRR = 7.34, 95% CI 1.69–31.81).

3.6. Changes planned - multivariate

There were no significant differences between the standard and tailored groups in the number of workplace changes planned. However, there were significant associations between managers with control of the OHS budget and the planned implementation of future changes.

Table 2
Bivariate Analysis – Results of t-tests following the manager interviews on the implementation of workplace changes.

	Standard	Tailored	Mean diff.	p-value	95% C.I.	
	Mean (SD)	Mean (SD)			Lower	Upper
<i>Recommended changes in report</i>						
Recommended changes	8.15 (3.31)	9.58 (4.74)	1.43	0.388	–1.93	4.79
Higher order	3.92 (1.75)	4.50 (2.61)	0.58	0.520	–1.25	2.40
Lower order	4.23 (2.09)	5.08 (2.87)	0.85	0.402	–1.21	2.92
<i>Workplace changes implemented</i>						
Recommended changes	2.38 (3.04)	5.33 (3.58)	2.95	0.036^a	0.21	5.69
Less than 6 months	1.62 (2.60)	3.25 (2.38)	1.63	0.116	–0.43	3.70
6–12 months	0.77 (2.05)	2.08 (2.77)	1.31	0.142	–0.47	3.10
Higher order recommended changes	1.31 (1.60)	2.33 (2.02)	1.03	0.171	–0.47	2.53
Less than 6 months	1.00 (1.53)	1.25 (1.42)	0.25	0.677	–0.97	1.47
6–12 months	0.31 (0.85)	1.08 (1.38)	0.78	0.111	–0.20	1.75
Lower order recommended changes	1.08 (1.75)	3.00 (2.22)	1.92	0.024^a	0.28	3.57
Less than 6 months	0.62 (1.39)	2.00 (1.54)	1.38	0.027 ^a	0.17	2.59
6–12 months	0.46 (1.20)	1.00 (1.04)	0.54	0.245	–0.40	1.47
Additional changes	0.77 (1.09)	2.33 (2.39)	1.56	0.044^a	0.05	3.08
Higher order	0.62 (0.96)	0.92 (1.16)	0.30	0.486	–0.58	1.18
Lower order	0.15 (0.38)	1.42 (2.27)	1.26	0.083	–0.19	2.72
Total changes (recommended + additional)	3.15 (2.73)	7.67 (4.23)	4.51	0.004^a	1.59	7.43
<i>Workplace changes planned</i>						
Recommended changes	0.62 (1.04)	1.33 (1.72)	0.72	0.228	–0.49	1.93
Higher order	0.31 (0.85)	0.67 (1.23)	0.36	0.403	–0.51	1.23
Lower order	0.31 (0.63)	0.67 (1.30)	0.36	0.400	–0.52	1.24
Additional changes	1.85 (1.34)	2.58 (2.02)	0.74	0.300	–0.71	2.19
Higher order	0.85 (1.07)	0.83 (1.27)	–0.01	0.979	–0.99	0.96
Lower order	1.00 (1.15)	1.75 (2.09)	0.75	0.288	–0.69	2.19
Total changes (recommended + additional)	2.56 (2.18)	3.92 (3.32)	1.46	0.204	–0.85	3.76
Total recommended changes – (implemented + planned)	3.00 (3.51)	6.67 (4.74)	3.67	0.037^a	0.24	7.098

^a Significant at the 0.05 level (2-tailed).

Table 3
Multivariate Analysis – Results of Poisson regression models to control for manager and organisational characteristics.

	Group		Recommendations		Workload		Company size		Manager age (years)		Manager tenure (years)		Control of OHS budget		
	IRR	95% CI	p-value	IRR	p-value	IRR	p-value	IRR	p-value	IRR	p-value	IRR	p-value	IRR	p-value
<i>Workplace changes implemented</i>															
Recommended changes implemented	1.68	1.07–2.63	0.024 ^a	1.14	0.000 ^a										
Less than 6 months	0.99	0.53–1.85	0.981	1.06	0.184	1.53	0.267	1.19	0.691	3.01	0.002 ^a	0.503	0.091	1.59	0.172
6–12 months	3.17	1.34–7.49	0.008 ^a	1.36	0.000 ^a			0.23	0.004 ^a			4.939	0.002 ^a		
Higher order changes implemented	1.38	0.64–3.00	0.415	1.35	0.001 ^a					1.88	0.076	1.631	0.249	1.56	0.196
Less than 6 months	0.58	0.24–1.41	0.228	1.39	0.002 ^a					3.64	0.008 ^a			1.77	0.187
6–12 months	3.25	1.14–10.80	0.028 ^a												
Lower order changes implemented	2.06	1.08–3.91	0.028 ^a	1.15	0.000 ^a										
Less than 6 months	1.43	0.61–3.38	0.416	1.17	0.042 ^a	1.78	0.360			1.98	0.075	0.300	0.048 ^a		
6–12 months	1.71	0.46–6.37	0.422	1.92	0.000 ^a	0.27	0.184	0.13	0.022 ^a			3.059	0.175	2.98	0.182
Additional changes implemented	1.90	1.12–3.20	0.017 ^a	1.11	0.000 ^a										
Higher order	2.70	0.98–7.46	0.055			0.26	0.005 ^a	3.98	0.047 ^a						
Lower order	7.34	1.69–31.81	0.008 ^a			4.29	0.019 ^a	0.25	0.007 ^a						
Total changes implemented – recommended and additional	2.09	1.43–3.10	0.000 ^a	1.08	0.000 ^a										
<i>Workplace changes planned</i>															
Recommended changes planned	0.16	0.64–3.88	0.330	1.16	0.002 ^a	6.77	0.068								
Higher order	1.84	0.55–6.12	0.322			1.07	0.939	0.17	0.094	4.77	0.042 ^a	1.556	0.637	6.55	0.023 ^a
Lower order	0.90	0.17–4.77	0.902	1.32	0.103			1.62	0.218					2.65	0.002 ^a
Additional changes planned	1.41	0.82–2.41	0.213					7.78	0.047 ^a	0.44	0.080				
Higher order	1.38	0.58–3.30	0.468												
Lower order	1.67	0.84–3.33	0.147												
Total changes planned – rec. and additional	1.33	0.83–2.13	0.235	1.06	0.021 ^a										
<i>Workplace changes implemented and planned</i>															
Total rec. changes implemented and planned	1.66	1.11–2.47	0.014 ^a	1.15	0.000 ^a										

NB – Recommendations column refers to the number of recommendations made specific to each category – i.e. total, higher order or lower order.

^a Significant at the 0.05 level (2-tailed).

3.7. Barriers and facilitators

3.7.1. Barriers

The themes which emerged addressing barriers from accounts provided by managers were similar between the standard and tailored intervention companies. However, the number of managers who reported experiencing specific barriers was different, with five of the 13 managers in the standard advice group reporting that they faced no specific barriers when implementing OHS-related changes compared with only one manager in the tailored advice group.

Barriers were conceptualized at organisational, workgroup managerial or employee-level.

At the organisational level the most frequently mentioned barrier related to budgetary constraints and resources:

At the workgroup managerial level the difficulty in overcoming entrenched attitudes were highlighted:

“Middle Managers are always focussed on production targets but these must be achieved with safety in mind.” (Company 2)

Barriers at the employee level were also specifically highlighted:

“Employees have been resistant to changes like job rotation and a reduction in the need to lift heavy items ... Staff have complained of increased discomfort due to a lack of exercise ... and that they are becoming fat.” (Company 1)

3.7.2. Facilitators

At the organisational level themes relating to facilitation of change were most frequently related to a direction from senior management:

“New Senior Management team is more safety aware ... this is a national directive.” (Company 3)

At the workgroup managerial level general awareness and communication were highlighted as important facilitators:

“There has been a definite increase in the awareness of risk among managers. The ergonomics report and associated information was tabled at manager’s meeting.” (Company 1)

Similar factors were reported at the employee level:

“OHS is now a monthly agenda item which has improved consultation – both by staff who can raise issues and by management who can advise staff of upcoming activities.” (Company 4)

4. Discussion

This paper has reported on a mixed methods evaluation of injury prevention advice tailored according to the SOC approach. The randomised quantitative component found that at 12-month follow-up, the companies in receipt of tailored advice had implemented recommended changes at a rate more than 60% higher than the standard group. This higher rate of implementation was seen primarily in the introduction of lower order changes, which were introduced at more than twice the rate in the tailored group. When the time to implementation was dichotomised into <6 months or 6–12 months following the receipt of advice, companies in receipt of tailored advice had introduced higher order changes at more than three times the rate of those in receipt of standard advice in 6–12 months. This is consistent with the forward budgetary

planning required for more expensive higher order changes to workplace environments.

Differences in the implementation of “additional” changes – workplace modifications designed to reduce the burden of musculoskeletal disorders, but which were not specifically recommended – between the two groups was marked. Those companies in the tailored group had implemented additional changes at nearly twice the rate when compared with the standard group. We propose that this may be indicative of a larger effect of the behaviour change approach. This suggests the potential for incorporation and integration of behaviour change information as part of a decision-making process within companies rather than just as a means of encouraging the implementation of specified advice.

When the additional changes were dichotomised as higher order or lower order their implementation was also related to company size. Higher rates of implementation for higher order changes were seen in larger companies with a corresponding lower rate of introduction for lower order changes. Large companies also planned the introduction of additional higher order changes at significantly higher rates than medium sized companies. While not specifically confirmed in our study this is probably related to greater financial resources and in-house expertise.

Even when actively sought, proposed workplace changes may not be implemented (Haslam, 2002; Whysall et al., 2006a). In their exploratory study, Whysall et al. (2006a) analysed the barriers and facilitators reported by workplace managers responsible for the introduction of ergonomics changes. They reported that the barriers and facilitators were primarily related to managerial commitment, managerial attitudes and workers’ resistance to change. It was suggested that the use of behaviour change theories in the development of workplace interventions may facilitate their implementation. In our qualitative component, we identified similar themes. However, in contrast to the findings of Whysall et al. (2006a) who reported worker resistance as the most commonly cited barrier to the implementation of workplace change, in our study budgetary constraint was the dominant barrier. This is unsurprising considering that our study occurred at the zenith of the global financial crisis when many companies were experiencing severe financial strain. Of particular interest however, is the relatively large proportion of managers (5/13) in the standard arm of the study who reported having experienced ‘no specific barriers’ to the implementation of workplace changes. Logically, this should have allowed the introduction of the recommended changes at a greater rate than in the tailored group. In fact, those who reported experiencing ‘no specific barriers’ had implemented, or had plans to implement, only one of the 32 recommended changes they received. Rather than not having experienced barriers we suggest that these OHS managers may have been more likely to have been unaware of workplace barriers themselves. Paradoxically, we have reported a higher rate of implementation for the recommended workplace changes among those managers who reported experiencing more barriers – those in the tailored group. The majority of these managers (8/12) reported that the information they received on the ‘stage of change’ distribution of their respective workgroups was useful, and had either influenced their choice of workplace changes or had influenced others in their organisation. This is supported by the results of the multivariate analysis.

Ergonomics consultants proposing workplace changes frequently have little influence over their implementation. Even when actively sought, ergonomics and injury prevention recommendations may not be fully implemented, or are simply ignored (Rothmore et al., 2013; Trevelyan and Haslam, 2001). Possible reasons include the perceived effectiveness of the recommendations or simply a lack of desire on the part of the company to

introduce change (Rothmore et al., 2013). Strategies to improve the implementation of advice are therefore needed.

4.1. Comparison to existing studies

Previous studies using the SOC approach in workplaces have shown its potential benefits by either applying it to pre-existing company plans (Whysall et al., 2006c) or by demonstrating its ability to identify worker readiness to change as a prelude to development of an intervention (Village and Ostry, 2010). While these methods provide a useful demonstration for its potential effectiveness in the development of workplace interventions they are not reflective of professional practice where consultants are engaged to provide specific advice on changes to the work environment. Consequently, practitioners may not see this approach as being immediately and directly relevant to their own practice. In our study, we have applied the SOC approach in a manner more closely aligned with professional practice where consultants are engaged to observe and evaluate the work environment and provide recommendations for its improvement.

5. Limitations

While comparable reports were provided to companies in the standard and tailored groups it was decided to supplement these for companies in receipt of the tailored advice with a visit to explain its rationale (they had been previously blinded to their group allocation). Standard practice amongst consultants varies and may include sending final reports or arranging follow-up visits to present and discuss their findings. For pragmatic reasons we elected to send reports to those in the standard group. It is possible that if the managers in the standard practice group had also received an additional visit, the observed effect size may have been reduced.

Studies conducted in dynamic work environments are also subject to the effects of uncontrolled workplace changes including company policy changes and general workplace improvements. While we were unaware of such changes in our sample they were not specifically accounted for in our analyses.

Our sample of 25 workgroups from a variety of industry sectors is similar in size to previously reported studies which have incorporated the SOC approach in occupational settings (Whysall et al., 2006b). While promising, there is a need to replicate our findings in a larger study in order to account for any potential imbalances, despite randomisation, in the standard and tailored arms of our study.

We considered that small companies (those with less than 20 employees) would be less likely to employ OHS consultants and would pose greater challenges in the recruitment of sufficiently large workgroups. They were therefore not included in our study. Our results are therefore not generalisable beyond medium-large organisations.

6. Conclusions

The results of this study suggest that the tailoring of advice according to behaviour-change principles can improve its

implementation. Not only were recommended changes implemented at a higher rate in companies which received tailored advice but they also introduced more additional changes (i.e. changes which were not specifically proposed). This may be indicative of a larger effect for the behaviour change approach within organisations. Larger studies are needed to confirm this.

