

A staged approach to reducing musculoskeletal disorders (MSDs) in the workplace

A long term follow-up

Prepared by **Loughborough University**
for the Health and Safety Executive 2007

A staged approach to reducing musculoskeletal disorders (MSDs) in the workplace

A long term follow-up

Kate Shaw, Professor Cheryl Haslam & Professor Roger Haslam

Department of Human Sciences

Loughborough University

Loughborough

Leicestershire

LE11 3TU

Musculoskeletal disorders (MSDs) remain the most common form of occupational ill-health in Great Britain. Recent research by the authors (Whysall, Haslam and Haslam, 2005) involved the development and evaluation of a new and innovative approach to reducing MSDs. These authors applied a model from health psychology (stage of change model) to develop interventions more closely matched to worker and manager stage of change. Twenty four interventions were monitored within a variety of organisations for up to six months. Tailored interventions (matched to stage of change) were found to be more effective in promoting risk-awareness, promoting behaviour change aimed at reducing risks, and in reducing self-reported musculoskeletal discomfort in a number of body areas.

The study described in this report involved a longer-term follow-up at 15 months post-intervention and at 20 months post-intervention to ascertain whether the improvements seen at 6 months persist in the longer term. The results show that the benefits in behaviour change and symptom reduction persist over a longer period of follow-up. Tailored interventions were found to be more effective in promoting behaviour change and reducing self-reported musculoskeletal discomfort over a 20 month follow-up period.

These findings suggest that scope exists for improving the success of interventions by tailoring advice according to stage of change. This approach increases the uptake, implementation, and maintenance of risk-reducing measures.

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.

HSE Books

© Crown copyright 2007

First published 2007

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written permission of the copyright owner.

Applications for reproduction should be made in writing to:
Licensing Division, Her Majesty's Stationery Office,
St Clements House, 2-16 Colegate, Norwich NR3 1BQ
or by e-mail to hmsolicensing@cabernet-office.x.gsi.gov.uk

ACKNOWLEDGEMENTS

We would like to thank the organisations that took part in this research for kindly providing us with access to their workplaces, and to the employees within these organisations for their time and their useful comments.

We would also like to thank our HSE colleagues Pauline Stenhouse, Peter Kelly and Sue Brandrick for their support, guidance and encouragement throughout the project.

CONTENTS

EXECUTIVE SUMMARY.....	vii
1 INTRODUCTION.....	1
1.1 Objectives.....	4
1.2 Research approach.....	4
1.3 Report format.....	4
2 METHOD.....	5
2.1 Research instruments	6
2.2 Sample	6
2.3 Analysis.....	6
3 STANDARD INTERVENTIONS.....	11
3.1 Results: 15 months post-intervention - Workers.....	11
3.2 Results: 15 months post-intervention - Managers.....	15
3.3 Results: 20 months post-intervention - Workers	16
3.4 Results: 20 months post-intervention - Managers.....	21
4 TAILORED INTERVENTIONS.....	22
4.1 Results: 15 months post-intervention - Workers	22
4.2 Results: 15 months post-intervention - Managers.....	28
4.3 Results: 20 months post-intervention - Workers	29
4.4 Results: 20 months post-intervention - Managers.....	36
5 MANAGERIAL INTERVIEWS.....	37
5.1 Participant characteristics.....	37
5.2 Barriers to change.....	37
5.3 Factors facilitating the change process	37
5.4 Outcomes of the intervention	37
6 SUMMARY AND CONCLUSIONS.....	40
6.1 Standard interventions	40
6.2 Tailored interventions.....	40
6.3 Manager interviews.....	41
6.4 Implications for theory and practice.....	41
6.5 Conclusions.....	43
7 REFERENCES.....	44-45
APPENDICES.....	46-65

EXECUTIVE SUMMARY

PROJECT AIMS

For over a decade musculoskeletal disorders (MSDs) have remained the most common cause of work-related ill health in Great Britain, presenting substantial costs to individual sufferers, employers, and health service providers alike. This raises the question as to why prevalence rates remain high in spite of ongoing attempts to tackle MSDs, and how interventions to reduce MSDs can be made more effective.

Behaviour is a crucial factor in the reduction of many of today's most widespread diseases and health problems, including MSDs. Most interventions aimed at reducing MSDs focus on the physical aspects of the work environment and the job task, rather than tackling 'psychological' factors such as risk perception or management commitment. Such an approach overlooks important psychosocial influences, which have been found to be associated with MSDs.

Recent research by the authors (Whysall, Haslam and Haslam, 2005) attempted to improve the efficacy of interventions by applying the stage of change model to the workplace. The stage of change model acknowledges the importance of addressing attitudes in order to achieve behaviour change, and assumes that any behaviour change involves movement through distinct stages:

- i) precontemplation (resistance to recognising or modifying problem behaviour)
- ii) contemplation (recognition of the problem, thinking about changing, but not ready to act)
- iii) preparation (intending to change in the next 30 days, and/or having made specific plans to do so)
- iv) action (having engaged in behaviour change, no longer than 6 months ago)
- v) maintenance (initiated changes over 6 months ago, working to consolidate gains made and avoid relapse)

According to the model, an individual's stage determines their receptiveness to, and the likely efficacy of, particular methods of education. In the precontemplation stage individuals are more influenced by graphic information about the health risks, whereas skills training or practical advice is more effective in promoting change among those in the preparation stage.

Whysall, Haslam and Haslam (2005) developed new tools to measure organisational and worker stage of change with respect to MSDs and then used these tools to develop interventions tailored to manager and worker stage of change. The effectiveness of tailored compared to standard interventions was measured on a variety of levels, including stage of change and self-reported musculoskeletal discomfort. Evaluations were conducted 6 months after the implementation of the interventions. Tailored interventions were significantly more effective in promoting risk-awareness; promoting progression through the stages of change; promoting behaviour change and reducing self-reported musculoskeletal discomfort in a number of body areas.

15 AND 20 MONTHS POST-INTERVENTION

To determine if the positive findings seen at 6 months persist over the long term, the authors conducted a longer-term follow-up of the interventions at 15 months post-intervention and at 20 months post-intervention. The effectiveness of tailored compared to standard interventions was measured in terms of: stage of change and self-reported musculoskeletal discomfort.

Tailored interventions were significantly more effective on a number of levels:

- promoting risk-awareness
- promoting behaviour change
- promoting the maintenance of risk-reducing behaviours
- reducing self-reported musculoskeletal discomfort in a number of body areas

The impact of the tailored interventions was sustained from 6 months post-intervention to 15 and 20 months post-intervention. For some body areas, there were further reductions in the percentage of workers reporting discomfort at 15 and 20 months compared to 6 months. While standard interventions showed some reductions in discomfort at 15 and 20 months, tailored interventions had a far greater impact in terms of changing behaviour and reducing MSD symptoms from 6 months to 20 months.

The importance of tackling attitudes and behaviours was reinforced by managers involved in both the tailored and standard interventions, during post-intervention interviews. Irrespective of condition (tailored/standard), the most commonly cited barriers to the effective reduction of MSD risks were:

- changing employee behaviour
- gaining managerial commitment to/authorisation for changes

Similarly, the most commonly cited facilitators to the process of reducing the risks were:

- supportive management
- communication

CONCLUSIONS

Both the quantitative and qualitative findings of this work support previous calls for the application of the stage of change approach to occupational health and safety (e.g. Dejoy, 1996; Haslam & Haslam, 2000; Prochaska et al., 2001), suggesting that scope exists for improving the success of health and safety interventions by tailoring advice according to stage change. By focusing on the attitudes, beliefs, and behavioural intentions that underpin an individual's current stage, tailored approaches can increase the uptake, implementation, and maintenance of risk-reducing measures.

The findings in this report provide strong evidence for the long-term effectiveness of tailored interventions versus standard interventions in promoting behaviour change and reducing musculoskeletal discomfort. Wide adoption of this approach is likely to make a significant contribution to reducing both the prevalence and incidence of MSDs.

Whilst MSDs were chosen to test the application of the stage of change model to the organisational context in this research our results suggest that the stage of change approach offers considerable scope for improving a wide range of health and safety issues in the workplace. As attitude and behaviour change are crucial components to any organisational change intervention, this model is likely to have extensive application to improving health and safety in the workplace.

1 INTRODUCTION

Musculoskeletal disorders (MSDs) are consistently the most commonly reported type of work-related ill health in Great Britain according to national surveys of self-reported work-related illness (Health & Safety Commission - HSC, 2005; 2004; 2001; 2000). In 2004/2005 over a million people experienced symptoms that they felt were caused or made worse by their work (HSC, 2005).

Despite numerous attempts to manage the problem including changing work methods, the use of personal protective equipment and engineering redesigns, MSDs still remain highly prevalent (Karsh et al., 2001). Additionally, studies into the effectiveness of interventions aiming to tackle MSDs have yielded mixed results. For instance, Melhorn, (1996) found that posture training showed positive results whereas the use of a new tool or exercise training did not show any positive effects. The methodology of a number of intervention studies has come under scrutiny. Westgaard and Winkel (1997) reviewed 92 studies of ergonomic interventions and concluded that many were methodologically flawed. For instance, many studies lacked control groups and had insufficient delays between intervention and follow up.

A possible explanation for the documented inconsistency of ergonomics interventions may lie in the variability of the intervention process itself. Indeed, HSE (2002) highlighted the importance of the intervention process, and proposed a seven staged cycle for the management of MSDs (specifically focusing on upper limb disorders – ULDs):

1. Understand the issues and commit to action
2. Create the right organisational environment
3. Assess the risk of ULDs in the workplace
4. Reduce the risks of ULDs
5. Educate and inform the workforce
6. Manage any episodes of ULDs
7. Carry out regular checks on programme effectiveness

Current interventions to reduce MSDs focus largely on the physical aspects of the work, tending to overlook the more ‘psychological’ aspects of the interaction between the worker and their environment (Whysall et al., 2004). Such an approach is at odds with both practical recommendations and the principles of behaviour change theory. In terms of practical recommendations, for example, the World Health Organisation (1988) recommended that ergonomic improvements to reduce the risks of MSDs should be combined with health promotion activities aimed at modifying behaviour. Similarly, HSE proposed that effective management of MSDs requires not only reducing the physical risks in the workplace, but also efforts to educate and inform the workforce. This suggests that current organisational attempts to reduce MSDs are unsuccessful due to a failure to take into account the psychology of change.