The field of musculoskeletal injury prevention is dominated by practitioners with an ergonomics or physical/occupational therapy background. Consequently the development of interventions with a behavioural focus may not be seen as immediately relevant in professional practice although it has been suggested that this may be more related to a lack of suitable techniques in their repertoire.

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Chapter 4

A long-term evaluation of the stage of change approach and compensable injury outcomes – a cluster randomised trial

Publication: **Rothmore P**, Aylward P, Gray J, Karnon J. A long-term evaluation of the stage of change approach and compensable injury outcomes – a cluster randomised trial. *Ergonomics*, DOI: 10.1080/00140139.2016.1199816.

4.1 Preface to Chapter 4

In the previous chapters, the limitations associated with existing applications of the Stage of Change approach were discussed and the results of a study in which this method was applied in a manner relevant to practitioners was presented.

The differing rates of advice implementation reported in Chapter 3 is a key finding - even expert advice is ineffective if it is not implemented. While methods to improve the implementation of advice are important to practitioners, an evaluation of the effectiveness of this advice is required. The measurement of, and changes in, self-reported musculoskeletal pain and discomfort is frequently used by practitioners, and reported in the literature, to evaluate the effectiveness of interventions. However, the evidence to support this measure as a predictor of compensable injury is equivocal. The aim of this chapter is to present the results of a long-term follow-up of injury rates and to examine other predictors of injury. This chapter will address the third research question:

Research question 3: What are the differences in the long-term health outcomes associated with the Stage of Change approach in respect to compensable musculoskeletal injuries?

4.2 Statement of authorship

Rothmore P, Aylward P, Gray, J, Karnon J. A long-term evaluation of the stage of change approach and compensable injury outcomes – a cluster randomised trial. *Ergonomics*, DOI: 10.1080/00140139.2016.1199816.

Paul Rothmore (Candidate)

Conceptualised the project, collected and analysed the quantitative and qualitative data, wrote the manuscript and acted as corresponding author.

Signed: Date: *September 22, 2016*

Paul Aylward

My contribution to this paper involved assisting with qualitative data analysis and manuscript evaluation. I give consent for Paul Rothmore to present this paper for examination towards the Doctor of Philosophy.

Signed: Date: *September 22, 2016*

Jodi Gray

My contribution to this paper involved assisting with quantitative data analysis, data collection and manuscript evaluation. I give consent for Paul Rothmore to present this paper for examination towards the Doctor of Philosophy.

Signed: Date: *September 22, 2016*

Jonathan Karnon

My contribution to this paper involved assisting with quantitative data analysis and manuscript evaluation. I give consent for Paul Rothmore to present this paper for examination towards the Doctor of Philosophy.

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Chapter 5

The stage of change approach for implementing ergonomics advice – translating research into practice

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5.1 Preface to Chapter 5

The previous chapters have outlined contemporary applications of the Stage of Change approach (Chapter 2), an analysis of implementation rates for injury prevention advice which has been tailored according to this approach (Chapter 3) and a long-term evaluation of the health outcomes for workers, with respect to compensable injuries (Chapter 4). A central theme of this thesis is the translation of research findings into practice. The aim of this chapter is to investigate the barriers and facilitators to the adoption of a Stage of Change approach by practitioners, thereby addressing Research Question 4:

Research question 4: What are the barriers and facilitators to the adoption of the Stage of Change approach in the development of musculoskeletal injury prevention interventions by practitioners and what is the potential utility of a Stage of Change assessment tool?

5.2 Statement of authorship

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Paul Rothmore (Candidate)

Conceptualised the project, collected and analysed the quantitative and qualitative data, wrote the manuscript and acted as corresponding author.

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Paul Aylward

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Jodi Oakman

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My contribution to this paper involved manuscript review and evaluation. I give consent for Paul Rothmore to present this paper for examination towards the Doctor of Philosophy.

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5.3 Publication

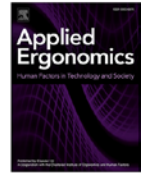
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The stage of change approach for implementing ergonomics advice – Translating research into practice



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ABSTRACT

The Stage of Change (SOC) approach has been proposed as a method to improve the implementation of ergonomics advice. However, despite evidence for its efficacy there is little evidence to suggest it has been adopted by ergonomics consultants. This paper investigates barriers and facilitators to the implementation, monitoring and effectiveness of ergonomics advice and the adoption of the SOC approach in a series of focus groups and a subsequent survey of members of the Human Factors Societies of Australia and New Zealand. A proposed SOC assessment tool developed for use by ergonomics practitioners is presented.

Findings from this study suggest the limited application of a SOC based approach to work-related musculoskeletal injury prevention by ergonomics practitioners is due to the absence of a suitable tool in the ergonomists' repertoire, the need for training in this approach, and their limited access to relevant research findings. The final translation of the SOC assessment tool into professional ergonomics practice will require accessible demonstration of its real-world usability to practitioners and the training of ergonomics practitioners in its application.

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1. Introduction

Work-related musculoskeletal disorders (MSDs) are a major cost burden to individuals, businesses and society (National Research Council and the Institute of Medicine, 2001; Woolf and Pfleger, 2003). In the European Union MSDs are the most frequently reported health problem among workers (Eurofound, 2012). In the USA, over the preceding decade, they have accounted for more than one-third of all work-related injuries resulting in work absence (National Institute for Occupational Safety and Health, 2004). While in Australia they are one of eight nationally recognised priority occupational diseases, accounting for total costs of more than \$61.8 billion each year (Safe Work Australia, 2015).

The contribution of physical and psychosocial risk factors to the development of MSDs and the importance of implementing multi-factorial interventions in their prevention is widely acknowledged

(Silverstein and Clark, 2004; Westgaard and Winkel, 2011; Macdonald and Oakman, 2015). Although some successes in the implementation of MSD prevention strategies have been reported (Silverstein and Clark, 2004; Denis et al., 2008; Palmer et al., 2012) MSDs remain a significant workplace issue (Wells, 2009). Wells (2009) proposed that this limited success may be associated with low rates of implementation. In other words, there is a gap between the proposed interventions designed by ergonomists and those which are implemented by organisations (Rothmore et al., 2013; Oakman et al., 2016).

Issues related to implementation include the level of awareness of ergonomics issues (Whysall et al., 2004), organisational attitudes (Perrow, 1983), and political, social and contextual issues (Theberge and Neumann, 2010). While several authors have proposed methods to improve the effectiveness of ergonomics interventions in organisational settings these have been primarily researcher-driven with little consideration for the transferability of their findings into daily professional practice (Theberge and Neumann, 2010). As an example, while Broberg and Hermund (2004)

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proposed the concept of OHS consultants as “political reflective navigators” this requires the consultant to navigate complex organisational structures in order to pursue an agenda while others in the organisation pursue different agendas (Theberge and Neumann, 2010). While useful when the consultant is embedded within an organisation throughout a project it is less so for short-term, routine consulting practice where an evaluation of the implementation and effectiveness of the advice provided is scarce (Whysall et al., 2004).

Several authors have proposed the structuring of injury prevention advice according to behaviour-change principles as a means of improving the implementation and effectiveness of interventions designed to reduce the burden of musculoskeletal injuries (Haslam, 2002; Rothmore et al., 2015; Oakman et al., 2016). The most frequently applied behaviour change method in the workplace setting has been Prochaska and Di Clemente's (1982) Stage of Change (SOC) framework (Whysall et al., 2006; Village and Ostry, 2010; Rothmore et al., 2015). This was originally developed to improve the effectiveness of public health strategies such as smoking cessation (Prochaska et al., 1993) and reducing alcohol consumption (Heather et al., 2009). In such applications individual readiness to change is assessed and the intervention targeted at the individual only. However, in the workplace setting, while individual readiness to change is assessed, the intervention is aimed at the workgroup (Oakman et al., 2016). An additional layer of complexity arises with consideration of the organisational context where organisational readiness to change is reflected in the views of supervisors and managers on the nature and extent of workplace practices and changes (Haslam, 2002).

In the SOC framework, readiness to change is assessed using a short series of closed questions after which the respondent is assigned to one of five stages:

1. Pre-contemplation - unaware or unconcerned about workplace hazards
2. Contemplation - considering change but not yet ready to act
3. Preparation - intend to change in the near future
4. Action - made changes in the previous 6 months
5. Maintenance - made changes and are working to consolidate gains and avoid relapse

Once the stage of change has been determined, advice can be tailored accordingly. For example, those in the earlier stages will benefit from information on the risks and hazards associated with their current actions and behaviours in order to encourage progression to the later stages. Conversely, those in the more advanced stages will benefit from practical information on how to make, or maintain the changes already made.

Studies which have used this approach have shown benefits in the implementation (Rothmore et al., 2015) and outcomes (Whysall et al., 2006; Doda et al., 2015) of workplace interventions. In their UK study, Whysall et al. (2006) applied the SOC framework to pre-existing company plans. When evaluated four to six months after implementation they demonstrated some support for moving employees from pre-contemplation to action and reduced discomfort levels. These were maintained at 15 and 20-months follow-up (Shaw et al., 2007). In an Australian study, Rothmore et al. (2015) described the implementation of ergonomics interventions by the OHS managers of 25 workgroups who had been randomly assigned to receive either 'standard' ergonomics advice (i.e. advice based on ergonomics principles) or 'tailored' advice (i.e. advice based on ergonomics principles but prioritised according to the workgroup's SOC profile). An important difference from Whysall's study was the development of the interventions as an integrated component. This is more closely aligned with professional

practice where consultants are engaged to identify problems and develop solutions. In this study all workgroup members completed an individual questionnaire to identify their SOC. The participating companies were subsequently visited by a single ergonomist (PR) in a 2–3 h site visit. Based on direct observations and discussions with employees and managers a report was prepared for the OHS manager. The report included details of the observations undertaken and the proposed changes. The companies were then randomly assigned to receive 'standard' or 'tailored' reports. Those companies which had been randomly assigned to receive tailored reports (n = 12) received additional information on the SOC profile of the workgroup as justification for the tailoring of the recommendations. This was not provided to companies in the standard group (n = 13). Where the SOC differed within the workgroup recommendations relevant to each stage present were provided. For example, in the description of the development of a tailored intervention described by Oakman et al. (2016) the distribution was as follows: six workers in contemplation/preparation stage, two in action, and 11 in maintenance. Consequently, the recommended changes took account of all three stages present in the workgroup. At 12 months follow-up, those who had received tailored advice had implemented the recommended changes at a significantly higher rate than those who had received standard ergonomics advice. Doda et al. (2015) subsequently analysed the associated health benefits. They reported that workers in companies which had received tailored advice were 40% less likely to report lower back pain than those in companies which had received standard ergonomics advice. Where the limited success in reducing the MSD burden has been associated with a failure to implement advice (Wells, 2009) and follow-up by consultants are scarce (Whysall et al., 2004) methods to improve the uptake are important. However, evidence that this approach has been adopted by health and safety practitioners in their routine practice is limited.

Potential barriers to the adoption of such an approach include the focus of ergonomics practitioners on the domain of practice in which they are most expert – the physical environment – and the lack of an assessment tool designed for use 'in the field.' The adoption of a method to frame and structure ergonomics advice according to behaviour-change theory will require a paradigm-shift. The process of translating research into practice has been proposed as intrinsically linked to the practice of ergonomics (Wilson, 2000) and to the future of the profession (Caple, 2008). Despite this, evidence suggests a 'disconnect' between researchers and practitioners which impedes the translation of research findings into practice (Salas, 2008).

The translation of research-based findings into professional practice will require an approach which bridges the 'research-practice gap' by both actively engaging ergonomics practitioners in research and improving the dissemination of findings.

Taking the above factors into account, the aims of this study were to translate the evidence-base for the SOC approach into professional practice by:

1. Identifying barriers and facilitators to the implementation, monitoring and effectiveness of ergonomics advice in preventing work-related MSDs
2. Identifying barriers and facilitators to the implementation of behaviour-based injury prevention advice by ergonomics practitioners
3. Obtaining the perspectives of ergonomics practitioners on the development and transferability of a behaviour-based assessment tool into professional practice

2. Methods

The engagement and participation of ergonomics practitioners was an integral part of the research process. They were engaged in a series of focus groups; contributed to the development of a proposed SOC assessment tool, and; participated in a survey of members of HFESA/HFESNZ.

2.1. Focus groups

Three focus groups were conducted with ergonomics practitioners purposely sampled from existing networks of the research team. In order to obtain a variety of perspectives and to assist in the translation of the study findings to the broad professional community they were conducted in three separate locations:

1. The University of Adelaide, Adelaide, South Australia
2. La Trobe University, Melbourne, Victoria
3. Massey University, Auckland, New Zealand

Each focus group, facilitated by the same researcher (PR), was between 45 and 60 min in length. A semi-structured interview schedule was used to guide the discussion, and participants were encouraged to elaborate on their own perspectives and experiences collectively and explore the areas interactively. A SOC assessment tool ‘concept’ was provided to participants for discussion and comment.

Audio recordings were transcribed prior to thematic analysis using the Framework Method (Ritchie and Lewis, 2003). The Framework Method is a systematic approach to data interpretation that identifies commonalities and differences in data before focussing on the identification of relationships and the development of themes.

Each focus group transcript was analysed separately prior to final synthesis. The findings from the focus groups were used to refine the SOC assessment tool and inform the development of a web-based survey.

2.2. Web-based survey

The survey of ergonomics practitioners, hosted on Survey Monkey, was developed according to Dillman’s Tailored Design Method (Dillman and Smyth, 2007) which has been previously used for survey development in a similar population (Chung and Shorrock, 2011). Academics familiar with both ergonomics and research methodologies reviewed the survey for refinement. The survey was then piloted with 13 ergonomics practitioners who had participated in the focus groups. The majority were from a physiotherapy or occupational therapy background (n = 7, 54%).