There is growing awareness that theoretical models of health related behaviour might be useful in improving health and safety at work. Whilst many models of health related behaviour have been proposed, the Stage of Change approach (Prochaska & DiClemente, 1982); has been highlighted as particularly beneficial for application in this context (e.g. Dejoy, 1996; Haslam & Haslam; 2000; Prochaska et al., 2001). Used extensively in connection with health behaviours such as drinking, smoking, and exercise, the stage of change model centres around the change process itself, emphasising the importance of ensuring that interventions are tailored according to recipients’ readiness to change (DiClemente et al., 1991).

Consistent with the notion that individuals' behaviours are strongly determined by their knowledge and attitudes, Prochaska and DiClemente maintain that a crucial, yet frequently overlooked step in reducing health risks is to ensure that the individuals concerned perceive the health issue to be a genuine risk. In terms of MSDs, it can be seen that managers are unlikely to implement changes, or employees to adopt changes to their working practices, unless they are genuinely concerned about the issue. Individuals who are unconcerned about the risks, and are not considering taking action to reduce the risks, are considered to be in the 'precontemplation' stage. According to the stage of change model, precontemplation is the first in a series of distinct stages through which behaviour change progresses:

- vi) precontemplation (resistance to recognising or modifying problem behaviour)
- vii) contemplation (recognition of the problem, thinking about changing, but not ready to act)
- viii) preparation (intending to change in the next 30 days, and/or having made specific plans to do so)
- ix) action (having engaged in behaviour change, no longer than 6 months ago)
- x) maintenance (initiated changes over 6 months ago, working to consolidate gains made and avoid relapse)

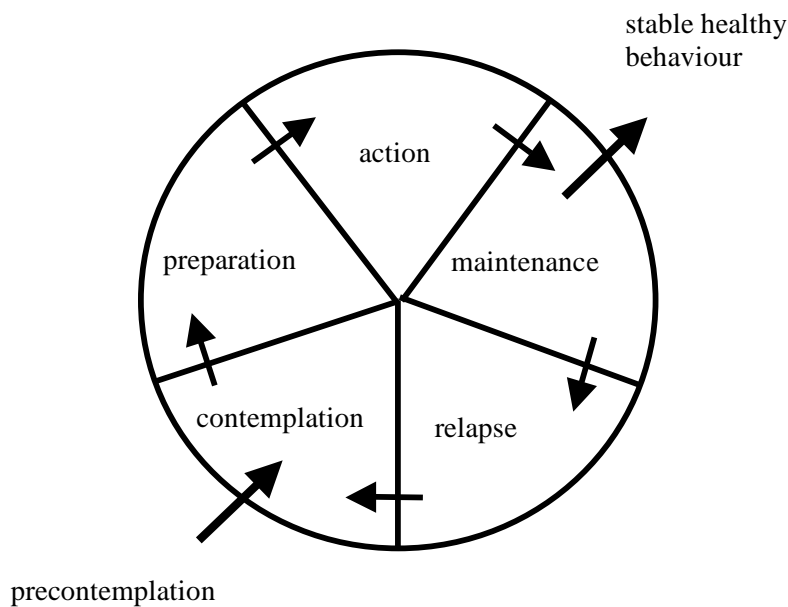


Figure 1 Stage of change (Prochaska & DiClemente, 1982)

The model has implications for promoting change in practice, as each stage has been found to be dominated by specific types of underpinning attitudes, beliefs and intentions regarding the

health issue. The key constructs believed to influence movement between stages being decisional balance (Velicier et al., 1985) and habit strength (Velicier et al., 1990). Decisional balance reflects an individual's weighing up of the pros and cons of changing. With smoking, for example, in precontemplation the pros of smoking outweigh the cons, but a crossover occurs in the contemplation stage, where the cons of smoking become equal to the pros. In the case of MSDs, therefore, a precontemplative construction worker, for example, may feel that the benefits of saving time by carrying two bags of cement at a time outweigh the possible risk of injury (despite the introduction of a weight limit on cement bags in order to protect workers). A worker who is contemplative, on the other hand, may begin to realise that the time saved by carrying two bags of cement is not worth the potential body damage caused. As individuals progress into the more advanced stages of change, the cons then begin to outweigh the pros of the risky behaviour.

This crossover effect has been observed in relation to 12 different health-related behaviours (Prochaska et al., 1994). Habit strength tends to be initially high in the precontemplation stage, but gradually weakens with progression through the stages. As a result, due to the varying dominance of these concepts over time, an individual's stage of change determines their receptiveness to (and, consequentially, the effectiveness of) health information aimed at promoting behaviour change. In the precontemplation stage, for instance, individuals are more influenced by graphic information about the health risks, whereas skills training or practical advice is more effective in promoting change among those in the preparation stage. In the maintenance stage, emphasis should be placed on the need to remain vigilant to the risks, and to establish systems of monitoring and feedback. Research adopting the model has shown that stage matched interventions increase the likelihood that individuals will take action (e.g. Prochaska et al., 1993; Rakowski et al., 1998).

Despite the intuitive relevance of the stage of change approach to the organisational context, attempts to apply the approach in practice have been limited. Urlings et al. (1990) provided some support for the benefits the application of such an approach might hold for organisational interventions. Urlings et al. explored the feasibility of adopting a staged approach to promote the introduction of standing aids into the Dutch furniture industry, although did not actually evaluate the implementation of such an approach. Furthermore, consisting of a single case study, these findings have limited use in terms of broader application.

Whysall, Haslam and Haslam (2005) developed new tools to measure organisational and worker stage of change with respect to MSDs and then used these tools to develop interventions tailored to manager and worker stage of change. Tools were developed to assess both organisational and individual worker stage of change regarding work-related MSDs, and administered to personnel within a wide range of organisations. The stage of change approach was then tested in practice, by monitoring 24 interventions aimed at reducing the risks of MSDs, and in half of these cases attempting to improve intervention effectiveness by tailoring interventions according to both worker and organisational stage of change. Evaluations of tailored versus standard interventions at 6 months post-intervention found tailored interventions to be more effective on a number of levels: promoting risk-awareness, promoting progression through stages of change and reducing self reported musculoskeletal discomfort in a number of body areas.

The aim of the current research, therefore, was to determine whether these positive findings persist over a longer period of time. The study followed up the organisations at 15 and 20 months after the initial implementation of interventions.

1.1 OBJECTIVES

The objectives of this project were to:

- provide a longitudinal evaluation of the effectiveness of tailored interventions compared to non-tailored interventions
- provide longitudinal case studies demonstrating the process of change and organisational experiences
- generate in depth data establishing the factors that enhance or inhibit positive behaviour change in organisations

1.2 RESEARCH APPROACH

A combination of research methods were used to achieve these objectives, including quantitative and qualitative elements. A number of post-intervention measures were taken within each case study organisation including:

- Employee survey
- Managerial survey
- Semi-structured interviews with managers

1.3 REPORT FORMAT

The report is divided into sections as follows:

Section 2 - Method

Section 3 – Standard interventions*

- Results: 15 months post-intervention
- Results: 20 months post-intervention

Section 4 – Tailored interventions*

- Results: 15 months post-intervention
- Results: 20 months post-intervention

Section 5 – Managerial interviews

Section 6 - Summary and conclusions

- Overview of findings
- Implications for theory and practice
- Conclusions

* Results sections report movement through stages of change, proportions of workers experiencing MSD discomfort and severity of discomfort (general attitudinal data relating to MSDs among the workforce and managers is presented in tables in Appendix 6).

2 METHOD

The first phase of the research is reported in full in the previous HSE report (Whysall, Haslam and Haslam, 2005). It involved pre- and post-intervention monitoring of 24 workplace interventions aimed at reducing the risks of work-related MSDs (see figure 2). These interventions were carried out in a range of sectors: manufacturing, delivery/logistics, education, healthcare, engineering, construction, printing and fire/rescue service. A number of pre- and post-intervention measures were taken within each case study organisation, namely:

- Observation of working practices
- Employee survey
- Managerial survey
- Semi-structured interviews with managers (post-intervention)

In approximately half of the cases, organisations were provided with pre-intervention information and advice on how to tailor their interventions according to both managerial and worker stage of change. For example, in cases where managers and/or workers were identified as being in the precontemplation stage, the organisation was advised of the importance to first educate and promote risk awareness among both of these groups of individuals, by highlighting the detrimental effects of MSDs. In order to do this effectively, emphasis was placed on the need for this information to be specifically targeted to the primary concerns of these two different groups (i.e. managers and workers):

Managerial concerns

- Reduced productivity
- Reduced product/service quality
- Employee suffering
- Damage to company reputation
- Increased absence
- Early retirement through ill health
- Increased turnover
- Higher recruitment and training costs
- Compensation claims
- Increased insurance premiums

Workers' concerns

- MSD discomfort
- Numbness, tingling
- Temporary or permanent disability
- Lost time from work
- Loss of earnings
- Treatment/healthcare costs

Health promotion materials were developed to assist organisations in this task, including leaflets, posters, presentations, and CD-ROMs. Further details on the tailoring process are presented in Appendix 6.

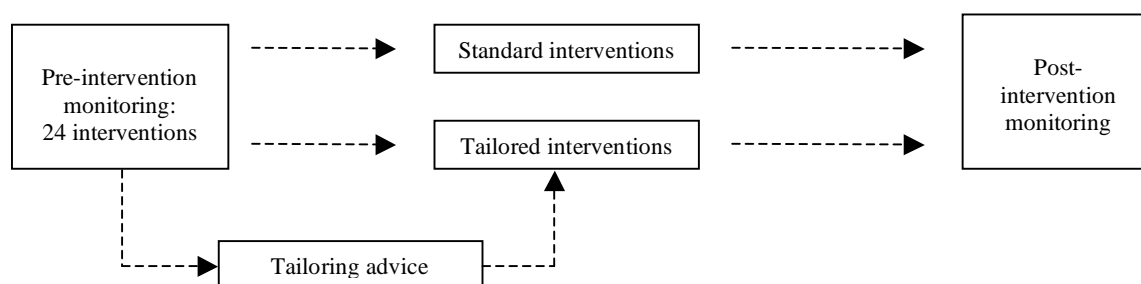


Figure 2 Implementation phase overview

Interventions were initially evaluated at 6 months post-intervention. The follow-up research (reported here) repeated evaluations at 15 months and at 20 months post-intervention.

2.1 Research instruments

The organisational and worker surveys used comprised three sections below as used in the Whysall, Haslam and Haslam (2005) research:

- demographic characteristics and background information (e.g. company size, role of the respondent, tenure)
- stage of change assessment (appendix 2)
- attitudes toward reducing MSDs (appendix 5)

The worker survey included an additional sections:

- musculoskeletal discomfort experienced in the previous 7 days
- discomfort rating (appendix 4)

2.2 Sample

A total of 16 case study interventions were monitored at 15 months post-intervention (8 tailored and 8 standard). Not all of the original interventions could be followed-up due to companies no longer being in existence or a return visit not being possible at the time of the study. A total of 13 interventions were followed up at 20 months post-intervention (6 tailored and 7 standard interventions). This was due to one company going into administration and two companies not being available at the time of the 20 month follow up. To boost the sample at follow-up, as well as administering checklists to employees who took part in the research previously, checklists were administered to people who were previously involved in the interventions but who did not previously take part in the survey. Both the worker and managerial checklists included a background information sheet to establish whether the participants had previously participated in the research (appendix 3).

2.3 Analysis

Descriptive statistics were used to identify the distribution of organisations and workers across the stages of change and workers' reported discomfort. Chi-square tests were used to identify significant differences in stage of change after the implementation of interventions and to identify significant differences in the number of people experiencing discomfort. In addition to analysing individual body areas, body areas were categorised into the upper limb, lower limb area (legs) and back. Kruskal Wallis tests were used to identify significant differences in workers' severity ratings.

In comparing the pre-intervention and post-intervention data at 15 months, the analysis considered only those 16 organisations involved at pre-intervention, 6 months post-intervention and 15 months intervention. In comparing the pre-intervention and post-intervention data at 20 months, the analysis considered only those 13 organisations involved at pre-intervention, 6 months post-intervention, 15 months intervention and 20 months post-intervention.

Transcribed data from post-intervention interviews with managers were analysed using the structured method outlined by Miles and Huberman (1994). The data under each theme was summarised and verbatim quotes used to illustrate the theme being described.

Organisational details relating to each case study are shown in table 1. Details of the interventions are shown in table 2. Appendix 6 lists stages of change and explains how information is tailored to the stages.

Table 1 Organisational details

* = Companies involved in both the 15 and 20 month follow up

Case	Tailored/ Standard	Sector	Org. size	Section/dept size	Nature of work
1 *	Standard	Manufacturing	11000	35	Manufacture of paving materials
2	Tailored	Manufacturing	850	20	Manufacture of alternators
3 *	Standard	Utilities	4500	120	Call centre
4 *	Tailored	Utilities	4500	160	Call centre
5 *	Standard	Utilities	4500	15	Administration
6	Tailored	Manufacturing	110	54	Foundry
7 *	Standard	Education	6000	40	Primary education
8 *	Tailored	Education	3000	55	Library
9 *	Standard	Education	6000	40	Primary education
10 *	Tailored	Transport & communications	8	8	Courier
11	Standard	Education	4000	32	Primary education
12 *	Tailored	Transport	4300	580	Baggage handling
13 *	Standard	Transport	157	157	Baggage handling
14 *	Tailored	Utilities	91600	23	Call centre/engineering
15 *	Standard	Manufacturing & delivery	6000	500	Delivery/despatch
16 *	Tailored	Manufacturing & delivery	6000	100	Delivery/despatch

Table 2 Intervention details

* = Companies involved in both the 15 and 20 month follow up

Case	Tailored/ Standard	Intervention details
1 *	Standard	Changes introduced: Monthly ‘toolbox talks’ on specific safety issues, health and safety inductions, health screening for new staff, return to work interviews following absence, monthly safety improvement team meetings (employee representatives and management), reduction in shift length, near miss reporting system, improved staff facilities (canteen, showers, staff room), resurfacing of yard, stock rotation system (reducing the need for manual handling of stock).
2	Tailored	<i>Workers were in the preparation stage, and so feedback was given regarding changes that would help reduce the risks. Managers and supervisors were in the action stage, and so advice was provided on the importance of maintaining efforts to reduce the risks by developing systems for ongoing monitoring and feedback.</i> Changes introduced: Job rotation, powered wire cutters, tool balancer, low impact hammers, and advice regarding improved working postures. An ergonomics issues board was introduced into the workshop, providing information on MSDs such as symptoms to look out for, and minutes from safety meetings to inform employees of intended actions and to generate feedback.
3 *	Standard	Changes introduced: Introduction of interactive web-based training package available for employees’ ongoing use from their own work stations, educating employees about how to assess their own areas for risks, and the types of changes that can help to reduce the risks.
4 *	Tailored	<i>The majority of employees were precontemplative, either because they were unconcerned about the risks, or because they had taken steps to reduce the risks, but felt that no further attention to the issue was necessary. The call centre manager was in the maintenance stage. Advice was given regarding the importance of highlighting ensuring that all workers appreciated the risks of MSDs, and the need for employees to remain vigilant to the risks once action has been taken. To facilitate this, information was provided regarding MSDs and the potential detrimental effects for workers (in terms of factors such as pain, discomfort, absence, and lost earnings).</i> Changes introduced: Introduction of interactive web-based training package available for employees’ ongoing use from their own work stations, educating employees about how to assess their own areas for risks, and the types of changes that can help to reduce the risks.

5 *	Standard	Changes introduced: Risk assessments for all tasks, manual handling training, foot and wrist rests provided where desired, workstations adjusted (e.g. table height) trolley for transporting mail sacks, space under desks cleared, reorganisation of storage areas, automatic staplers, job rotation, blinds replaced to reduce glare.
6	Tailored	<i>Approximately half of the workforce were in the preparation stage, and half in the precontemplation stage, having taken steps to reduce the risks, but feeling that no further attention to the issue was necessary. Two managers were in preparation, and one in precontemplation. Advice was given regarding the importance of highlighting the need for employees to remain vigilant to the risks once action has been taken, and to ensure that all managers are convinced of the need to take action. To facilitate the latter point, information was provided regarding MSDs and the potential detrimental effects for managers/organisations (in terms of factors such as increased absence, reduced productivity, compensation claims).</i> Changes introduced: Production process altered to enable stacking to take place at operative's own pace, using a sloping stacking table, health screening, improved risk-assessment procedure (emphasis on identifying risks for MSDs), accident reporting systems and workshop for senior managers regarding the risks of MSDs.
7 *	Standard	Changes introduced: Training in moving and handling, reorganisation of storage areas, assistive lifting devices and job rotation.
8 *	Tailored	<i>The majority of workers were in the precontemplation stage, so advice was given regarding the importance of ensuring that workers appreciated the risks of MSDs. To facilitate this, information was provided regarding MSDs and the potential detrimental effects for workers (in terms of factors such as pain, discomfort, absence, and lost earnings).</i> Changes introduced: Introduction of self-service terminal and drop boxes to reduce handling of books by staff at issue desk, foot rests where desired, maintenance of trolleys, reorganisation of equipment storage to ease access, refresher training in manual handling and how to identify problems.
9 *	Standard	Changes introduced: Training in moving and handling, reorganisation of storage areas, assistive lifting devices, adjustable wheeled stool for teachers.
10 *	Tailored	<i>The majority of workers were in the precontemplation stage, so advice was given regarding the importance of ensuring that workers appreciated the risks of MSDs. To facilitate this, information was provided regarding MSDs and the potential detrimental effects for workers (in terms of factors such as pain, discomfort, absence, and lost earnings).</i> Changes introduced: Installation of automatic doors, replacement of delivery trolley with motorised vehicle, removal of obstacles in delivery area enabling vehicles to back up to loading bay, enforcement of mail bag weight limits around the organisation.
11	Standard	Changes introduced: Training in moving and handling, reorganisation of storage areas, assistive lifting devices, job rotation, adjustable wheeled stool for teachers.

12 *	Tailored	<i>The majority of workers were in the preparation stage, and so feedback was given regarding changes that would help reduce the risks. Their manager was in the action stage, and so advice was provided on the importance of maintaining efforts to reduce the risks by developing systems for ongoing monitoring and feedback. Changes introduced: Reduction of baggage weights permitted.</i>
13 *	Standard	Changes introduced: Reduction of baggage weights permitted.
14 *	Tailored	<i>The majority of workers were in the precontemplation stage, so advice was given regarding the importance of ensuring that workers appreciated the risks of MSDs. To facilitate this, information was provided regarding MSDs and the potential detrimental effects for workers (in terms of factors such as pain, discomfort, absence, and lost earnings). Changes introduced: Training regarding the potential effects of MSDs and work-related risks of MSDs.</i>
15 *	Standard	Changes introduced: Training in manual handling, health screening, improved storage of products on vehicles, mobile ramps to facilitate delivery.
16 *	Tailored	<i>Workers were in the preparation stage, and so feedback was given regarding changes that would help reduce the risks. Their managers, however, tended to be precontemplative, and so advice was given on the importance of gaining their commitment by ensuring that they are convinced of the need to take action. To facilitate this, information was provided regarding MSDs and the potential detrimental effects for managers/organisations (in terms of factors such as increased absence, reduced productivity, compensation claims). Changes introduced: Training in manual handling, health screening, improved storage of products on vehicles, mobile ramps to facilitate delivery.</i>

SECTION 3 – STANDARD INTERVENTIONS

3.1 RESULTS – 15 MONTHS POST-INTERVENTION - WORKERS

3.1.1 Participant characteristics

Details of the workers involved in the 8 standard interventions, at pre-intervention, 6 and 15 months post-intervention, are shown in table 3. The additional respondents included in the 15 month evaluation (who had been involved in the intervention but had not been surveyed at 6 months) comprised some younger workers which brought the mean age down.

Table 3 Workers' personal characteristics

	Pre-intervention (N = 105)		6 months post- intervention (N = 101)		15 months post- intervention (N = 114)	
	Mean	Std.Deviation	Mean	Std.Deviation	Mean	Std.Deviation
Age (years)	39	11.3	42	11.3	39	12.1
Tenure (years)	8	7.5	10	9.4	9	8.6
Hrs worked (wk)	38	12.3	37	11.2	39	9.6

3.1.2. Stage of change

Prior to the implementation of the interventions, the majority of the workers in the standard intervention condition were in the precontemplation and preparation stages (32 % and 31%). Following the implementation of interventions little movement occurred in terms of worker stage of change as shown in figure 3. Table 4 shows results of a chi-square analysis comparing the number of workers in each stage over the three time periods.