The final version of the survey comprised 27 questions in four sections:

1. How do you develop and monitor the effectiveness of your advice?
2. The Stage of Change approach
3. Scope of practice
4. Demographics

All members of HFESA/HFESNZ (n = 713) were sent a link to the web-based survey by HFESA/HFESNZ. In order to encourage questionnaire completion, respondents were provided the option to skip questions where they chose. Follow-up reminders to complete the survey were sent at 7-day intervals (HFESA twice; HFESNZ once).

Survey responses were analysed using descriptive statistics in

STATA 13.1 (StataCorp). The Wilcoxon-Mann-Whitney test (ordinal outcomes), Pearson’s chi-square test (categorical outcomes) and Fisher’s exact test (categorical outcomes with expected low frequencies) were used to identify statistically significant differences between internal and external consultants regarding the prioritisation, monitoring and evaluation of intervention advice.

2.3. The stage of change assessment tool

In section 2 of the survey, respondents were asked to view the proposed SOC assessment tool (Supplementary Material) and provide feedback.

3. Results

3.1. Focus groups

3.1.1. Participant characteristics

In total, 23 ergonomics practitioners participated in the focus groups – five in Adelaide, nine in Melbourne and nine in Auckland. Thirteen females and ten males participated with a mean age of 46 years (range = 26 to 58) and a mean of 16 years of experience (range = 1 to 30). Participants were employed in a range of sectors both public and private. The majority of participants were from a physiotherapy/occupational therapy background (n = 11, 48%).

3.1.2. Developing interventions

Participants consistently reported that when developing interventions they sought to target the advice according to the risk profile and attitudes of the managers and workers. Terms such as understanding the company ‘context’ and being able to ‘sell’ it to the audience were used. The importance of providing persuasive, targeted advice was emphasised:

“... getting buy-in or getting insight into why people don’t perceive something as a risk and understanding that context for them because their world view will be very different to mine.” (Melbourne Focus Group Participant)

“At any given time you’re only as good as your audience and the people you’ve been able to involve and engage.” (Melbourne Focus Group Participant)

Participants consistently described that the main method for prioritising advice was based on ease of implementation:

“Do the easy, the low hanging fruit, you do the easy things.” (Auckland Focus Group Participant)

3.1.3. Monitoring implementation

Participants consistently reported being unaware as to whether their advice was implemented. Main reasons described by participants were a lack of opportunity for follow-up and the very tight timeframes under which they were engaged. Participants reported a reluctance of employers to pay for formal monitoring or evaluation of intervention effectiveness:

“In a consulting role you get in, hit hard, and get out again. You don’t have much involvement in terms of what a program might achieve.” (Melbourne Focus Group Participant)

“You don’t necessarily know and at the end of the day you’ve provided recommendations and sometimes you don’t get much say beyond that, do you?” (Auckland Focus Group Participant)

Other participants relied on informal processes to identify success:

“Often you unlock a champion, or someone there that will keep you informed, as well as the progress of, you know, the changes that have been implemented and how they are working.” (Auckland Focus Group Participant)

In addition, some participants considered an ‘a priori’ lack of client intention to act was present:

“Companies might commission a review by a consultant – but they won’t do it ... they just want to be seen to be doing something.” (Adelaide Focus Group Participant)

3.1.4. Evaluating effectiveness

Given the difficulties monitoring implementation, a consistent theme emerged across all three focus groups that consultants were unsure about the effectiveness of their advice. Participants considered this was due to the nature of consulting contracts and the reluctance of employers to pay for formal evaluation following the intervention:

“As an external consultant usually you have very little feedback let alone opportunities for investigating the effectiveness of the outcome.” (Adelaide Focus Group Participant)

“Companies don’t want to know if something is not working.” (Auckland Focus Group Participant)

Consultants tended to rely on informal measures such as repeat business:

“They call you back if they are happy with you.” (Adelaide Focus Group Participant)

Repeat business was also used by some as an opportunity to evaluate previously provided advice as described by one participant:

“So you get asked back and then you can check on the other things you have done.” (Auckland Focus Group Participant)

A further theme also emerged suggesting that consultants may not be aware of suitable evaluation methods – for example there may be an over-reliance on the use of lagging indicators such as claim numbers and lost hours. While useful for economic evaluation, they are reliant on long-term follow-up and overlook the potential for leading indicators such as the number of changes which have been implemented:

“I don’t think a lot of practitioners have good evaluation research skills.” (Melbourne Focus Group Participant)

Overall, participants reported they had low levels of influence over whether their advice was implemented and limited awareness of its effectiveness:

“From a consultancy point of view, you make an intervention, it might be successful, you don’t know, you don’t hear.” (Auckland Focus Group Member)

3.1.5. Ergonomics tools

Participants in each of the focus groups identified a wide range of ergonomics tools they commonly used in practice. The tools included both physical and psychosocial assessment methods. In describing how consultants made choices about their tools a range of responses were provided. Some participants focussed on the scientific rigour of methods:

“Validation, I think, is an important thing.” (Auckland Focus Group Participant)

Others, adopted a more pragmatic approach:

“It’s because that’s what you learnt.” (Auckland Focus Group Participant)

Irrespective of competing reasons, participants identified the main characteristics required of field-based tools were ease-of-use and the ability to add impact to the recommendations.

Participants considered that adoption of the SOC approach by practitioners would depend on whether this approach would enhance the quality of their services and improve the relevance of their reporting:

“I think it will be very acceptable to people if they see a clear advantage to being able to classify people in order to channel your recommendations instead of just writing, you know, two pages of recommendations.” (Adelaide Focus Group Participant)

3.2. Web based survey

3.2.1. Participant characteristics

A total of 219 survey responses were obtained from 636 HFESA and 77 HFESNZ members. The overall response rate was 31%. In order to encourage completion of the web-based survey responses to all questions were not mandatory. Therefore, response rates to each question varied from 219 in places where respondents chose not to provide an answer (range: 165–219).

Participants’ background was mostly physiotherapy or occupational therapy (n = 85, 39%). Most participants were members of HFESA (n = 150, 69%) compared to HFESNZ (n = 12, 6%). Slightly more females participated (n = 95, 43%) than male (n = 73, 33%). Participants’ mean age was 49 years (SD = 11, range = 24 to 80), with a mean of 18 years practice in the occupational health and ergonomics field (SD = 10, range = 2 to 45). Participants worked in both external (n = 74, 34%) and internal (n = 85, 39%) consulting roles. Participants’ work was primarily focussed in the physical domain of ergonomics practice (Fig. 1) with a median of 60% of their time (IQR = 33%–80%), much higher than time spent in the organisational (median = 20%, IQR = 15%–40%) or cognitive domains (median = 15%, IQR = 10%–25%).

Participants practiced ergonomics across all industries including education and training (n = 89, 41%), transport, postal and warehousing (n = 95, 43%), administrative and support services (n = 106, 48%), manufacturing (n = 108, 49%), or health care and social assistance (n = 115, 53%). Participants primarily practiced in the application areas of musculoskeletal disorders (n = 148, 68%) and safety and health (n = 146, 67%).

3.2.2. Advice provided to clients

Table 1 provides a summary of survey responses on the prioritising, implementation and effectiveness of advice provided to clients.

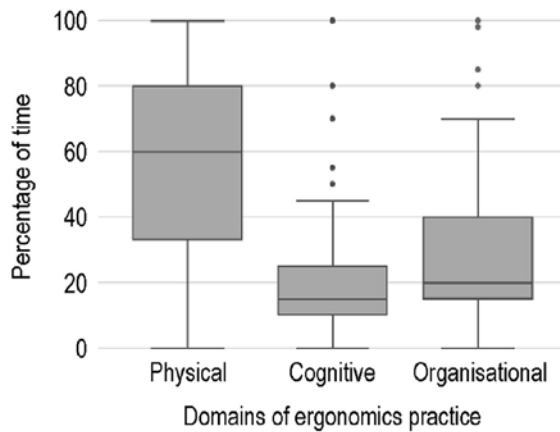


Fig. 1. Percentage of participants' time spent in each domain of ergonomics practice. Response not provided for $n = 48$.

Participants indicated that when developing advice for clients they undertook a prioritisation process ($n = 187$, 85% always or usually), regardless of whether they were internal or external consultants ($p = 0.119$). Prioritisation of advice was undertaken using three approaches:

- Risk management approach ($n = 158$, 72%) - where recommendations are prioritised according to the likely risk of injury
- Hierarchy of controls approach ($n = 98$, 45%) - where recommendations are prioritised according to the effectiveness of the control measures, and
- Perceived ease of implementation ($n = 79$, 36%) - where recommendations are prioritised according to level of difficulty associated with their implementation

Additionally, some participants reported taking into account the costs involved, a point consistent with the findings from the focus group discussions.

Internal consultants were more likely to know whether the advice they provided was implemented, compared to external consultants (internal: $n = 50$, 59% always or usually; external: $n = 33$, 45%; $p = 0.021$). While internal consultants monitored implementation as part of their role within the organisation ($n = 51$, 60%), external consultants gathered information regarding implementation by either following up with the client directly ($n = 44$, 60%) or receiving unsolicited feedback from the client ($n = 19$, 26%). Where external consultants reported specific barriers to monitoring the implementation and effectiveness of their advice, 20% ($n = 44$) reported this was related to the nature of their external role, 18% ($n = 39$) reported it was not part of the brief, and 16% ($n = 34$) reported that the company did not supply the information. In total, 35% ($n = 77$) of consultants (internal and external) experienced difficulty with monitoring the implementation of their advice due to companies not providing relevant information.

Evaluation of intervention effectiveness was more likely to be done by internal consultants (internal: $n = 61$, 72%; external: $n = 32$, 43%; $p < 0.001$). External consultants were reliant on following up with the client directly ($n = 44$, 60%) or receiving unsolicited feedback ($n = 15$, 20%), while internal consultants monitored effectiveness as part of their role within the organisation ($n = 51$, 60%). Both internal and external consultants reported the cost to the company (internal: $n = 29$, 13%; external: $n = 37$, 17%) and disinterest by the company (internal: $n = 41$, 19%; external:

$n = 45$, 21%) as barriers to monitoring intervention effectiveness.

3.3. The stage of change assessment tool

Table 2 provides a summary of survey responses to the behaviour change process and the SOC Assessment Tool provided in the survey.

Many survey participants were not aware of any behaviour change models ($n = 98$, 45%). Of those respondents with an awareness of behaviour change models, the Prochaska and Di Clemente (1982) Stage of Change model was the most well-known ($n = 80$, 37%).

After viewing the proposed SOC assessment tool itself (Supplementary Material), 21% ($n = 45$) of survey participants reported that the application of behaviour change principles was outside their current area of expertise. Additionally, participants reported that the absence of readily available published research in this area ($n = 44$, 20%) demonstrating practical application ($n = 23$, 11%) were barriers to their use of such a tool.

The primary facilitator to its use was the availability of an easy to use tool, with clear instructions, designed for use in the field ($n = 130$, 59%). Other important factors included access to research demonstrating the practical application of the tool ($n = 111$, 51%) and training ($n = 90$, 41%). Few participants indicated they would be unlikely to use the tool ($n = 38$, 17%), with the majority either likely ($n = 80$, 37%) or uncertain ($n = 57$, 26%).

4. Discussion

This paper has investigated barriers and facilitators to the implementation and monitoring of ergonomics advice and the use of behaviour-based tools, such as SOC, during advice development. Our results provide further support to the findings of Whysall et al. (2004), Theberge and Neumann (2010), Broberg and Hermund (2004) and Neumann et al. (2010), who have all identified the need to design interventions sensitive to the drivers for organisational change. A key difference in our study was the intent to integrate the research process with the development of a SOC assessment tool for use in the field.

4.1. Barriers and facilitators to the implementation and monitoring of ergonomics advice

Many of the themes identified qualitatively were found to be broadly prevalent through the web based survey. In our study, consultants reported that they were generally unaware whether the advice they had provided was implemented by the client or whether it had been effective. Reasons for this included the lack of feedback provided by the client, the very tight timeframes and cost-constraints associated with private consulting contracts. This is consistent with previously reported findings by Whysall et al. (2004) regarding ergonomics consultants in the UK. In our study, consultants tended to rely on informal feedback from clients and the assumption that repeat business was an indicator that advice previously provided had been effective. However, disinterest and a lack of motivation on the part of companies to implement change were also reported.

Understanding organisational and individual commitment, motivation and attitudes are important factors in the implementation of interventions (Nielsen et al., 2006). The focus group participants emphasised the importance of prioritising their advice according to ease of implementation and the attitudes of managers and workers. However, this was less evident in the survey findings where respondents reported the risk management approach as the predominant means of prioritising advice. These differences may

Table 1
Prioritising and monitoring the implementation and effectiveness of advice to clients.