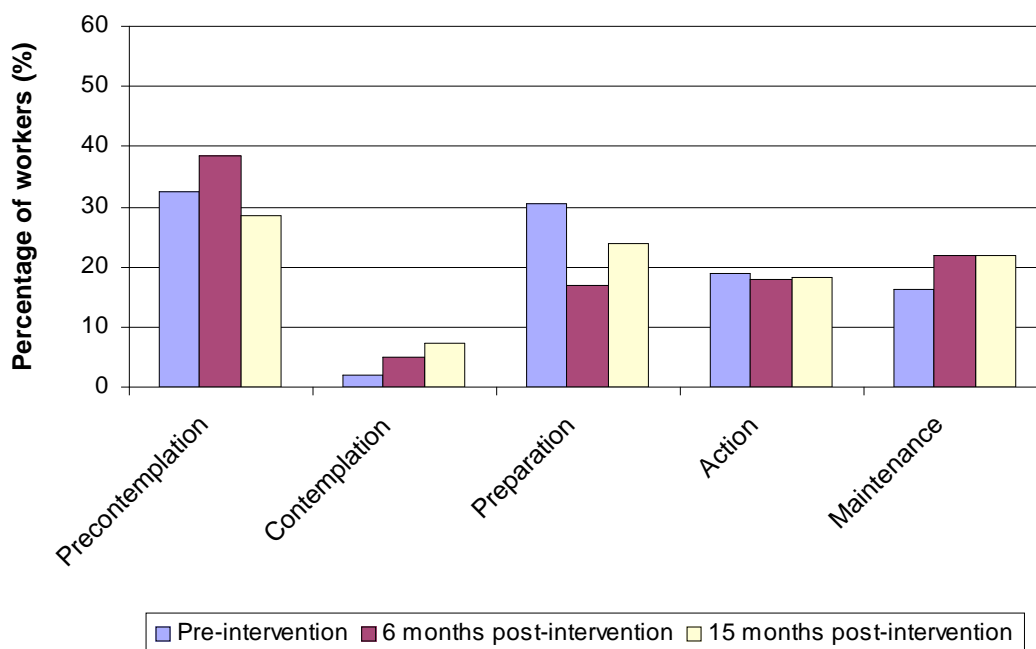


Figure 3. Worker stage of change

Table 4 Chi-square analysis and significance level

Follow up	Stage	Chi square	p value
Pre-intervention and 6 months post-intervention	Preparation	5.29	< 0.05

Summary of changes in stage following standard interventions at 15 months

- There were significantly fewer workers in the preparation stage at 6 months
- There were no significant differences across other stages between 6 and 15 months post-intervention

3.1.3 Discomfort Experienced in last 7 days

Workers were asked whether they had experienced musculoskeletal discomfort in the last 7 days prior to the implementation of interventions and at 6 and 15 months post-intervention. The actual frequency of workers having reported discomfort in each body area is given in table 5 and shown in percentages in figure 4. Figure 5 shows the percentage of workers reporting pain/discomfort in the body areas categorised as upper limbs, lower limb area and back. Figure 6 shows mean ratings of discomfort severity. Table 6 shows the results of a chi-square analysis comparing the number of workers reporting discomfort over the three time periods.

Table 5 Worker's self-reported discomfort

		Pre-intervention	6 months post-intervention	15 months post-intervention
Total number of participants		104	101	114
Number of workers having experienced pain in each body area	Neck	49	52	50
	Shoulder	49	39	40
	Upper arm	17	19	20
	Elbow	24	20	25
	Forearm	18	17	15
	Wrist	26	25	22
	Hand	23	22	19
	Upper back	24	20	21
	Lower back	57	51	51
	Legs	33	35	30

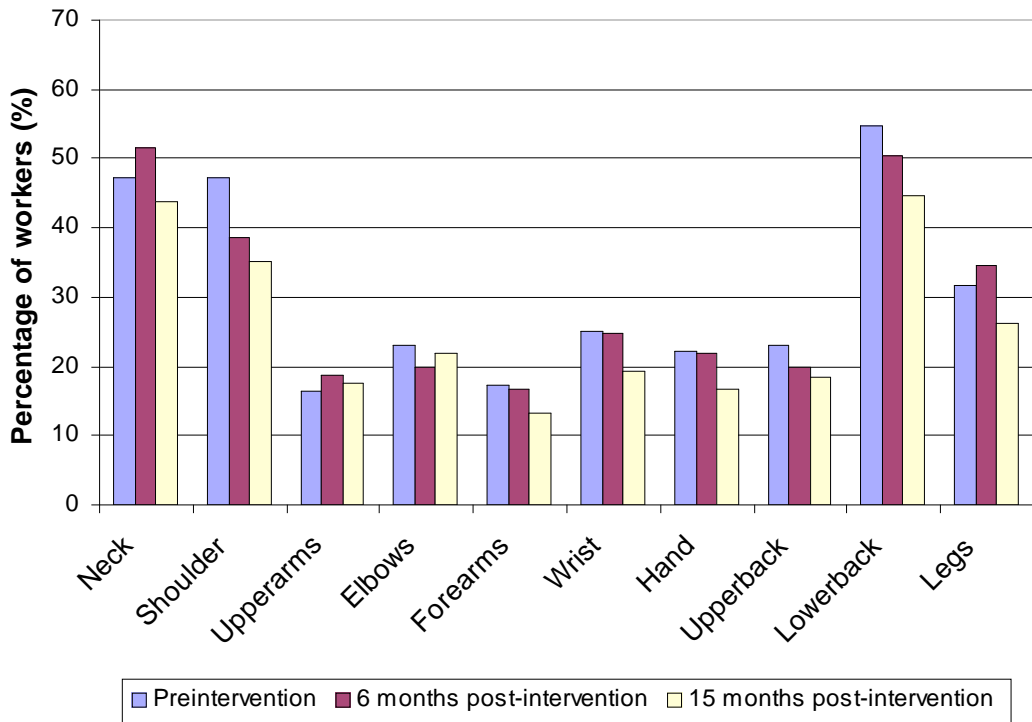


Figure 4 Percentage of respondents experiencing discomfort in the previous 7 days

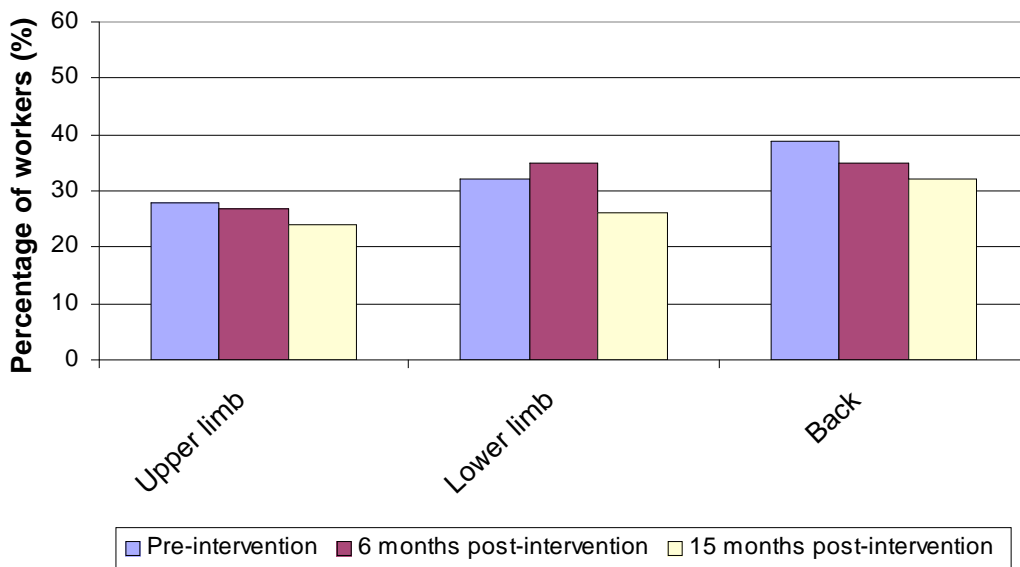


Figure 5 Percentage of respondents experiencing discomfort in the last 7 days (combined body areas)

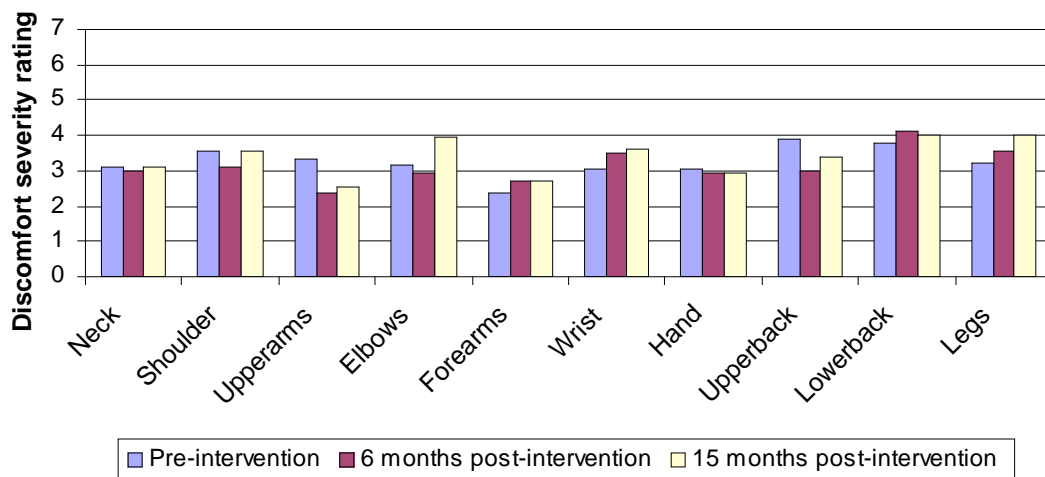


Figure 6 Mean ratings of discomfort severity

Table 6 Chi square analysis and significance level

Follow up	Discomfort area	Chi square	p value
Pre-intervention and 15 months post-intervention	Upper limb	3.76	0.05

Summary of changes in discomfort following standard interventions at 15 months

- There were no significant changes in the proportions of respondents reporting discomfort in any of the individual body areas
- At 15 months there was a significant decrease in the number of workers reporting discomfort in the upper limbs compared to pre-intervention (there was also a decrease in discomfort in the lower limb area but this was not significant as it was based on a small sample (discomfort in legs))
- There were no significant differences in ratings of discomfort between the pre-intervention, 6 and 15 months post-intervention data

3.2 RESULTS - 15 MONTHS POST-INTERVENTION - MANAGERS

3.2.1 Participant characteristics

In the standard intervention condition, 16 managers participated in the pre-intervention survey. At 6 months post-intervention 10 managers completed the survey and at 15 months intervention 16 managers completed the survey.