	Consultant role		p value	Total ^a (%)
	External (%)	Internal (%)		
Total participants	74	85		219
Consultant prioritises the advice provided:			0.119 ^f	
Always	30 (40.5)	42 (49.4)		98 (44.7)
Usually	34 (45.9)	39 (45.9)		89 (40.6)
Sometimes	8 (10.8)	3 (3.5)		15 (6.8)
Seldom	0 (0.0)	1 (1.2)		1 (0.5)
Never	2 (2.7)	0 (0.0)		2 (0.9)
Not provided	0 (0.0)	0 (0.0)		14 (6.4)
Advice is prioritised by:^b				
Risk management approach	55 (25.1)	69 (31.5)	0.463 ^f	158 (72.1)
Hierarchy of controls approach	36 (16.4)	43 (19.6)	0.941 ^f	98 (44.7)
Ease of implementation	31 (14.2)	36 (16.4)	0.929 ^f	79 (36.1)
Other (specified)	17 (7.8)	19 (8.7)	–	47 (21.5)
Not provided	0 (0.0)	0 (0.0)	–	15 (6.8)
Consultant knows whether the advice provided is implemented:			0.021 ^e	
Always	2 (2.7)	14 (16.5)		18 (8.2)
Usually	31 (41.9)	36 (42.4)		92 (42.0)
Sometimes	33 (44.6)	28 (32.9)		88 (40.2)
Seldom	8 (10.8)	7 (8.2)		20 (9.1)
Never	0 (0.0)	0 (0.0)		0 (0.0)
Not provided	0 (0.0)	0 (0.0)		1 (0.5)
Implementation known by:			>0.001 ^f	
Unsolicited feedback from the client	19 (25.7)	6 (7.1)		36 (16.4)
Follow up directly with the client	44 (59.5)	22 (25.9)		86 (39.3)
Monitor as an internal consultant ^d	7 (9.5)	51 (60.0)		69 (31.5)
Other	4 (5.4)	6 (7.1)		12 (5.5)
Not provided	0 (0.0)	0 (0.0)		16 (7.3)
Barriers to knowing:^{b,c}				
Not part of the brief	39 (17.8)	16 (7.3)	>0.001 ^f	73 (33.3)
Very difficult as an external consultant ^g	44 (20.1)	13 (5.9)	>0.001 ^f	73 (33.3)
Company does not provide the information	34 (15.5)	29 (13.2)	0.442 ^f	77 (35.2)
Unsure how to do this	1 (0.5)	5 (2.3)	0.116 ^e	6 (2.7)
Other (specified)	14 (6.4)	29 (13.2)	–	54 (24.7)
Not provided	0 (0.0)	2 (0.9)	–	18 (8.2)
Consultant monitors the intervention's effectiveness:			>0.001 ^e	
Always	7 (9.5)	17 (20.0)		32 (14.6)
Usually	25 (33.8)	44 (51.8)		86 (39.3)
Sometimes	27 (36.5)	22 (25.9)		61 (27.9)
Seldom	14 (18.9)	2 (2.4)		24 (11.0)
Never	1 (1.4)	0 (0.0)		1 (0.5)
Not provided	0 (0.0)	0 (0.0)		15 (6.8)
Monitored by:			>0.001 ^f	
Unsolicited feedback from the client	15 (20.3)	6 (7.1)		26 (11.9)
Follow up directly with the client	44 (59.5)	22 (25.9)		90 (41.1)
Monitor as an internal consultant ^g	6 (8.1)	51 (60.0)		65 (29.7)
Other (specified)	0 (0.0)	0 (0.0)		19 (8.7)
Not provided	8 (10.8)	6 (7.1)		18 (8.2)
Barriers to monitoring:^{b,c}				
Cost to company	37 (16.9)	29 (13.2)	0.144 ^f	79 (36.1)
Company disinterest	45 (20.5)	41 (18.7)	0.940 ^f	109 (49.8)
Not part of the brief	43 (19.6)	18 (8.2)	>0.001 ^f	84 (38.4)
Very difficult as an external consultant ^d	40 (18.3)	10 (4.6)	>0.001 ^f	66 (30.1)
Unsure how to do this	1 (0.5)	3 (1.4)	0.619 ^e	5 (2.3)
Other (specified)	5 (2.3)	24 (11.0)	–	36 (16.4)
Not provided	0 (0.0)	3 (1.4)	–	23 (10.5)

^a Total includes 74 external consultants, 85 internal consultants, 13 participants who indicated their role as 'other', and 47 participants who did not report their consultant role.

^b Multiple answers to the question were possible, therefore percentages do not add to 100.

^c Participants were asked about barriers only if they indicated they did not always do the activity.

^d While the primary role of the participant was as an internal consultant, they may have had additional employment as an external consultant, and vice versa.

^e P value determined using Wilcoxon-Mann-Whitney test.

^f P value determined using Chi-Square test.

^g P value determined using Fishers Exact test.

be due to methodological issues (i.e. direct discussion versus web-based survey) or related to demographic differences between the groups. However, an important finding was that consideration of these factors was not formally incorporated in the development of advice in either group.

Having identified the issue thematically in the focus group

work, the web-survey indicated that acquiring knowledge of the implementation and effectiveness of the advice provided was broadly problematic for practitioners. This was particularly so for external consultants. Even though nearly 60% of external consultants reported following up directly with clients, they also reported the difficulties associated with working externally as the principle

Table 2
Knowledge of behaviour change models and perceptions of the proposed Stage of Change assessment tool.

	Number (%)
Total participants	219 (100.0)
Behaviour change models the consultant is aware of:^a	
Value-expectancy models (Ajzen and Fishbein, 1980; Rogers, 1983)	35 (16.0)
Contextual or environmental models (DeJoy and Southern, 1993)	32 (14.6)
Behaviour change models (Prochaska and Di Clemente, 1982)	80 (36.5)
None of these	98 (44.7)
Other	18 (8.2)
Not provided	23 (10.5)
Barriers to use of the proposed Stage of Change assessment tool:^a	
Published research in this area is not readily available	44 (20.1)
Published research in this area is inconclusive	21 (9.6)
Published research in this area has no practical application	23 (10.5)
The application of behaviour-change principles is outside the consultant's area of expertise	45 (20.5)
This is not relevant to the consultant's area of professional practice	21 (9.6)
Other	56 (25.6)
Not provided	51 (23.3)
Facilitators to use of the proposed Stage of Change assessment tool:^a	
Access to published research in this area	65 (29.7)
Published research showing practical application	111 (50.7)
An easy to use tool designed for use in the field with instructions for use	130 (59.4)
Training in the application of this method	90 (41.1)
Other	22 (10.0)
Not provided	46 (21.0)
Likelihood of using the proposed Stage of Change assessment tool provided:	
Very unlikely	14 (6.4)
Somewhat unlikely	24 (11.0)
Unsure	57 (26.0)
Somewhat likely	57 (26.0)
Very likely	23 (10.5)
Not provided	44 (20.1)

^a Multiple answers to the question were possible, therefore percentages do not add to 100.

barrier, along with the lack of information provided and disinterest by the company. This is consistent with the findings of Trevelyan and Haslam (2001) and from the focus groups where it was reported by some that “companies don’t want to know if something is not working.” Similarly, in dynamic work environments it is not unusual for company priorities, or personnel, to change (Pedersen et al., 2012), which can exacerbate difficulties in obtaining sufficient information to allow for an evaluation of intervention effectiveness.

4.2. Barriers and facilitators to the implementation of behaviour-based ergonomics advice

In our study, consultants reported paying little attention to the change process associated with workplace interventions. This may be because the majority of respondents focussed on the physical domain of ergonomics, with a large proportion noting that the application of behavioural change strategies lay outside their area of expertise. Many respondents were not aware of behaviour change methods. This finding supports those of Whysall et al. (2004) who reported, in their UK sample of 14 ergonomics consultants, that the assessment of physical factors dominated ergonomics practice. A similar focus on physical factors was reported by Wells et al. (2013) in a study of 21 Canadian ergonomists’ use of workplace assessment methods. Interestingly, in their study, while ergonomists mentioned psychosocial factors during interviews they did not mention using, or having the need for, any psychosocial assessment tools (Wells et al., 2013). Paradoxically, however, they reported a consistent theme of the need to convince organisations to make changes.

One of the strongest barriers to the incorporation of research findings into professional practice was identified as the difficulty in obtaining access to journal articles and a lack of clearly stated

implications for practice – i.e. the research-practice gap. This finding parallels the results of a cross-sectional survey of 587 practitioners from 46 countries conducted by Chung and Shorrock (2011). In their study, respondents indicated that the difficulty in obtaining access to journal articles was associated with limited access to databases which are routinely used in academia (e.g. Scopus, PubMed). This was due to subscription constraints, time, and the skills required to browse, retrieve and evaluate published articles. Even when journal articles were obtained, despite these barriers, a lack of practical relevance served as a disincentive to further searches.

Anderson et al. (2001) suggested the ‘disconnect’ between researchers and practitioners was a result of competing priorities. Practitioners working in dynamic work environments with significant time constraints may focus on topical and popular methods, irrespective of theoretical validity. Conversely, researchers may focus on research in more easily controlled environments, such as simulated environments or laboratories, in order to achieve a significant result (and a publishable peer reviewed paper) even if the practical relevance is limited (Wilson, 2000). In order to translate research findings into practice, and bridge this research-practitioner gap, active engagement of practitioners during research is critical to ensure clear relevance for professional practice (Rothmore et al., 2013).

Despite evidence for the effectiveness of the SOC approach as a means to improve the implementation of ergonomics advice (Rothmore et al., 2015) and the health benefits for workers (Whysall et al., 2006; Shaw et al., 2007; Doda et al., 2015) adoption by practitioners is limited. We propose that this lack of adoption is related to the issues associated with the research-practice gap, as highlighted by our survey respondents.

Previous studies of ergonomics practice have highlighted the difficulties associated with the formal monitoring of the

implementation and effectiveness of the advice provided to organisations (Whysall et al., 2004; Wells et al., 2013) and our findings support this. While participants in the study by Wells et al. (2013) mentioned the need to “convince” organisations to implement their recommendations, participants in the current study mentioned the need to “sell” their advice. Irrespective of the term, consultants recognise the need to frame their advice to maximise its uptake.

4.3. The proposed stage of change assessment tool

The SOC tool ‘concept’ discussed in the focus group was designed for research application and had been previously used by Rothmore et al. (2015). Modifications to this tool, in the present study, were made based on comments provided by the focus groups. The intent was to develop an easy to use tool (with instructions) designed for practitioners working in the field.

Survey respondents suggested they would be likely to adopt the SOC assessment tool (Supplementary Material). This is of particular significance as most respondents were working in the area of physical ergonomics and considered that the application of behaviour-change principles was outside their area of expertise. This suggests that the principal barrier to the adoption of more holistic practice may be the lack of a clear, practical ‘user friendly’ tool in the ergonomists’ repertoire.

The structuring of injury prevention advice according to behaviour-change principles was originally proposed by Haslam (2002), with evidence relating to its effectiveness also published by Whysall et al. (2006) and Village and Ostry (2010). However, the practical application of these studies was limited as the methods used were not reflective of professional practice. In the study by Whysall et al. (2006) the SOC approach was applied to pre-existing company plans while Village and Ostry (2010) demonstrated its ability to identify worker readiness to change as a prelude to developing an intervention. More recently, Rothmore et al. (2015) and Doda et al. (2015) have demonstrated the potential benefits of this approach in a study more closely aligned with professional practice where recommendations were developed following direct observation and evaluation of the work environment.

5. Strengths and weaknesses of this research

We have sought to bridge the research-practice gap by engaging ergonomics practitioners in all facets of the research process: seeking their views in focus groups; using their feedback during the development of web-based survey tools for the broader profession; inviting the participation of members of HFESA/HFESNZ; seeking their comments and feedback on a proposed SOC assessment tool designed for use in the field, and; exploring barriers and facilitators to its use.

Whilst we sought to engage with consultants as broadly as possible we elected to focus on members of HFESA/HFESNZ. These organisations were chosen because their members are drawn from a wide variety of professional backgrounds and who practice in a range of domains. Although the response rate of 31% is modest, this figure is based on all 713 members of HFESA/HFESNZ. We sought to elicit responses only from those who practice primarily in the area of MSD prevention (which would not include all members). As a result it is likely that our response rate represents a higher percentage of those who practice primarily in this area, but we are unable to quantify this. However, this compares favourably with a previous survey of ergonomists by Chung and Shorrock (2011) where the reported participation rate was 9%. There are also other large professional organisations whose members may have a specific interest in the prevention of work-related MSDs (e.g.

Physiotherapy, Occupational Therapy and Occupational Safety and Health). However, as broad professional associations, we considered that the proportion of members in Australia and NZ with a specific interest in the development of interventions to prevent work-related MSDs would be low.

We have reported that a majority (53%) of the survey respondents indicated a level of willingness to incorporate the SOC tool in their current practice (likely, 37%; unsure 26%). While this feedback may reflect a tendency to respond positively to new information (i.e. a social desirability bias) this is an inherent limitation to all surveys of this type.

6. Conclusions

The SOC approach has been proposed as a method to improve the implementation of ergonomics advice. However, despite evidence for its efficacy there is little evidence to suggest it has been adopted by professional consultants. The translation of research evidence into professional practice outlined in this paper relied heavily on engagement with ergonomics practitioners with the intent of developing a draft SOC assessment tool designed for their use. As a method for improving the implementation of ergonomics advice we suggest that it provides consultants with a method to interpret the change process in complex organisational settings where they are only visitors. Developing technical solutions may be the least of the issues faced by ergonomics consultants. The greater issue is the implementation of the advice provided and methods to improve this are needed. Findings from this study suggest the limited application of a SOC based approach to work-related musculoskeletal injury prevention by professional consultants is due to a suitable tool not being available, the need for training in its application and the lack of access to relevant research findings. We have sought to bridge the research-practice gap by involving ergonomics practitioners in all facets of the research - with encouraging results. The final translation of the SOC assessment tool into professional ergonomics practice will require further dissemination and instruction in the use of the assessment tool. The subsequent demonstration of its real-world usability will further support its uptake.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.apergo.2016.08.033>.

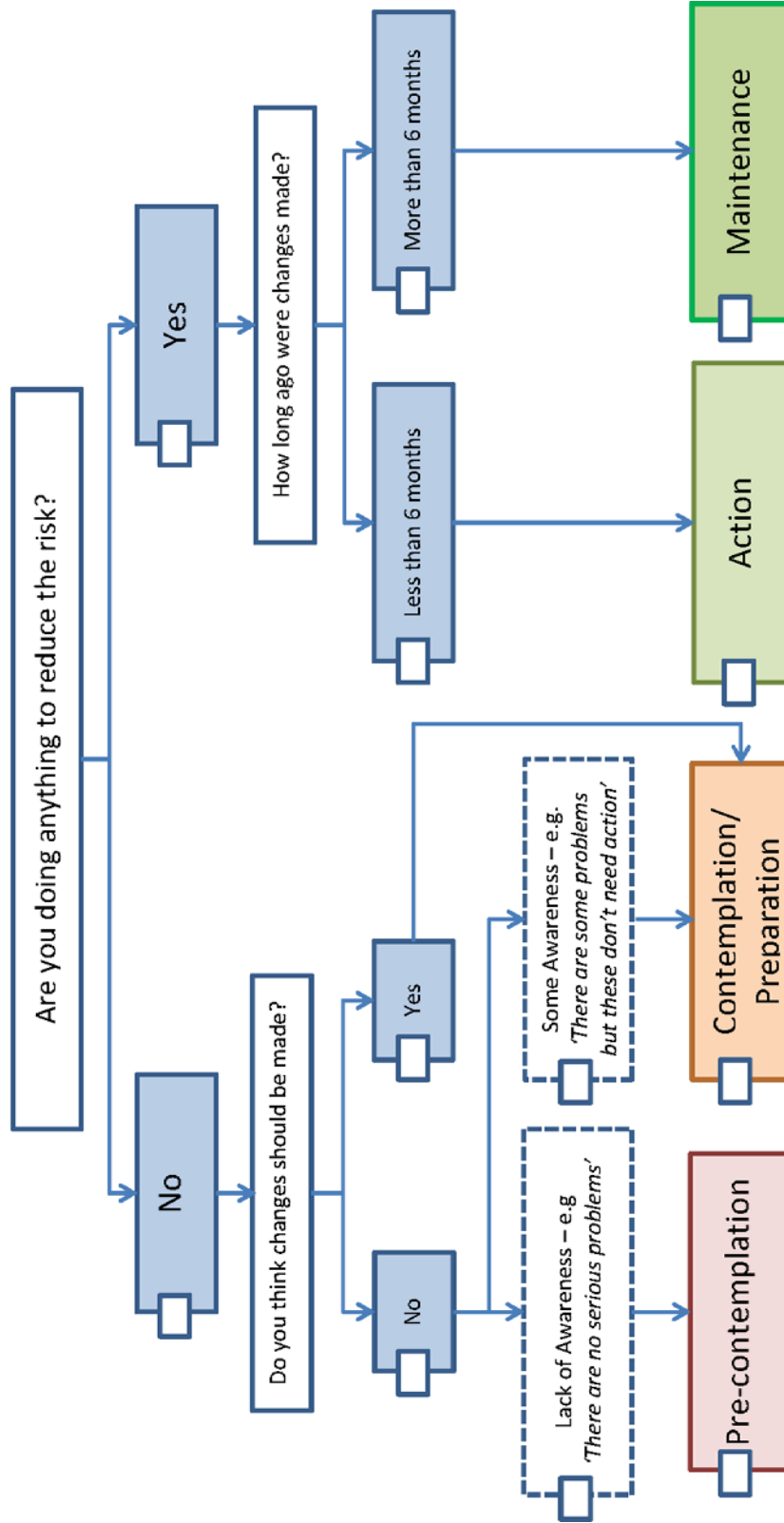
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Stage of Change Screening Assessment

Follow the flowchart, by ticking the boxes, to determine the subject's stage of change



STAGE-BASED INTERVENTIONS

Pre-contemplation: Awareness raising, information on negative outcomes

Contemplation/Preparation: Practical advice, training, benefits of change

Action: Ongoing advice, feedback/support, skills training

Maintenance: Positive reinforcement, ongoing monitoring

Subject: _____

Company: _____

Date: _____

Department: _____

Stage of Change Screening Overview

This is a screening tool to assist with the development, prioritisation and implementation of ergonomics interventions.

In the Stage of Change framework readiness to change is assessed using a short series of closed questions. Once the stage of change has been determined advice is then tailored to improve receptiveness.

1. *Pre-contemplation (unaware or unconcerned about workplace hazards)*

People at this stage may be unaware of risks and do not therefore consider any need for change, or, if aware, are unconcerned. They may benefit from interventions to raise their awareness of risks including:

- Graphic information on the significance, probability and cause of work-related injury/illness
- Presentation of case studies

2. *Contemplation/Preparation*

People at this stage see a need for change and may be making plans for change but may not consider the urgency or lack knowledge of “how” to change. They may benefit from practical advice/training and some active participation in proposed workplace changes including:

- Presentation of information (case-studies) on the benefits and the effectiveness of preventative strategies
- Active participation in workplace redesign or pre-purchase equipment trials

3. *Action (made changes in the previous 6 months)*

People at this stage are engaged in change efforts and may need ongoing advice, further skills training, feedback and support. They will benefit from:

- Further training in activities such as hazard & risk identification and assessment
- Ongoing active participation in workplace changes and continuous improvement strategies

4. *Maintenance*

People at this stage are actively engaged in maintaining changes and improvements made. They will benefit from:

- Continual reinforcement (i.e. feedback) on their efforts to in order to prevent relapse
- Ongoing involvement/consultation in monitoring workplace practices and any proposed changes
- An ongoing and collaborative relationship with OHS advisors

Chapter 6

Discussion and conclusions

6.1 Introduction

The primary aims of this thesis were to:

- Review contemporary approaches to the application of behaviour-change methods in the development of workplace injury prevention interventions
- Determine whether the implementation of practitioner advice, by companies, was influenced by the targeting of advice according to the Stage of Change approach
- Determine whether there were any long-term health outcomes associated with the Stage of Change approach in respect to compensable musculoskeletal injuries
- Investigate the barriers and facilitators to the adoption of the Stage of Change approach by practitioners and the potential utility of a Stage of Change tool to encourage this

In this chapter, the implications of the research presented in each of the chapters will be addressed, followed by a discussion of the limitations of this research program and recommendations for future research.

6.2 Key findings and implications

6.2.1 What are the contemporary approaches to the application of behaviour-change methods in the development of workplace injury prevention initiatives?

This first research question was addressed in Chapter 2. While initially planned as a review of the contemporary literature on this topic it was submitted for publication, at the invitation of the editor, in a Special Issue of Physical Therapy Reviews on the topic of Occupational Health and Safety. This was written to promote discussion on the application of behaviour-change principles in the development of work-related musculoskeletal injury and to highlight the gap

between the evidence for the potential effectiveness of the Stage of Change approach and its adoption by practitioners.

This discussion paper emphasised the relatively few attempts at the application of behaviour change principles in the development of musculoskeletal injury prevention interventions in the published literature and the difficulties associated with their translation into professional practice. The Stage of Change framework was highlighted as an example of an approach, which, despite demonstrating some early, and promising, results for its potential effectiveness, has not been adopted by practitioners. It was proposed that this lack of translation from research to practice was due, in part, to the application and evaluation methods used in the published research. While Whysall, Haslam and Haslam (2006b) used this approach to prioritise pre-existing planned company actions this is not reflective of professional ergonomics practice where ergonomists are engaged to identify *and* develop ergonomics interventions. It was postulated that they may not see this approach as being relevant to their own practice. Similarly, evaluation of effectiveness has been dependent on progression through the stages (assuming that those in more advanced stages will be more risk aware), or on changes in musculoskeletal pain and discomfort (assuming that reductions will lead to reduced injury rates).

Since publication in 2013, a follow-up discussion paper, incorporating a case-study drawn from this thesis, was published in 2016 (Oakman, Rothmore and Tappin 2016). The only other study published on the application of the Stage of Change approach in the development of workplace musculoskeletal injury prevention interventions utilised the same cohort described in Chapter 3 of this thesis (Doda et al. 2015). This is further discussed in section 6.2.3.

6.2.2 Is the implementation of practitioner advice, by companies, influenced by the targeting of advice according to the stage of change approach?

The second research question is answered in Chapter 3. This study was designed to address the limitations associated with previous applications of the Stage of Change approach in workplaces by more closely reflecting professional practice. As highlighted in Chapter 2 the

Stage of Change approach has previously been applied in workplace settings by either applying it to pre-existing company plans (Whysall, Haslam and Haslam 2006b) or by demonstrating its usefulness in identifying worker readiness to change as a prelude to intervention development (Village and Ostry, 2010). As previously discussed, in professional practice, consultants are engaged to both identify issues *and* design appropriate interventions. For this study, field visits were conducted at each of the companies in order to identify workplace issues via direct observation and discussion with workers and managers. Each of the workers was individually interviewed to identify their Stage of Change. At this stage the allocation of each workgroup (i.e. to receive standard or tailored interventions) was double-blinded. Standardised reports detailing the observations made and recommended changes were prepared for each company. While the level of detail was similar in all the reports, those allocated to the tailored group received additional information on the Stage of Change profile of their workgroup. Those in receipt of tailored reports were visited to provide information on the interpretation and relevance of this additional information. When interviewed 12-months later those managers who had received tailored advice had implemented the recommended changes at 1.7 times the rate of those who had received standard advice. Perhaps even more importantly, they had implemented changes, of their own design, at nearly twice the rate of those who had received standard advice. These are key findings.

As highlighted in Chapter 2, a significant barrier to effective injury prevention is the failure of many companies to implement advice. The reasons suggested for this inaction have been proposed as a general lack of interest or competing company priorities (Pederson, Nielsen and Kines 2012, Whysall, Haslam and Haslam 2006a). Strategies to improve the implementation of advice are therefore needed.

While Chapter 3 has provided evidence for the effectiveness of the Stage of Change approach in improving the implementation of advice this is primarily of interest to practitioners seeking to improve the implementation of the advice they provide. To further demonstrate the effectiveness of this advice, long-term evaluation of the associated health outcomes is needed.

6.2.3 Are there any long-term health benefits associated with the stage of change approach in respect to compensable musculoskeletal injuries?

The success of any injury prevention intervention plan is dependent on its implementation. When considering that practitioners frequently rely on the effectiveness of their advice for repeat-business then evidence for the effectiveness of Stage of Change based advice in improving the rate of implementation is likely to be persuasive for its adoption. However, this approach does have a psychosocial aspect which requires some discussion with workers in order to identify their 'stage'. The relevance of this may not be immediately apparent to organisations which are seeking to solve a 'physical' workplace problem. Indeed, during the initial recruitment phase organisations were encountered which declined to participate for this very reason. However, from a pragmatic perspective, even the sceptical may be persuaded with evidence for the effectiveness of this approach in respect to improved health outcomes for their workers.

In 2015 Doda et al. published the results of a cluster randomised trial in which 25 workgroups had been randomly assigned to receive standard ergonomics advice or advice which had been tailored according to the Stage of Change approach. Short-term health benefits (one year after implementation of the advice) were evaluated with respect to reduced musculoskeletal pain and discomfort. Workers who had received tailored advice were 40% less likely to report low back pain when compared with those who had received standard ergonomics advice. However, changes in pain and discomfort are only potential predictors of long-term health outcomes such as compensable injury. Analysing a longer-term follow-up of the same study population as Doda et al. (2015) this study sought to evaluate the long-term health outcomes associated with the Stage of Change approach in respect to compensable musculoskeletal injuries.

This study analysed injury data on the cohort of workers three years after the one year follow-up. While the outcomes were not significant at the conventional $p=0.05$ level those who had received tailored advice were 55% (OR=0.45, 95% CI 0.19-1.08) less likely to report a compensable injury.

The multivariate analysis also showed that workload, job satisfaction and musculoskeletal pain and discomfort (MSPD) were significantly correlated with injury outcomes. The finding that those who reported higher levels of MSPD were at an increased risk of a compensable musculoskeletal injury supports the use of this intermediate measure of outcome, by practitioners, as a means for evaluating the effectiveness of interventions. It is consistent with the previous findings of an association with diagnosed musculoskeletal cases (Gerr, Fethke, Anton et al. 2014, Gerr, Fethke, Merlino et al. 2014, Hagberg et al. 2012,) and provides support to the findings of Macdonald, Evans, and Armstrong (2007) and Oakman (2014) who reported an association between MSPD and compensable injury. Similarly, the correlation of job satisfaction and injury outcomes provides further support to the growing body of evidence for the link between psychosocial factors and compensable injury.

6.2.4 What are the barriers and facilitators to the adoption of the stage of change approach by practitioners and what is the potential utility of a stage of change tool?

The previous research questions sought to establish evidence for the potential effectiveness of the Stage of Change approach. This final research question has sought to translate these findings into professional practice.

As identified in Chapter 2 there is a gap between research evidence and professional practice. In order to bridge this gap this final study sought to engage practitioners in the development and dissemination of the research findings.

In the first phase, practitioners in three locations – Adelaide, Melbourne and Auckland – participated in a series of focus groups to:

- Investigate the barriers and facilitators to the implementation and monitoring of the effectiveness of their advice
- Investigate the barriers and facilitators to the implementation of Stage of Change-based injury prevention advice by ergonomics practitioners, and;

- To seek their views on the development and adoption of a Stage of Change-based assessment tool

The engagement of practitioners in the early phase of this study was an important part of the research translation process. This guided the development of an ergonomics profession-wide survey and the development of a Stage of Change assessment tool designed for use ‘in the field’ by practitioners.