Whilst managers' responses were crucial to the tailoring of interventions, due to the relatively small numbers of managers, care must be taken in interpreting these results as generalisable to the broader managerial population.

3.2.2 Stage of change

Prior to the implementation of interventions, the majority of managers were in the action stage (38%) at 15 months post-intervention the majority of managers were in the action and maintenance stage (60% and 56%). Figure 7 shows managerial stage of change.

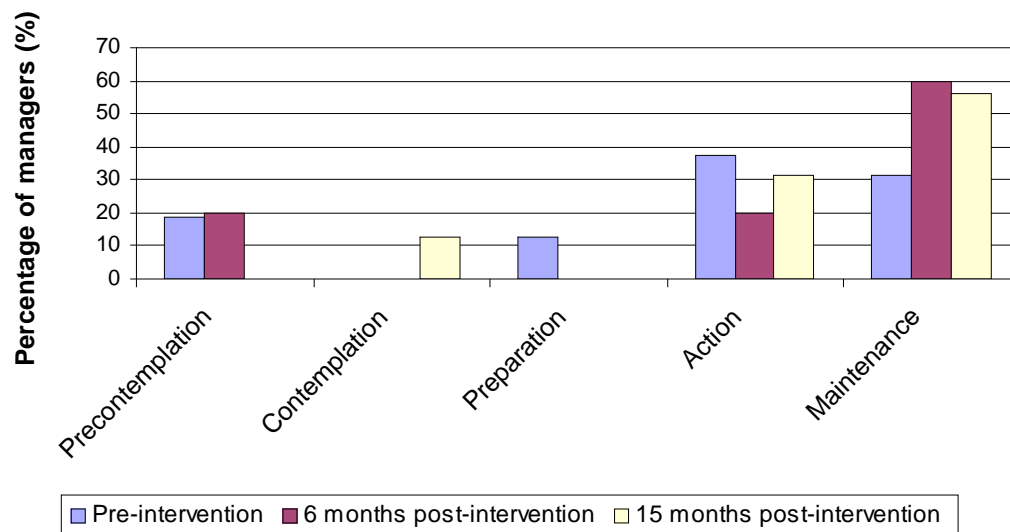


Figure 7 Managerial stage of change (standard interventions)

Summary of changes in managers' stage of change

- The noticeable increase in the number of managers in the maintenance stage following the implementation of interventions was not significant due to the relatively small sample

3.3 RESULTS – 20 MONTHS POST-INTERVENTION- WORKERS

3.3.1 Participant characteristics

Details of the workers involved in the 7 standard interventions, at pre-intervention, 6, 15 and 20 months post-intervention, are shown in table 7 and 8.

Table 7 Worker’s personal characteristics

	Pre-intervention (N = 89)		6 months post-intervention (N = 87)	
	Mean	Std.Deviation	Mean	Std.Deviation
Age (years)	40	11.2	43	10.9
Tenure (years)	7	7.1	10	9.8
Hrs worked per wk	40	11.4	38	10.8

Table 8 Worker’s personal characteristics

	15 months post-intervention (N = 108)		20 months post-intervention (N = 85)	
	Mean	Std.Deviation	Mean	Std.Deviation
Age (years)	39	12.5	35	10.4
Tenure (years)	9	8.7	8	7.7
Hrs worked per wk	39	9.4	37	8.6

3.3.2 Stage of change

Prior to the implementation of the interventions, the majority of workers in the standard intervention condition were in the precontemplation (27%) and preparation (30%) stages. At 20 months post-intervention the majority were in action (32%) and maintenance (27%). Figure 8 shows worker stage of change. Table 9 shows results of a chi-square analysis comparing the number of workers in each stage over the four time periods.

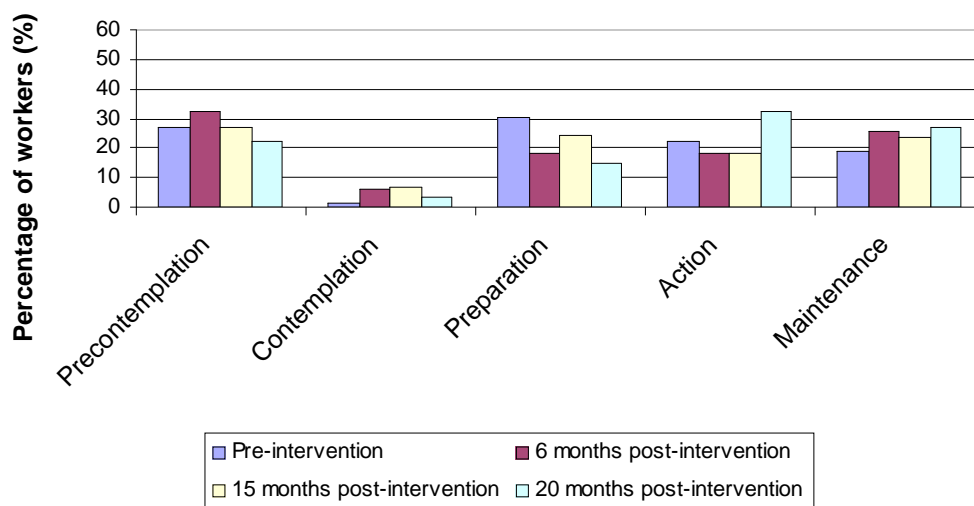


Figure 8 Worker stage of change (standard interventions)

Table 9 Chi-square analysis and significance levels

Follow up	Stage	Chi square p value	
Pre-intervention and 20 months post-intervention	Preparation	5.78	< 0.05
15 and 20 months post-intervention	Action	4.57	< 0.05

Summary of changes in stage following standard interventions at 20 months

- There were significantly fewer workers in the preparation stage at 20 months post-intervention compared to pre-intervention
- There were significantly more workers in the action stage at 20 months post-intervention than there were at 15 months post-intervention

3.3.3 Discomfort experienced the last 7 days

Workers were asked whether they had experienced any musculoskeletal discomfort in the last 7 days prior to the implementation of interventions and at 6, 15 and 20 months post-intervention. The actual frequency of workers having reported discomfort in each body area is given in tables 10 and 11 and shown in percentages in figure 9. Figure 10 shows the percentage of workers reporting discomfort in the individual body areas categorised into upper limbs, lower limb area and back. Figure 11 shows mean ratings of discomfort severity. Tables 12 and 13 show the results of a chi-square analysis comparing the number of workers reporting discomfort over the four time periods.

Table 10 Worker's self reported discomfort

		Pre-intervention	6 months post-intervention
Total number of participants		88	87
Number of workers having experienced discomfort in each body area	Neck	43	46
	Shoulder	44	35
	Upper arm	16	17
	Elbow	23	18
	Forearm	16	15
	Wrist	24	22
	Hand	22	20
	Upper back	23	17
	Lower back	51	46
	Legs	30	31

Table 11 Workers' self-reported discomfort

		15 months post-intervention	20 months post-intervention
Total number of participants		108	81
Number of workers having experienced discomfort in each body area	Neck	36	30
	Shoulder	41	29
	Upper arm	15	14
	Elbow	25	19
	Forearm	15	14
	Wrist	22	24
	Hand	19	15
	Upper back	21	19
	Lower back	46	32
	Legs	28	15

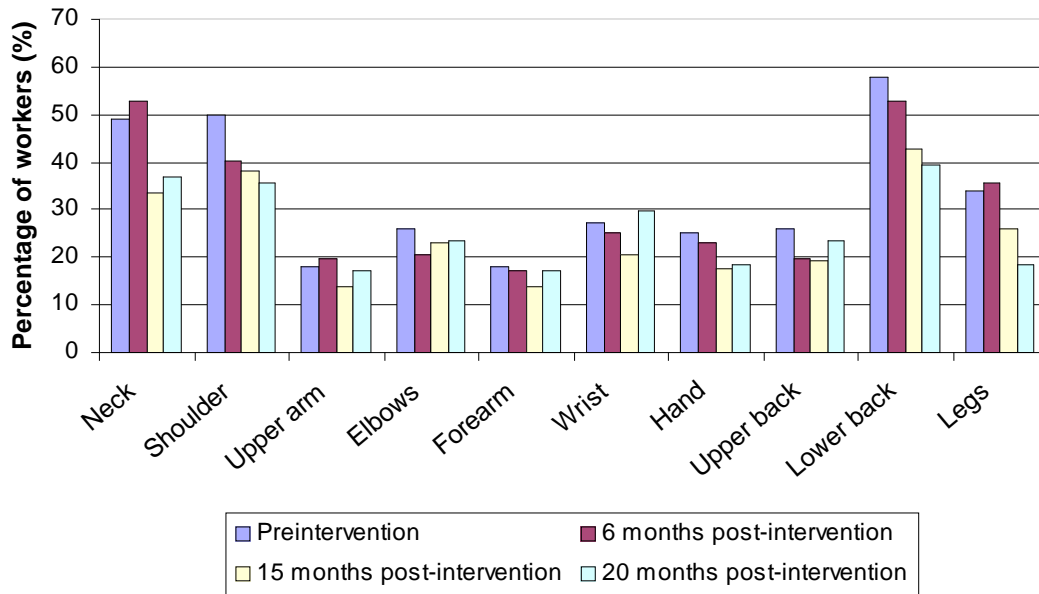


Figure 9 Percentage of respondents experiencing discomfort in the previous 7 days