In the second phase of this study an online survey of members of the Human Factors and Ergonomics Societies of Australia and New Zealand, who self-identified as having a particular interest in the prevention of musculoskeletal disorders, was conducted.

There were several key findings from this survey. Firstly, a large proportion of the respondents indicated that they were generally unaware whether the advice they had provided was implemented by the client or not, and if implemented, whether it had been effective. This was consistent with the findings of a previous study of ergonomics consultants in the UK (Whysall, Haslam and Haslam 2004). Given this general lack of awareness, and the barriers to formal workplace monitoring and evaluation reported by the respondents, a method with demonstrated effectiveness in improving the implementation of advice - and therefore its effectiveness – without formal monitoring, is needed.

Secondly, relatively few respondents reported addressing issues associated with the change process when developing workplace interventions. There was a tendency to focus on the *identification* of the changes required rather than *how* they could be successfully made. Considering that workplace interventions inevitably involve change this was surprising. However, despite self-identifying as being predominately involved with physical ergonomics, after viewing a draft Stage of Change assessment tool, only a small proportion of respondents (17%) indicated that they would be unlikely to use it. This implies both the need for, and usefulness of, a suitable assessment tool in the ergonomists’ repertoire; the current absence of which is a barrier to optimal intervention design and implementation. When considering the importance of addressing both physical and psychosocial factors in the prevention of

musculoskeletal injury prevention this willingness to adopt a behaviour-change approach is encouraging.

6.3 Practical implications

While interventions to reduce the MSD burden have been partially successful (Denis et al. 2008, Palmer et al. 2012, Silverstein and Clark 2004) there is clearly a need to further improve these efforts. Even with greater awareness and understanding of the joint, and interactive roles of physical and psychosocial factors and the subsequent development of multi-factorial interventions the problem remains. Rather than continuing to focus on underlying MSD aetiology, this thesis proposes that methods to improve the implementation of advice is a currently overlooked, but critical component, of MSD prevention. The lack of adoption of the SOC approach by ergonomics practitioners, despite evidence for its potential effectiveness is an obvious example. The relative dominance of practitioners who are focussed on the physical domain of ergonomics practice (as identified in Chapter 5) may partly explain this. However, an openness to the adoption of new methods, by ergonomics practitioners, at least in Australia and New Zealand, was also apparent.

The evidence for the benefits of the SOC approach in addressing the MSD burden is undeniable. Studies by Whysall, Haslam and Haslam (2006b), Village and Ostry (2010), and Barrett et al. (2005) highlighted its potential application in the workplace using outcome measures such as 'stage-progression'. This thesis has extended this 'potential' by demonstrating its effectiveness in practical application, and in a manner more closely related to professional ergonomics practice. An important point is that the SOC approach does not require a fundamental change to ergonomics practice. The assessment and identification of workplace risks and the development of control measures is unchanged. The critical difference with this approach lies in the prioritising of these control measures in accordance with the SOC status of the workers during their implementation. As such, it is entirely compatible with commonly used, existing frameworks such as the risk management or hierarchy of controls approaches. Its ultimate acceptance will be reliant on the dissemination of these findings and the development and delivery of appropriate training (outlined in 6.4.5).

6.4 Thesis limitations and recommendations for future research

The limitations of each of the studies have been discussed in the relevant chapters. This section will focus on the limitations of the thesis as a whole. These limitations relate to manager interaction, the participating companies, compensation definitions and survey respondents.

6.4.1 Manager interaction

The worksite visits, the ergonomic reports and manager interviews were conducted by a single ergonomist. Consequently, the development of individual rapport with the managers over several years may have influenced the introduction of the recommended changes. While standardised reports were provided to all companies those in receipt of tailored advice were provided with an additional visit in order to explain the rationale for the Stage of Change approach (they had been previously blinded to their group allocation). This additional visit was an integral component of the intervention which may vary from standard practice among consultants who may, or may not arrange follow-up visits to present or discuss their findings. It is possible that if the managers in the standard advice group had also received an additional visit, the observed effect size may have been reduced.

6.4.2 Participating companies

The participating companies were all based in the metropolitan area of Adelaide, South Australia. While several of these were part of national and international conglomerates it is possible that the attitudes of the managers responsible for the implementation of musculoskeletal injury prevention interventions was influenced by local cultural, business and economic conditions and would differ from those in other states of Australia, or internationally. However, when considering that all managers were exposed to similar business and economic conditions and the randomisation applied, the intervention, as implemented, was effective. Nevertheless, unobserved potential confounders may remain.

6.4.3 Compensation definitions

The long-term evaluation of the health outcomes for workers in participating companies was confined to a single regulatory jurisdiction (South Australia). An inherent limitation in evaluations of this type are the varying regulatory definitions used to determine the work-relatedness of musculoskeletal injury. While these vary substantially internationally, workers' compensation schemes within Australia are broadly comparable. More pertinent however, is the potential for variation in the processing and acceptance of compensation claims within companies. Compensation claims are generally lodged with local claims officers who may accept or reject them. It is possible that injuries which were accepted as compensable in our sample would not have been so determined in other companies. However, the converse is also true – i.e. workers may have had claims for compensation rejected which would have been accepted elsewhere.

6.4.4 Survey respondents

While the engagement of practitioners was integral to the identification of barriers and facilitators to the adoption of a Stage of Change approach, and the development of a draft Stage of Change Assessment tool the survey was limited to members of Human Factors and Ergonomics Societies of Australia and New Zealand. While the response rate of 31% appears modest, this figure is based on all 713 members of the societies. We sought to elicit responses only from those who practice primarily in the area of MSD prevention (which would not include all members). As a result it is likely that our survey response rate represents a much larger percentage of those who practice primarily in this area. However, the findings are limited to the Australia and New Zealand professional practice environment.

6.4.5 Recommendations for future research

The findings of this thesis could be usefully compared and contrasted across a range of environments with differing regulatory jurisdictions. Similarly while the attitudes of practitioners in Australia and New Zealand to the adoption of a Stage of Change approach were examined in this study and found to be favourable, the extent to which the Stage of Change approach is considered beneficial and viable for ergonomic practitioners in other countries is currently unknown. Most importantly, however, while a draft Stage of Change Assessment Tool has been developed, it is as yet, untested in the ‘real-world’ environment by practitioners. The final phase required, which is beyond the scope of this thesis, is the full dissemination of the findings, the development of a training program for practitioners and a subsequent demonstration of the ‘real world’ usability of the draft tool, and the method, in a variety of working environments. The findings presented in Chapter 5 identified that external consultants faced more barriers in the implementation and evaluation of their interventions than internal consultants. A future translation project should therefore focus on internal consultants. A proposed outline for such a project would include:

- the recruitment of internal consultants from a range of organisations in different geographical locations
- a workshop for participants which included the presentation of evidence for the potential effectiveness of the SOC approach and training in the use of the SOC assessment tool
- the completion of an ergonomics evaluation, according to their usual practice, at their workplace along with the determination of the SOC profile of the workers
- a follow-up workshop to discuss the proposed interventions, to interpret the SOC profile of the workers and to develop a SOC-based prioritised intervention plan
- the implementation of the developed SOC-based intervention plans at the workplace
- a final workshop to evaluate the training program and the implementation of the SOC-based plans in the workplace

In such a project a process evaluation would be ongoing throughout the project with an implementation evaluation conducted at its completion.

6.5 Conclusion

This thesis commenced with a discussion of the evidence for the adoption of a behaviour change approach to the development of injury prevention advice and the need to address the ‘research-practice gap’ by engaging with practitioners in all phases of research (Chapter 2). This was followed by evidence for the benefits of the Stage of Change approach in respect to improved implementation of advice (Chapter 3) and the health benefits to workers (Chapter 4). It concluded with the findings of practitioner focus groups, the results of a survey of practitioners in Australia and New Zealand, and the presentation of a draft Stage of Change Assessment Tool (Chapter 5).

The findings have provided evidence for the use of the Stage of Change approach in the development of ergonomics interventions in respect to increased implementation of recommended interventions and improved health outcomes for workers. Rather than ignoring this component of practice, the absence of a suitable tool in the ergonomists’ repertoire, and suitable training in its application, have been the principle barriers to its adoption by practitioners. The final translation of these research findings into professional ergonomics practice will require the development of a training program and subsequent evaluation of its ‘real-world’ usability in a variety of work environments.

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Appendix A

Supplementary material for chapter 3



RESEARCH BRANCH
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23 December 2010

Associate Professor D Pisaniello
Discipline of Public Health

Dear Associate Professor Pisaniello

PROJECT NO: H-129-2008
Improving enterprise-level interventions designed to reduce musculoskeletal disorders in the workplace

Thank you for your report on the above project. I write to advise you that I have endorsed renewal of ethical approval for the study on behalf of the Human Research Ethics Committee.

The expiry date for this project is: 31 October 2011

Where possible, participants taking part in the study should be given a copy of the Information Sheet and the signed Consent Form to retain.

Please note that any changes to the project which might affect its continued ethical acceptability will invalidate the project's approval. In such cases an amended protocol must be submitted to the Committee for further approval. It is a condition of approval that you immediately report anything which might warrant review of ethical approval including (a) serious or unexpected adverse effects on participants (b) proposed changes in the protocol; and (c) unforeseen events that might affect continued ethical acceptability of the project. It is also a condition of approval that you inform the Committee, giving reasons, if the project is discontinued before the expected date of completion.

A reporting form is available from the Committee's website. This may be used to renew ethical approval or report on project status including completion.

Yours sincerely


PROFESSOR GARRETT CULLITY
Convenor
Human Research Ethics Committee



INFORMATION SHEET

Interviews: Improving Enterprise-Level Interventions Designed to Reduce Musculoskeletal Disorders in the Workplace

The University of Adelaide is conducting a study looking at managers' attitudes to prevent the musculoskeletal disorder at workplaces.

The main purposes of this interview are to evaluate the intervention process and identify barriers and incentives of the intervention based on the managers' perception.

The interview sessions will be conducted for 15-30 minutes, and will be face-to-face. Your participation is entirely voluntary and you are free to withdraw at any time. The findings from the interviews will be systematically interpreted and compiled into an independent report, which will be electronically available to participants and key stakeholders. Participants will not be identifiable, and personal details will remain confidential.

This project aims to evaluate the effectiveness of MSD prevention in South Australian with a view to improving methods to minimise the MSDs in workplaces. We believe that your views and your participation in the project are important to reduce the risk of musculoskeletal discomfort in workplaces.

If you would like further information or need assistance, please contact:

Dr Dino Pisaniello, Discipline of Public Health, University of Adelaide. Ph: 8303 3571

An independent complaints procedure form will also be given to you, if you would like to lodge a complaint about the conduct of the research.

***A/Prof. Dino Pisaniello
Discipline of Public Health, University of Adelaide***

Level 9, Tower Building, 10 Pulteney Street, Mail Drop 207 Phone: 8303 3571



CONSENT TO PARTICIPATE IN STUDY

- 1 (please print name)
consent to take part in the University of Adelaide research project called:
Improving Enterprise-Level Interventions Designed to Reduce Musculoskeletal Disorders in the Workplace
2. I acknowledge that I have read and understood the Information Sheet called:
Interviews: Improving Enterprise-Level Interventions Designed to Reduce Musculoskeletal Disorders in the Workplace
3. Even though this study aims to improve the occupational health and safety of workers, I have been informed that I may not gain any direct benefit.
4. I understand that information from interviews will be used for research by the University team.
5. I have been given the right to refuse any information I don't want to give.
6. I have the right to withdraw from this study at any time
7. I understand and have been told that information from the interviews will not be used by anyone except members of the University study team and individuals will not be identifiable in the final report.
8. I'm aware that a copy of this form will be stored by the Discipline of Public Health at the University of Adelaide.
9. I acknowledge that the above information was verbally presented to me - I understood it and had time to query anything I didn't understand.

.....

(please sign here)

(please print date)

.....Witness

Position

Date

A/Prof. Dino Pisaniello

Discipline of Public Health, University of Adelaide

Level 9, Tower Building, 10 Pulteney Street, Mail Drop 207 Phone: 8303 3571

MANAGER INTERVIEW QUESTIONS

Changes Made

1. Have any new health and safety measures been introduced in the past 6-12-months?
If yes, can you describe them?

e.g. What was done?

.....

Change/Action 1:

How long ago was this introduced?

.....

Change/Action 2:

How long ago was this introduced?

.....

Change/Action 3:

How long ago was this introduced?

.....

Change/Action 4:

How long ago was this introduced?

.....

Change/Action 5:

How long ago was this introduced?

.....

Change/Action 6:

How long ago was this introduced?

.....

Change/Action 7:

How long ago was this introduced?

.....

Change/Action 8:

How long ago was this introduced?

.....

Change/Action 9:

How long ago was this introduced?

.....

Change/Action 10:

How long ago was this introduced?

.....

Change/Action 11:

How long ago was this introduced?

.....

Change/Action 12:

How long ago was this introduced?

.....

2. Were any of these changes made as a result of the recommendations?

If yes, which ones?

3. Why did you choose these particular changes?

- *Cost – This was definitely not a factor in the choice.*
- *Convenience*
- *Timing*
- *Acceptability to the Workforce*
- *Acceptability to Management*
- *Other*

4. What has been the effect of these Actions/Changes?

- *Safety Culture/Behaviour*
 - *No Change*
 - *Increased Awareness.*
 - *Decreased Awareness*

- *Job Satisfaction*
 - *No Change*
 - *Increased Satisfaction*
 - *Decreased Satisfaction*

- *Reports of Pain/Discomfort*
 - *No Change*
 - *Increased Reporting*
 - *Decreased Reporting*

- *Changes in safe work practices*
 - *No Change*
 - *Improvement in safe work practice*
 - *Decline in safe work practice*

- *Changes to work environment*
 - *No Change*
 - *Improvement in work environment*
 - *Decline in work environment*

Changes Planned

5. Have any new health and safety measures been planned (but are yet to be introduced) since receiving the recommendations?

If yes, can you describe them?

e.g. What is planned?

.....

Change/Action 1:

When is this planned?

.....

Change/Action 2:

When is this planned?

.....

Change/Action 3:

When is this planned?

.....

Change/Action 4:

When is this planned?

.....

Change/Action 5:

When is this planned?

.....

Change/Action 6:

When is this planned?

.....

Change/Action 7:

When is this planned?

.....

6. Are any of these planned changes as a result of the recommendations?

If yes, which ones?

7. Why did you choose these particular planned changes?

- *Cost*
- *Convenience*
- *Timing*
- *Acceptability to the Workforce*
- *Acceptability to Management*
- *Other*

8. If there were no changes made and none are planned what is the reason?

- *Cost*
- *Convenience*
- *Timing*
- *Acceptability to the Workforce*
- *Acceptability to Management*
- *Other*

Supporting Factors/Facilitators

9. Have you noticed any factors which have facilitated/supported the introduction of new health and safety measures?

If yes, please describe.

- *Employee attitudes/behaviour*
- *Managerial attitudes to risk or change*
- *Authorisation for change*
- *Budgetary*
- *Other*.....

Barriers/Challenges/Facilitators

10. Have you faced any barriers / challenges to introducing new health and safety measures?

If yes, please describe.

- *Employee attitudes/behaviour*
- *Managerial attitudes to risk or change*
- *Authorisation for change*
- *Budgetary*
- *Other.....*

11. Do you (your department) have an injury prevention budget?

If yes, what is its size?

12. Does the organisation have an injury prevention budget?

If yes, what is its size?

13. How are injury prevention initiatives budgeted in your organisation?

- *Business Case*
- *Yearly allocation*
- *Other*

a. *If you prepared a business case did the information provided at baseline assist in this?*

14. Has the Global Financial Crisis had an impact on your company and the ability to introduce new safety initiatives?

Study Involvement/Usefulness of Information

15. Have you found your involvement in the study to be useful?

- *Ergonomic report*
- *Job Satisfaction Survey*
- *Safety Survey*
- *BPD*
- *Benchmarking*
- *Other*

16. Would you participate in similar University-based follow-up studies?

Additional questions for Managers who received SOC information (Tailored Group)

17. Did you find the stage of change information useful?

18. Did the stage of change information provided influence the choice of any changes introduced (or planned)?

19. Was the stage of change information useful in persuading others of the need to introduce changes?

- *E.g. Was it useful in the preparation of a Business Case for funding?*

20. How closely did the employees' stage of change ratings reflect your own perceptions of employees' attitudes?

Appendix B

Supplementary material for chapter 4



RESEARCH BRANCH
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CRICOS Provider Number 00123M

23 July 2013

Mr P Rothmore
Public Health

Dear Mr Rothmore

PROJECT NO: H-220-2011
***Implementation and implications of a behaviour-based intervention to prevent
work-related musculoskeletal disorders***

Thank you for your emails dated 9.5.13 and 16.7.13 requesting amendment to the above project. I write to advise you that on behalf of the Human Research Ethics Committee I have approved the request to conduct a follow-up questionnaire with individuals who indicated interest in being recontacted. Thank you for providing the revised questionnaire and participant information sheets and consent forms.

The ethical endorsement for the project applies for the period until: 30 September 2015

Where possible, participants taking part in the study should be given a copy of the Information Sheet and the signed Consent Form to retain.

Please note that any changes to the project which might affect its continued ethical acceptability will invalidate the project's approval. In such cases an amended protocol must be submitted to the Committee for further approval. It is a condition of approval that you immediately report anything which might warrant review of ethical approval including (a) serious or unexpected adverse effects on participants (b) proposed changes in the protocol; and (c) unforeseen events that might affect continued ethical acceptability of the project. It is also a condition of approval that you inform the Committee, giving reasons, if the project is discontinued before the expected date of completion.

A reporting form is available from the Committee's website. This may be used to renew ethical approval or report on project status including completion.

Yours sincerely

Dr John Semmler
Convenor
Human Research Ethics Committee

Appendix C

Supplementary material for chapter 5



RESEARCH BRANCH
OFFICE OF RESEARCH ETHICS, COMPLIANCE
AND INTEGRITY

LEVEL 7, 115 GRENFELL STREET
THE UNIVERSITY OF ADELAIDE
SA 5005 AUSTRALIA

TELEPHONE +61 8 8313 5137
FACSIMILE +61 8 8313 3700
EMAIL hrec@adelaide.edu.au

CRICOS Provider Number 00123M

3 April 2014

Mr P Rothmore
School: Public Health

Dear Mr Rothmore

ETHICS APPROVAL No: H-2014-059

PROJECT TITLE: Taking the next step: Operationalising a behaviour-based approach for musculoskeletal injury prevention interventions

The ethics application for the above project has been reviewed by the Low Risk Human Research Ethics Review Group (Faculty of Health Sciences) and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research (2007)* involving no more than low risk for research participants. You are authorised to commence your research on **03 Apr 2014**.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled *Project Status Report* is to be used when reporting annual progress and project completion and can be downloaded at <http://www.adelaide.edu.au/ethics/human/guidelines/reporting>. Prior to expiry, ethics approval may be extended for a further period.

Participants in the study are to be given a copy of the Information Sheet and the signed Consent Form to retain. It is also a condition of approval that you **immediately report** anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol; and
- the project is discontinued before the expected date of completion.

Please refer to the following ethics approval document for any additional conditions that may apply to this project.

Yours sincerely,

Sabine Schreiber
Secretary, Human Research Ethics Committee
Office of Research Ethics, Compliance and Integrity



PARTICIPANT INFORMATION SHEET

PROJECT TITLE: Taking the next step: Operationalising a behaviour-based approach for musculoskeletal injury prevention interventions

PRINCIPAL INVESTIGATOR: Paul Rothmore

What is the project about?

Research suggests that structuring injury prevention advice according to behaviour-change principles may improve the effectiveness of interventions designed to reduce the burden of musculoskeletal injuries. However the behaviour-change tool used in research is not practical for general use by OHS practitioners. This study will use focus groups to explore the barriers and facilitators to the use of the behaviour-based tool by OHS practitioners. The information gathered will inform the modification the tool, adapting it to be suitable for ‘in the field’ use by practicing ergonomists.

Who is conducting the research?

The research is being conducted by:

Paul Rothmore

The University of Adelaide, Adelaide, Australia
+61 8 83133568

In collaboration with:

Dr. Jodi Oakman

La Trobe University, Melbourne, Australia
+61 3 9479 3235

Dr. David Tappin

Massey University, Auckland, NZ
+64 9 4140800

It is being funded by SafeWork SA.

What will I be asked to do?

As a member of the Human Factors and Ergonomics Society with an interest in the prevention of work-related musculoskeletal disorders you are being invited to participate in a focus group with your professional peers. The topic you will be asked to discuss is “What are the barriers and facilitators to the implementation of behaviour-based ergonomics advice by professionals.” This discussion will be guided by a series of “open” questions which will invite you to contribute your own perspective. These discussions will be audio-recorded and transcribed for later analysis. Transcriptions will not contain any information which may identify you.

It is expected that your participation in the Focus Group will last from 60-90 minutes.

What are the benefits of the research project?

As a practicing OHS professional, this project may ultimately benefit you by further developing your understanding of the barriers and facilitators you encounter in professional practice, and by developing a tool which may help you to provide behaviour-based ergonomics advice.

Are there any risks associated with participating in this project?

There are no foreseeable risks or adverse effects associated with your participation in this study.

Can I withdraw from the project?

Participation in this project is completely voluntary. You can decide to withdraw from the study at any time. However, if you chose to participate in a group discussion session, you will not be able to withdraw your contributions as they will form part of the group discussion and it is not possible to identify individual contributions. During the discussion you can chose not to answer questions or to leave the room if you no longer wish to participate.

What will happen to my information?

All audio recordings and transcripts containing personal information will remain confidential and no information which could lead to your identification will be released, except as required by law. Under Australian privacy law all information collected about you must be kept confidential, unless you agree to it being released. If you consent to take part in this study, the data collected for the study will be looked at by the research team. All these people will have a duty of confidentiality to you as a research participant and no information that could identify you will be given to anyone else. If the results of this study are published, for example in scientific journals, you will not be identified by name. Records and data about your participation in this study may be used for study purposes or for further analyses in the future. All such records and your right to them will be protected in accordance with Australian law.

Research data will be kept by the Chief Investigator. An electronic record/copy of the research data will be stored on the chief researcher's computer and protected by password access. Hard copies of research data will be stored in a locked filing cabinet at the researcher's office for a period of 5 years. No additional copies of the research data will be made or distributed.

Results of this study will be used to inform the development of a web-based survey. The survey results may be published in conference papers, journals or other venues as appropriate, however, no identifying information will be included.

In order to preserve confidentiality and to facilitate discussion it is requested that you not reveal the identity of the participants in the focus group or their specific opinion.

Who do I contact if I have questions about the project?

If you have any questions or problems associated with your participation in the project, please contact the Chief Investigator, Paul Rothmore on +61 8 8313 3568.

If I want to participate, what do I do?

If you are willing to participate in the research, please complete the enclosed consent form and bring it with you to the focus group.



The University of Adelaide

Human Research Ethics Committee (HREC)

This document is for people who are participants in a research project.

CONTACTS FOR INFORMATION ON PROJECT AND INDEPENDENT COMPLAINS PROCEDURE

The following study has been reviewed and approved by the University of Adelaide Human Research Ethics Committee:

Project Title:	Taking the next step: Operationalising a behaviour-based approach for musculoskeletal injury prevention
Approval Number:	H-2014-059

The Human Research Ethics Committee monitors all the research projects which it has approved. The committee considers it important that people participating in approved projects have an independent and confidential reporting mechanism which they can use if they have any worries or complaints about that research.

This research project will be conducted according to the NHMRC National Statement on Ethical Conduct in Human Research (see <http://www.nhmrc.gov.au/publications/synopses/e72syn.htm>)

1. If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the project co-ordinator:

Name:	Paul Rothmore. Lecturer and Program Coordinator, School of Population Health
Phone:	+61 08 8313 3568

2. If you wish to discuss with an independent person matters related to:

- making a complaint, or
- raising concerns on the conduct of the project, or
- the University policy on research involving human participants, or
- your rights as a participant,

contact the Human Research Ethics Committee's Secretariat on phone +61 08 8313 6028 or by email to hrec@adelaide.edu.au

Human Research Ethics Committee (HREC)**CONSENT FORM**

1. I have read the attached Information Sheet and agree to take part in the following research project:

Title:	Taking the next step: Operationalising a behaviour-based approach for musculoskeletal injury prevention
Ethics Approval Number:	H-2014-059

2. I have had the project, so far as it affects me, fully explained to my satisfaction by the research worker. My consent is given freely.
3. Although I understand the purpose of the research project it has also been explained that involvement may not be of any benefit to me personally.
4. I have been informed that, while information gained during the study may be published, I will not be identified and my personal results will not be divulged.
5. I understand that I am free to withdraw from the project at any time. However, I understand that if I participate in a group discussion session, I will not be able to withdraw my contributions as these form part of the group discussion and individual contributions cannot be identified.
6. I understand that during the group discussion session audio recording will be used.
7. I am aware that I should keep a copy of this Consent Form, when completed, and the attached Information Sheet.

Participant to complete:

Name: _____ Signature: _____

Date: _____

Researcher/Witness to complete:

I have described the nature of the research to

(print name of participant)

and in my opinion she/he understood the explanation.

Signature: _____ Position: _____

Date: _____



FOCUS GROUP QUESTIONNAIRE

Name: Date:

Introductory/Background Information

1. Gender
 Male Female

2. How old are you?

3. How many years have you practiced in the field of Occupational Health/Ergonomics?
.....

4. What is your job title?

5. In what type or organisation are you primarily employed?
 Self-employed/Independent
 Private sector organisation (primarily a consultancy firm)
 Private sector organisation (not primarily a consultancy firm)
 Government organisation/agency/department
 Academic/Research organisation
 Other (please specify)

6. Are you a member of any of the following professional associations?
 Human Factors and Ergonomics Society
 Physiotherapy Association
 Occupational Therapy Association
 Safety Institute
 Other (please specify)

7. In which industries have you practiced occupational health/ergonomics in your career?

- | | |
|---|--|
| <input type="checkbox"/> Construction | <input type="checkbox"/> Defence |
| <input type="checkbox"/> Healthcare | <input type="checkbox"/> Information and Communication |
| <input type="checkbox"/> Manufacturing | <input type="checkbox"/> Transport and Storage |
| <input type="checkbox"/> Other (please specify) | |

8. In which application areas have you practiced occupational health/ergonomics in your career to date?

- | | |
|---|--|
| <input type="checkbox"/> Tasks, jobs and work processes | <input type="checkbox"/> Displays, control and HCI |
| <input type="checkbox"/> Safety Management | <input type="checkbox"/> Workplaces and furniture |
| <input type="checkbox"/> Training | |
| <input type="checkbox"/> Other (please specify) | |



Please complete the following questions at the end of the focus group.