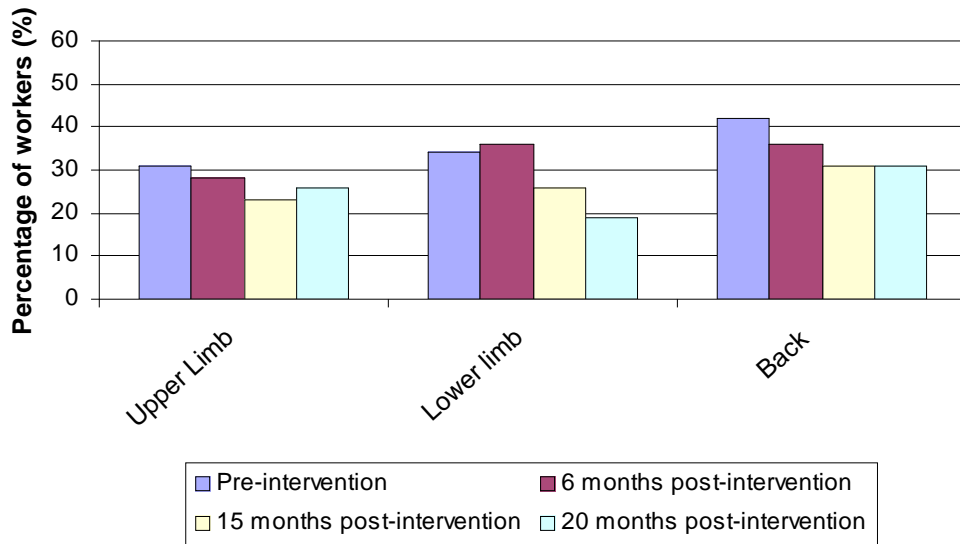


Figure 10 Percentage of respondents experiencing discomfort in the last 7 days (combined body areas)

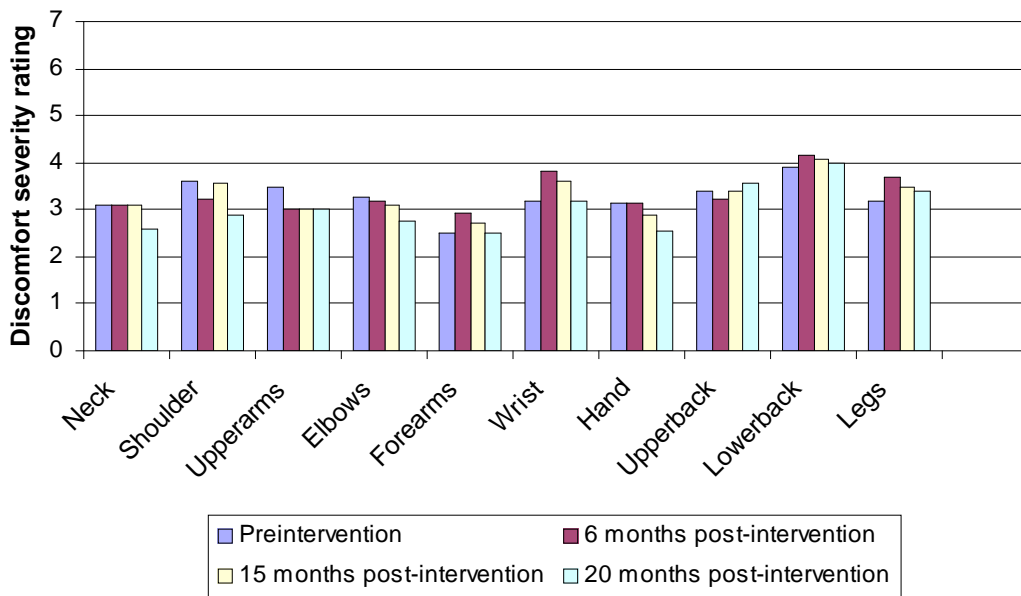


Figure 11 Mean ratings of discomfort severity

Table 12 Chi-square analysis and significance levels

Follow up	Stage	Chi square	P value
Pre-intervention and 20 months post intervention	Lower back	5.74	< 0.05
	Legs	5.24	< 0.05

Table 13 Chi-square analysis and significance levels

Follow up	Pain area	Chi square	p value
Pre-intervention and 15 months post-intervention	Upper limb	10.21	0.001
	Back	5.12	< 0.05
Pre-intervention and 20 months post-intervention	Lower limb	5.24	< 0.05
	Back	5.12	< 0.05
6 and 20 months post-intervention	Lower limb	4.04	< 0.05

Summary of changes in discomfort following standard interventions at 20 months

- At 6 months post-intervention there were no significant differences in the number of workers that reported discomfort compared to pre-intervention
- At 15 months post – intervention there were significant reductions in the number of workers reporting discomfort in the upper limbs and back compared to pre-intervention (although there was a reduction in the number of workers reporting discomfort in the lower limb area this did not decrease significantly due to the smaller sample size)
- At 20 months post-intervention there were reductions in the number of workers reporting discomfort in the lower limb area and back compared to pre-intervention
- There was a significant reduction in the number of workers reporting discomfort between 6 and 20 months post-intervention in the lower limb area
- There were no significant differences in the number of workers reporting discomfort between 15 and 20 months post-intervention (although there was a reduction in the number of workers reporting discomfort in the lower limb area this did not decrease significantly due to the smaller sample size)
- There were no significant differences in discomfort severity ratings between the pre-intervention, 6, 15 and 20 months post-intervention data
- There was a significant reduction in the number of respondents reporting discomfort in the lower back and legs at 20 months post-intervention compared to pre-intervention
- There were no significant differences between 15 and 20 months

3.4 RESULTS – 20 MONTHS POST-INTERVENTION - MANAGERS

3.4.1 Participant characteristics

In the standard intervention condition, 16 managers participated in the pre-intervention survey, 10 at 6 months post-intervention, 16 at 15 months intervention 8 at 20 months post-intervention.

3.4.2 Stage of change

Prior to the implementation of interventions of the majority of managers were in the action stage (38%), at 6 months the majority were in maintenance (60%) and at 20 months post-intervention the majority were in action and maintenance (40% and 40%). Figure 12 shows managerial stage of change.

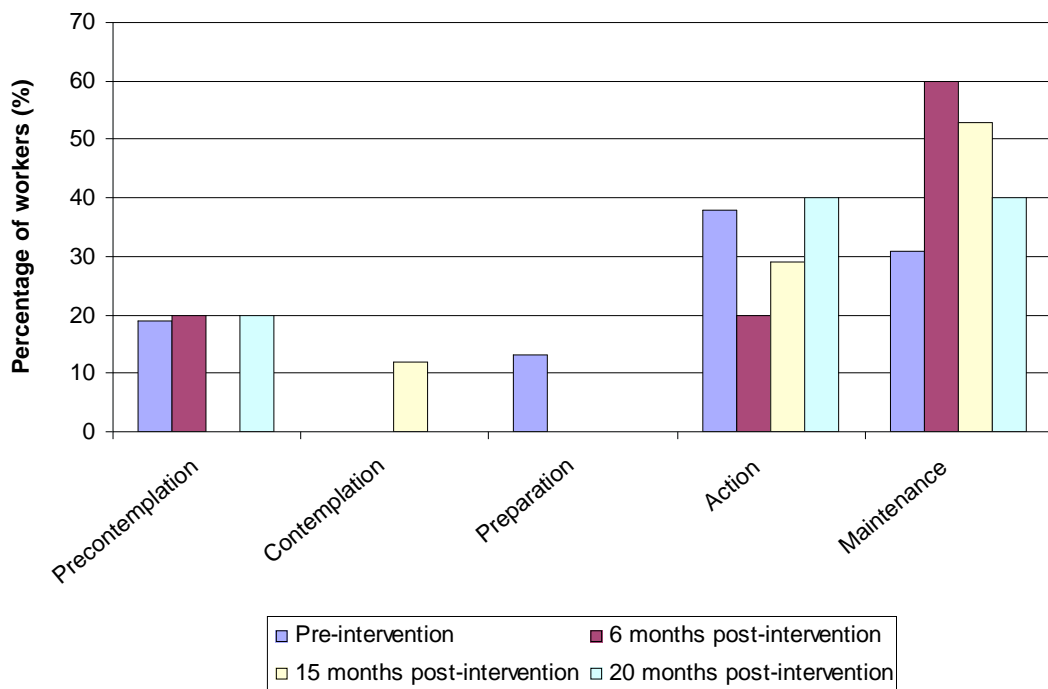


Figure 12 Managerial stage of change (standard interventions)

Summary of changes in managers' stage of change

- □ None of the differences were significant (due to small sample size)

SECTION 4 – TAILORED INTERVENTIONS

4.1 RESULTS – 15 MONTHS POST-INTERVENTION – WORKERS

4.1.1 Participant characteristics

Details of the workers involved in the 8 tailored interventions, at pre-intervention, 6 and 15 months post-intervention, are shown in table 14. The additional respondents included in the 15 month evaluation (who had been involved in the intervention but had not been surveyed at 6 months) comprised some younger workers which brought the mean age down.

Table 14 Worker’s personal characteristics

	Pre-intervention (N = 112)		6 months post- intervention (N = 80)		15 months post- intervention (N = 104)	
	Mean	Std.Deviation	Mean	Std.Deviation	Mean	Std.Deviation
Age (years)	39	11.3	44	10.5	40	11.1
Tenure (years)	9	8.3	9	8.4	7	6.5
Hrs worked (wk)	39	10.3	38	11.1	38	9.4

4.1.2. Stage of change

Prior to the implementation of the interventions, the majority of the workers in the tailored intervention condition were in the precontemplation and preparation stages (31% and 48%). Post-intervention considerable movement occurred in terms of stage of change: at 15 months post-intervention the majority of workers were in the action and maintenance stages (26% and 43%) respectively. Figure 13 shows worker stage of change. Table 15 shows the results of a chi-square analysis comparing the number of workers in each stage over the three time periods.

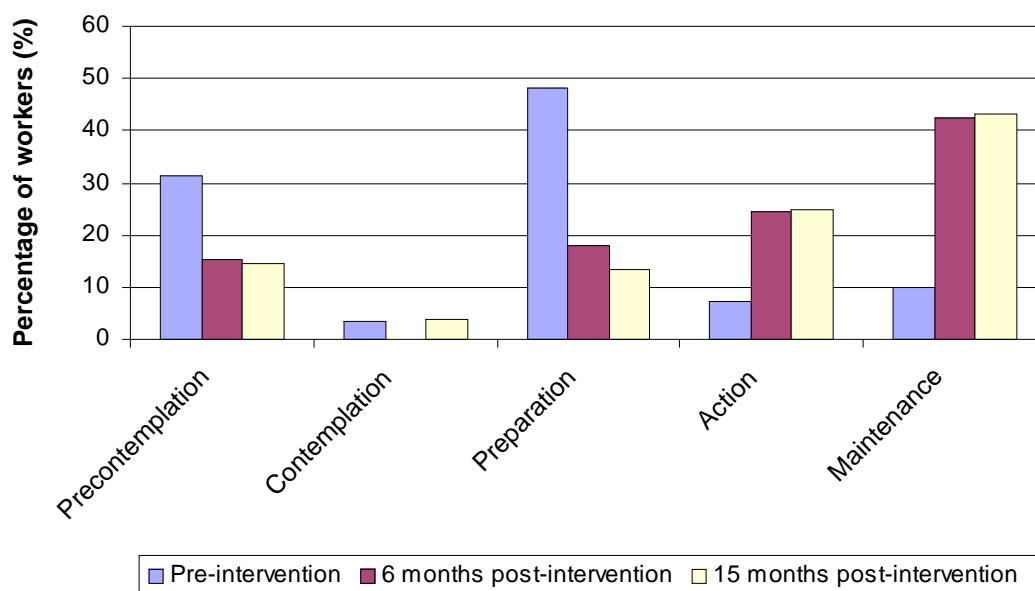


Figure 13 Worker stage of change (tailored interventions)

Table 15 Chi-square and significance levels

Follow up	Stage	Chi square	p value
Pre-intervention and 6 months post-intervention	Precontemplation	6.22	< 0.05
	Preparation	18.33	< 0.001
	Action	11.18	<0.001
	Maintenance	27.3	< 0.001
Pre-intervention and 15 months post-intervention	Precontemplation	8.58	<0.003
	Preparation	30.2	< 0.001
	Action	12.9	< 0.001
	Maintenance	31.42	< 0.001

Summary of changes in stage following tailored interventions at 15 months

- At 6 months there were significantly fewer workers in the precontemplation stage and the preparation stage compared to pre-intervention and there were significantly more workers in action and maintenance stages compared to pre-intervention
- At 15 months there were significantly fewer workers in the precontemplation stage at 15 months and significantly fewer workers in the preparation stage compared to pre-intervention and there were significantly more workers in action and maintenance compared to pre-intervention
- There were no significant differences between 6 and 15 months, suggesting that the effect of the intervention has been maintained over the long term

4.1.3 Discomfort experienced the last 7 days

Workers were asked whether they had experienced any musculoskeletal discomfort in the last 7 days prior to the implementation of interventions and at 6 and 15 months post-intervention. The actual frequency of workers having reported discomfort in each body area is given in table 16 and shown in percentages in figure 14. The percentage of workers reporting discomfort when the individual body areas were categorised into upper limb, lower limb and back is shown in figure 15. Mean ratings of discomfort severity are displayed in figure 16. Tables 17 and 19 compare the number of workers reporting discomfort over the three time periods. Table 18 shows severity of discomfort across the three time periods.

Table 16 Workers' self reported discomfort

		Pre-intervention	6 months post-intervention	15 months post-intervention
Total number of participants		112	80	91
Number of workers having experienced discomfort in each body area	Neck	55	30	25
	Shoulder	60	36	28
	Upper arm	39	13	10
	Elbow	47	20	18
	Forearm	37	15	13
	Wrist	56	15	23
	Hand	46	25	17
	Upper back	38	14	19
	Lower back	72	34	34
	Legs	48	16	20

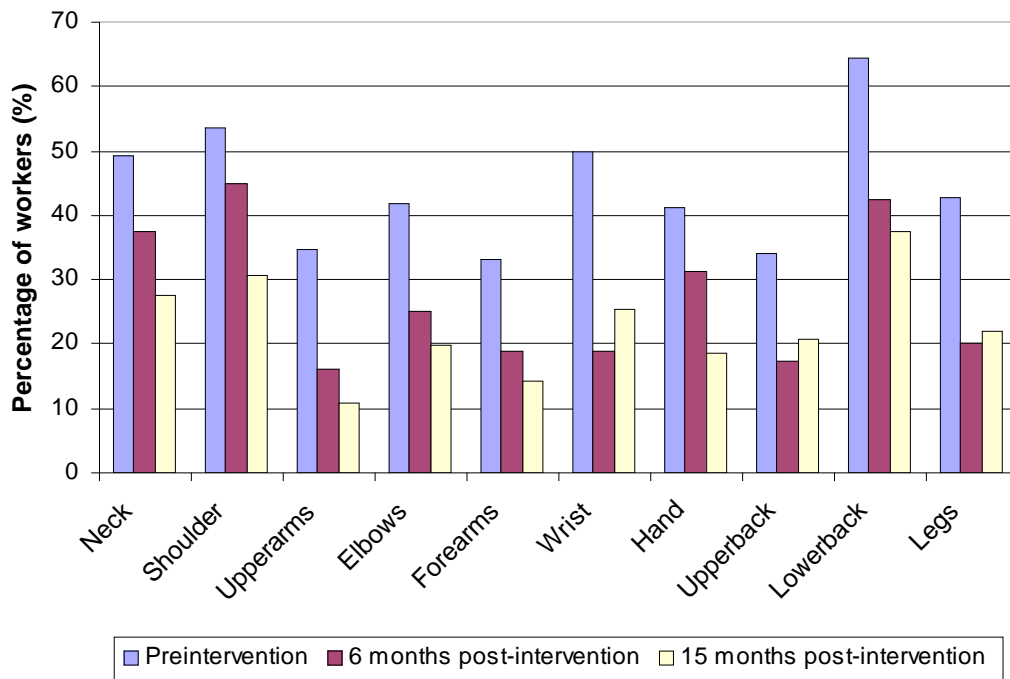


Figure 14 Percentage of respondents experiencing discomfort in the previous 7 days

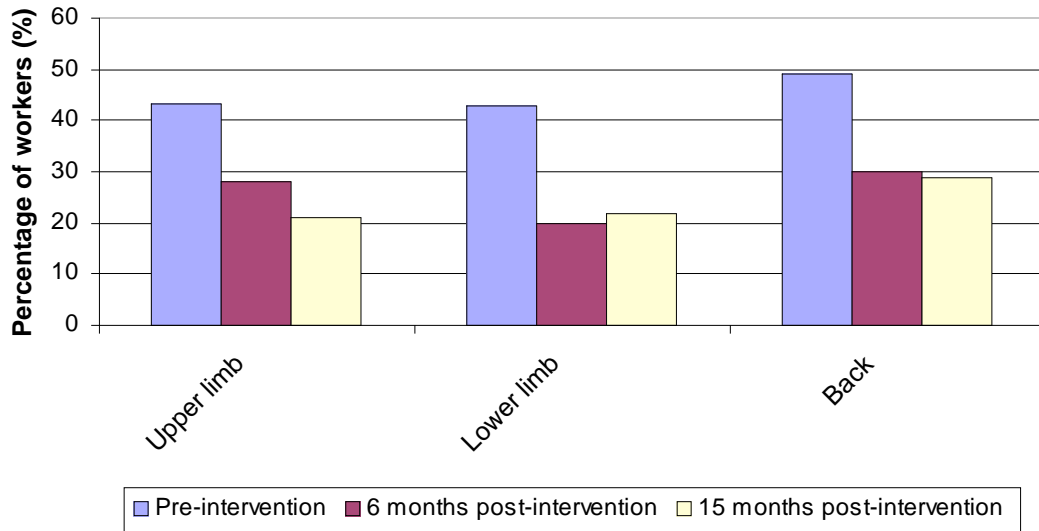


Figure 15 Percentage of respondents experiencing discomfort in the last 7 days (combined body areas)

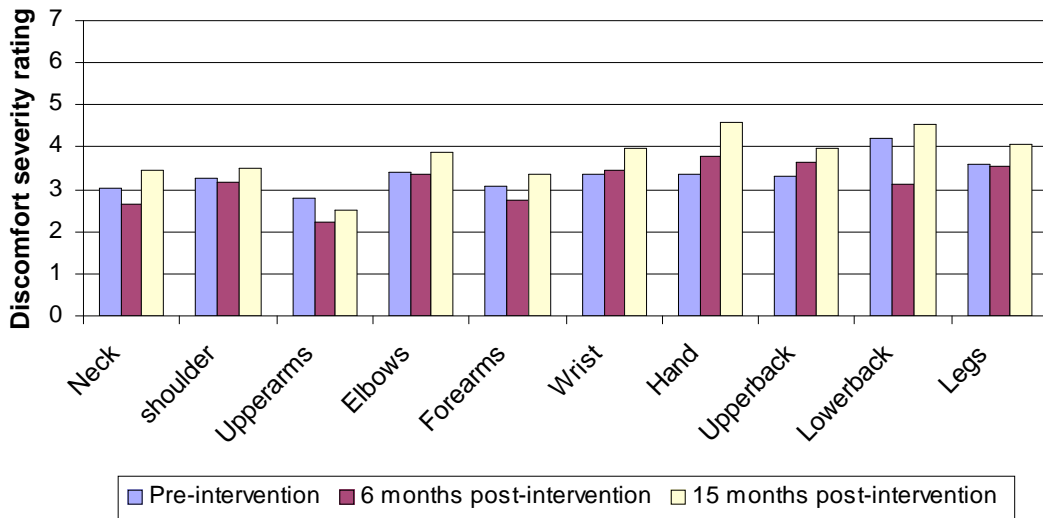


Figure 16 Mean ratings of discomfort severity

4.1.4 Individual body areas

Table 17 Chi-square analysis and significance levels

Follow up	Discomfort area	Chi square p value	
Pre – intervention and 6 months post-intervention	Upper arm	8.15	0.004
	Elbows	5.9	< 0.05
	Forearms	4.82	< 0.05
	Wrist	14.78	< 0.001
	Upper back	6.38	< 0.05
	Lower back	8.96	0.003
	Legs	10.9	0.001
Pre – intervention and 15 months post-intervention	Neck	9.84	0.002
	Shoulder	10.63	0.001
	Upper arms	15.57	< 0.001
	Elbow	11.35	0.001
	Forearm	9.50	0.002
	Wrist	12.91	< 0.001
	Hand	11.71	0.001
	Upper back	4.23	< 0.05
	Lower back	14.69	< 0.001
	Legs	9.83	0.002