FOCUS GROUP PROCESS QUESTIONNAIRE

1. Did you feel able to contribute to the Focus Group discussion?

2. Was the group the correct size?

3. Were there any issues which you were unable to raise but should be considered?

4. Do you have any other comments?

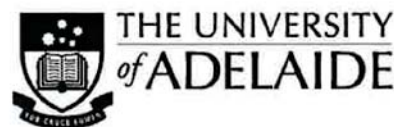
5. Do you consent to being contacted in the future about this research topic and future participation?
 - a. If so, please provide your contact details.
Name:
 - Telephone Number:
 - e-mail address:

If you would like to discuss anything further please contact Paul Rothmore on +61 8 8313 3568 or via e-mail – paul.rothmore@adelaide.edu.au



TOPIC GUIDE FOR FOCUS GROUPS

1. A little bit about ourselves – first names, background, area of professional practice.
2. How do currently monitor the effectiveness of your interventions?
3. How do you know whether your advice has been implemented?
4. What are the barriers to the implementation of your advice?
5. What could facilitate the implementation of your advice?
6. What role do outcome measures have in evaluating the effectiveness of your advice?
 - a. Which outcome measures do you use?
 - b. Why do you use these particular ones?
7. Do you prioritise the advice you provide?
 - a. Risk management approach
 - b. Hierarchy of controls approach
8. What do you see as the role of analysis tools when developing your advice?
9. Which analysis tools do you commonly use?
 - a. Why do you use these?
 - b. What characteristics do they share?
10. What do you think is the role of behaviour change theory in workplace changes?
11. How likely would you be to use a behaviour-change assessment tool if it were available?
12. Are there any factors that would increase the likelihood of using a behaviour-change assessment tool in professional practice?
 - a. What characteristics should it have?
13. Are there any areas in which greater clarification is needed?



RESEARCH BRANCH
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EMAIL hrec@adelaide.edu.au

CRICOS Provider Number 00123M

12 December 2014

Mr P Rothmore
School of Public Health

Dear Mr Rothmore

ETHICS APPROVAL No: H-2014-273

PROJECT TITLE: Taking the next step: Operationalising a behaviour-based approach for musculoskeletal injury prevention interventions (Stage 2)

The ethics application for the above project has been reviewed by the Low Risk Human Research Ethics Review Group (Faculty of Health Sciences) and is deemed to meet the requirements of the *National Statement on Ethical Conduct in Human Research (2007)* involving no more than low risk for research participants. You are authorised to commence your research on **12 Dec 2014**.

Ethics approval is granted for three years and is subject to satisfactory annual reporting. The form titled *Project Status Report* is to be used when reporting annual progress and project completion and can be downloaded at <http://www.adelaide.edu.au/ethics/human/guidelines/reporting>. Prior to expiry, ethics approval may be extended for a further period.

Participants in the study are to be given a copy of the Information Sheet and the signed Consent Form to retain. It is also a condition of approval that you **immediately report** anything which might warrant review of ethical approval including:

- serious or unexpected adverse effects on participants,
- previously unforeseen events which might affect continued ethical acceptability of the project,
- proposed changes to the protocol; and
- the project is discontinued before the expected date of completion.

Please refer to the following ethics approval document for any additional conditions that may apply to this project.

Yours sincerely,

Sabine Schreiber
Secretary, Human Research Ethics Committee
Office of Research Ethics, Compliance and Integrity

The web-based survey (Survey Monkey)

PRINCIPAL INVESTIGATOR: Paul Rothmore

What is the project about?

Research suggests that structuring injury prevention advice according to behaviour-change principles may improve the effectiveness of interventions designed to reduce the burden of musculoskeletal injuries. However, the behaviour-change approach used in research is not practical for general use by OHS practitioners. Researchers at the University of Adelaide have been developing a tool to make it more practical.

This study is asking OHS practitioners to view the assessment tool and respond to a survey. The information gathered will inform further modification of the tool, adapting it to be suitable for in the field use by practicing ergonomists.

Who is conducting the research?

Paul Rothmore. The University of Adelaide, Adelaide, Australia.

Phone: +61 8 8313 3568

Email: paul.rothmore@adelaide.edu.au

In collaboration with:

Dr. Jodi Oakman. La Trobe University, Melbourne, Australia.

Dr. David Tappin. Massey University, Auckland, NZ.

It is being funded by SafeWork SA.

What will I be asked to do?

As a member of the Human Factors and Ergonomics Society with an interest in the prevention of work-related musculoskeletal disorders you are being invited to participate in the survey. You will be asked to view the assessment tool and respond to a web based survey. This will take approximately 20 minutes to complete.

What are the benefits of the research project?

As a practicing OHS professional, this project may ultimately benefit you by developing a tool which may help you to provide behaviour-based ergonomics advice.

As a thank you for participating, you can enter a draw to win a one year membership to HFESA or HFESNZ (valued at \$300).

Are there any risks associated with participating in this project?

There are no foreseeable risks or adverse effects associated with your participation in this study.

Can I withdraw from the project?

Participation in this project is completely voluntary. You can decide to withdraw from the study at any time.

What will happen to my information?

At the end of the survey you will be asked to enter your email address. This address will be removed from your survey responses before analysis and only used to notify the winner of the draw that they will be receiving a one year membership to HFESA or HFESNZ.

No other information which may identify you will be collected. Your responses will remain confidential and only members of the study team will be able to view them. The results of the survey will form part of the final report to SafeWork SA (the funder of the study) and may be published in peer-reviewed journals and presented at professional conferences.

Research data will be kept by the Chief Investigator. A copy of the research data will be stored on the chief researcher's computer and protected by password access. Research data will be stored for a period of 15 years.

Who do I contact if I have questions about the project?

If you have any questions or problems associated with your participation in the project, please contact the Chief Investigator, Paul Rothmore on +61 8 8313 3568 or by email at paul.rothmore@adelaide.edu.au.

Who do I contact if I have a complaint or any concerns about the project?

The study has been approved by the Human Research Ethics Committee at the University of Adelaide (approval number H-2014-273). If you have questions or problems associated with the practical aspects of your participation in the project, or wish to raise a concern or complaint about the project, then you should consult the Chief Investigator (Paul Rothmore, phone: +61 8 8313 3568, email: paul.rothmore@adelaide.edu.au). If you wish to speak with an independent person regarding concerns or a complaint, the University's policy on research involving human participants, or your rights as a participant, contact the Human Research Ethics Committee's Secretariat (phone: +61 8 8313 6028, email: hrec@adelaide.edu.au). Any complaint or concern will be treated in confidence and fully investigated. You will be informed of the outcome.

If I want to participate, what do I do?

If you are willing to participate in the research, please click on the button below to start the survey.

Section 1: How You Develop and Monitor the Effectiveness of Your Advice

1. When you provide advice to organisations do you know whether this is implemented?
 - Always
 - Usually
 - Sometimes
 - Seldom
 - Never

2. How do you know whether the advice you provide is implemented?
 - I rely on unsolicited feedback from the client
 - I follow up directly with the client
 - I monitor this as part of my role as an internal consultant
 - Other (please specify) _____

3. What are the barriers to knowing whether the advice you provide is implemented? Tick all that apply.
 - Not part of the brief
 - Very difficult to do this as an external consultant
 - Company does not respond or provide the information
 - Unsure how to do this
 - Other (please specify) _____

4. If you make a number of recommendations do you prioritise the advice you provide?
 - Always
 - Usually
 - Sometimes
 - Seldom
 - Never

5. How do you prioritise the advice that you provide? Tick all that apply.
 - Risk management approach
 - Hierarchy of controls approach
 - Ease of implementation
 - Other (please specify) _____

6. Do you monitor the effectiveness of your interventions?
 - Always
 - Usually
 - Sometimes
 - Seldom
 - Never

7. How do you monitor the effectiveness of your interventions?

- I rely on unsolicited feedback from the client
- I follow up directly with the client
- I monitor this as part of my role as an internal consultant
- Other (please specify) _____

8. What are the barriers to monitoring the effectiveness of your interventions? Tick all that apply.

- Cost to company
- Company disinterest
- Not seen as a direct benefit to company
- Not part of the brief
- Very difficult to do this as an external consultant
- Unsure how to do this
- Other (please specify) _____

Section 2: The Stage of Change Approach

In professional practice, injury prevention advice commonly proposes changes to the work system, the work environment and individual work practices. An understanding of the behaviour change process, and its application in the development of workplace interventions, has been suggested as a means for improving the uptake of advice. Some models have been suggested to help in this.

9. Which of the following models are you aware of? Tick all that apply.

- Value-expectancy models (e.g. Ajzen & Fishbein, 1980 and Rogers, 1983)
- Contextual or environmental models (e.g. DeJoy & Southern, 1993)
- Behaviour change models (Prochaska & Di Clemente, 1982)
- I am not aware of any of these models
- Other (please specify) _____

Please click [here](#) to download a pdf file containing the Stage of Change Screening Tool. Take a look at the two page tool, then respond to the questions below.

In the Stage of Change framework (one of the behaviour change models), readiness to change is assessed using a short series of closed questions after which participants are assigned to a specific stage. Once the Stage of Change has been determined, advice is then tailored to improve effectiveness.

10. Which of the following are barriers to your use of this Stage of Change Screening Tool when developing ergonomics recommendations? Tick all that apply.

- Published research in this area is not readily available
- Published research in this area is inconclusive
- Published research in this area has no practical application
- The application of behaviour-change principles is outside my area of expertise
- This is not relevant to my area of professional practice
- Other (please specify) _____

11. Which of the following might facilitate your use of this Stage of Change Screening Tool when developing ergonomics recommendations? Tick all that apply.

- Access to published research in this area
- Published research showing practical application
- An easy to use tool designed for use in the field with instructions for use
- Training in the application of this method
- Other (please specify) _____

12. How likely would you be to use the Stage of Change Screening Tool presented in this survey?

- Very unlikely
- Somewhat unlikely
- Unsure
- Somewhat likely
- Very likely

13. Are there any other comments you would like to make about the screening tool?

Section 3: Scope of Practice

14. Thinking of the time you spend practicing ergonomics, please indicate the percentage of time you spend in the following domains of practice. Note that the total must equal 100%.

Physical Ergonomics

Primarily related to physiology, anatomy, biomechanics and the design of tools and products

Cognitive Ergonomics

Primarily related to aspects of psychology, human behaviour and cognitive functions

Organisational Ergonomics

Primarily related to organisational structure, work processes and job design

15. In which industries have you practiced occupational health/ergonomics in your career?

Tick all that apply.

- Accommodation and Food Services
- Administrative and Support Services
- Agriculture, Forestry and Fishing
- Arts and Recreation Services
- Construction
- Education and Training
- Electricity, Gas, Water and Waste Services
- Financial and Insurance Services
- Health Care and Social Assistance
- Information Media and Telecommunications
- Manufacturing
- Mining
- Professional, Scientific and Technical Services
- Public Administration and Safety
- Rental, Hiring and Real Estate Services
- Retail Trade
- Transport, Postal and Warehousing
- Wholesale Trade
- Other (please specify) _____

16. In which application areas have you practiced occupational health/ergonomics in your career to date? Tick all that apply.

- Activity Theories for Work Analysis and Design
- Aerospace HFE
- Affective Design
- Aging
- Agriculture
- Anthropometry
- Auditory Ergonomics
- Building and Construction
- Ergonomics for Children and Educational Environments
- Ergonomics in Design
- Ergonomics in Manufacturing
- Gender and Work
- Healthcare Ergonomics
- Human Factors and Sustainable Development
- Human Simulation and Virtual Environments
- Mining
- Musculoskeletal Disorders
- Online Communities
- Organisational Design and Management
- Process Control
- Psychophysiology in Ergonomics
- Safety and Health
- Slips, Trips and Falls

- Transport
- Visual Ergonomics
- Work With Computing Systems - WWCS
- Other (please specify) _____

Section 4: Demographics

17. Gender

- Male
- Female

18. Please indicate your age in years: _____

19. How many years have you practiced in the field of Occupational Health/Ergonomics?

20. Are you a Certified Professional Ergonomist (CPE)?

- Yes
- No

21. Which Branch of HFESA / HFESNZ are you in?

- ACT
- NSW
- NT
- QLD
- SA
- TAS
- VIC
- WA
- NZ
- Other (please specify) _____

22. Are you also a member of any of the following professional associations? Tick all that apply.

- Physiotherapy Association
- Occupational Therapy Association
- Safety Institute
- Other (please specify)

23. What is your highest level of formal qualification?

- TAFE qualification
- Bachelors Degree
- Honours Degree
- Graduate Certificate
- Graduate Diploma
- Masters
- Doctorate
- Other (please specify) _____

24. In which field of study was your Bachelors Degree undertaken?

- Engineering
- Ergonomics
- Human Movement
- Nursing
- Occupational Therapy
- Physiotherapy
- Psychology
- Other (please specify) _____

25. In what type of role are you primarily employed?

- External Consultant - Sole Trader
- External Consultant - Ergonomics/OHS Consultancy Organisation
- Internal Consultant - Public Sector
- Internal Consultant - Private Sector
- Academic / Research
- Not currently employed
- Other (please specify) _____

26. Approximately how many people are employed in your primary organisation?

- 1 to 4
- 5 to 19
- 20 to 199
- 200+

27. Would you like to provide any comments in relation to this questionnaire?

28. If you wish to enter the draw to win a one year membership to HFESA or HFESNZ (valued at \$300), please enter your email address below.

This address will be removed from your survey responses before analysis and only used to notify the winner of the draw that they will be receiving a one year membership to HFESA or HFESNZ.

Thank you for taking the time to complete this survey.