Table 18 Kruskal Wallis analysis and significance level

Follow up	Discomfort area	Kruskall Wallis	p value
Pre-intervention, 6 and 15 months post-intervention	Lower back	12.24	0.002

Summary of changes in discomfort in individual body areas following tailored interventions at 15 months

- At 6 months there were significant reductions in the number of workers that reported discomfort in the upper arms, elbows, forearms, wrist, upper back, lower back and legs compared to pre-intervention
- At 15 months there were significant reductions in the number of workers that reported discomfort in the neck, shoulder, upper arms, elbows, forearms, wrist, hand, upper back, lower back and legs compared to pre-intervention
- There were no significant differences between 6 and 15 months post-intervention
- Workers' ratings of lower back pain were significantly lower at 6 months post-intervention

4.1.5 Combined body areas

Table 19 Chi square analysis and significance levels

Follow up	Discomfort area	chi square	p value
Pre-intervention and 6 months post-intervention	Upper limb	35.38	< 0.001
	Lower limb	10.97	< 0.001
	Back	14.07	< 0.001
Pre-intervention and 15 months post-intervention	Upper limb	78.84	< 0.001
	Lower limb	9.83	0.002
	Back	16.69	< 0.001
6 and 15 months post-intervention	Upper limb	6.82	0.009

Summary of changes in combined body areas following tailored interventions at 15 months

- At 6 months post-intervention there were significant reductions in the number of workers reporting discomfort in the upper limb, lower limb area and back compared to pre-intervention
- At 15 months post-intervention there were significant reductions in the number of workers reporting discomfort in the upper limb, lower limb area and back compared to pre-intervention
- There was a significant decrease in the number of workers reporting discomfort in the upper limb area between 6 and 15 months post-intervention

4.2 RESULTS – 15 MONTHS POST-INTERVENTION – MANAGERS

4.2.1 Participant characteristics

In the tailored intervention condition, 20 managers participated in the pre-intervention survey. At 6 months post-intervention 9 managers completed the survey and at 15 months post-intervention 17 managers completed the survey. Due to the relatively small numbers of managers, care must be taken in interpreting these results as generalisable to the broader managerial population.

4.2.2 Stage of change

Prior to the implementation of interventions, the majority of managers were in the maintenance stage (55%). At 15 months post-intervention the majority of managers were in the maintenance stage (59%). Figure 17 shows managerial stage of change. Table 20 shows the only significant difference over the three time periods.

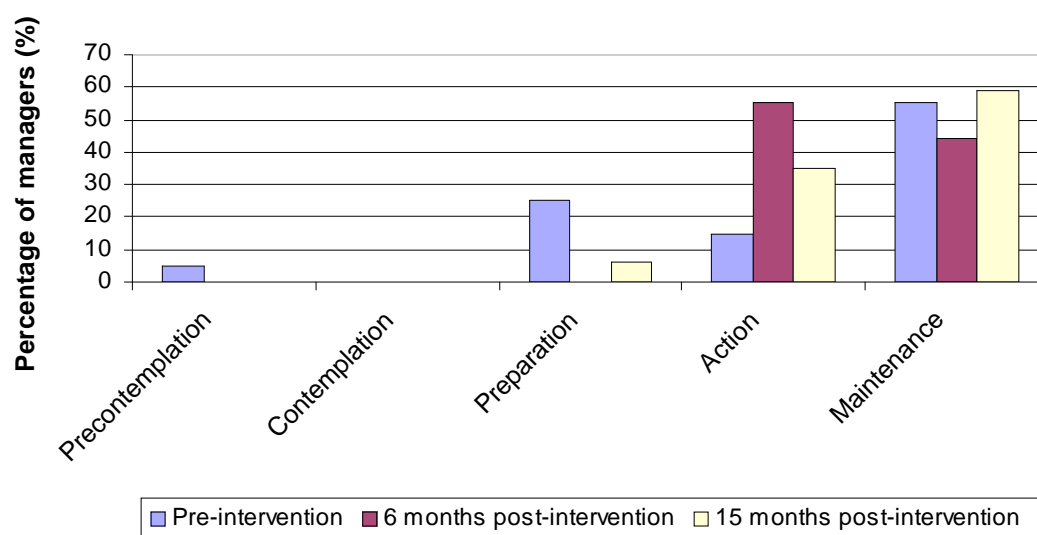


Figure 17 Managerial stage of change (tailored interventions)

Table 20 Chi-square analysis and significance levels

Follow up	Stage	chi square	p value
Pre-intervention and 6 months post-intervention	Action	5.11	p < 0.05

Summary of changes in managers' stage of change

- There was a significant increase in the number of managers in the action stage at 6 months post-intervention compared to pre-intervention

4.3 RESULTS - 20 MONTHS POST-INTERVENTION – WORKERS

4.3.1 Participant characteristics

Details of the workers involved in the 6 tailored interventions, at pre-intervention, 6, 15 and 20 months post-intervention, are shown in table 21 and 22.

Table 21 Personal characteristics

	Pre-intervention (N = 93)		6 months post-intervention (N = 64)	
	Mean	Std.Deviation	Mean	Std.Deviation
Age (years)	41	9.7	45	10.6
Tenure (years)	8	8.7	9	9.11
Hrs worked per wk	38	11.1	37	11.9

Table 22 Personal characteristics

	15 months post-intervention (N = 85)		20 months post-intervention (N = 85)	
	Mean	Std.Deviation	Mean	Std.Deviation
Age (years)	40	11.5	37	12.3
Tenure (years)	6	6.0	7	6.9
Hrs worked per wk	36	9.2	36	8.0

4.3.2 Stage of change

Prior to the implementation of the interventions, the majority of workers in the tailored intervention condition were in the precontemplation and preparation stages (36% and 41%). At 20 months post-intervention the majority were in maintenance (33%). Figure 18 shows worker stage of change. Table 23 compares the number of workers in each stage across the four time periods.

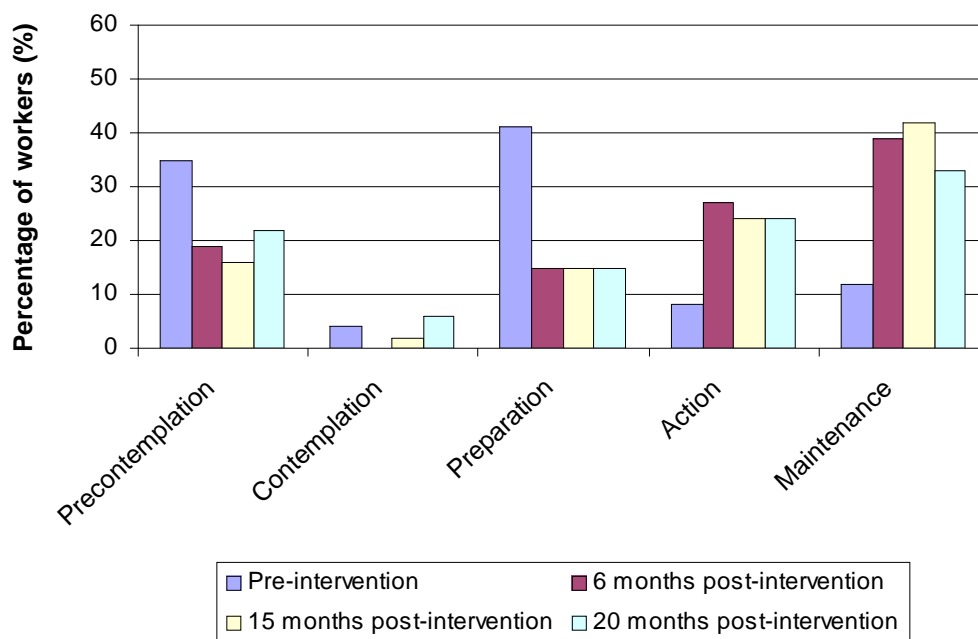


Figure 18 Worker stage of change

Table 23 Chi square analysis and significance levels

Follow up	Discomfort area	Chi square	P value
Pre-intervention and 6 months post-intervention	Precontemplation	4.70	< 0.05
	Preparation	12.22	< 0.001
	Action	11.25	0.001
	Maintenance	15.38	< 0.001
Pre-intervention and 15 months post-intervention	Precontemplation	8.26	0.004
	Preparation	14.2	< 0.001
	Action	8.26	0.004
	Maintenance	21.29	<0.001
Pre-intervention and 20 months post-intervention	Preparation	14.2	< 0.001
	Action	8.84	0.003
	Maintenance	11.57	0.001

Summary of changes in stage following tailored interventions at 20 months

- At 6 months there were significantly fewer workers in the precontemplation stage and the preparation stage compared to pre-intervention
- At 6 months there were significantly more workers in action and maintenance compared to pre-intervention
- At 15 months there were significantly fewer workers in the precontemplation stage and preparation stage compared to pre-intervention
- At 15 months there were significantly more workers in action and maintenance compared to pre-intervention
- At 20 months there were significantly fewer workers in preparation and significantly more in action and maintenance compared to pre-intervention
- There were no significant differences between 15 and 20 months post-intervention

4.3.3 Discomfort experienced the last 7 days

Workers were asked whether they had experienced any musculoskeletal discomfort in the last 7 days prior to the implementation of interventions and at 6, 15 and 20 months post-intervention. The frequency of workers having reported discomfort in each body area is given in tables 24 and 25 and shown in percentages in figure 19. Figure 20 shows the percentage of workers reporting discomfort in the individual body areas categorised into upper limb, lower limb and back. Mean ratings of discomfort severity are displayed in figure 21. Tables 26 and 27 compare the number of workers reporting discomfort over the four time periods.

Table 24 Frequency of workers having reported discomfort

		Pre-intervention	6 months post-intervention
Total number of participants		93	64
Number of workers having experienced discomfort in each body area	Neck	40	24
	Shoulder	42	28
	Upper arm	24	10
	Elbow	33	12
	Forearm	22	13
	Wrist	38	9
	Hand	31	17
	Upper back	24	10
	Lower back	57	30
	Legs	33	12

Table 25 Frequency of workers having reported discomfort

		15 months post-intervention	20 months post-intervention
Total number of participants		73	85
Number of workers having experienced discomfort in each body area	22	20	20
	22	17	17
	8	15	15
	11	12	12
	8	10	10
	18	8	8
	11	15	15
	14	13	13
	28	20	20
	18	10	10

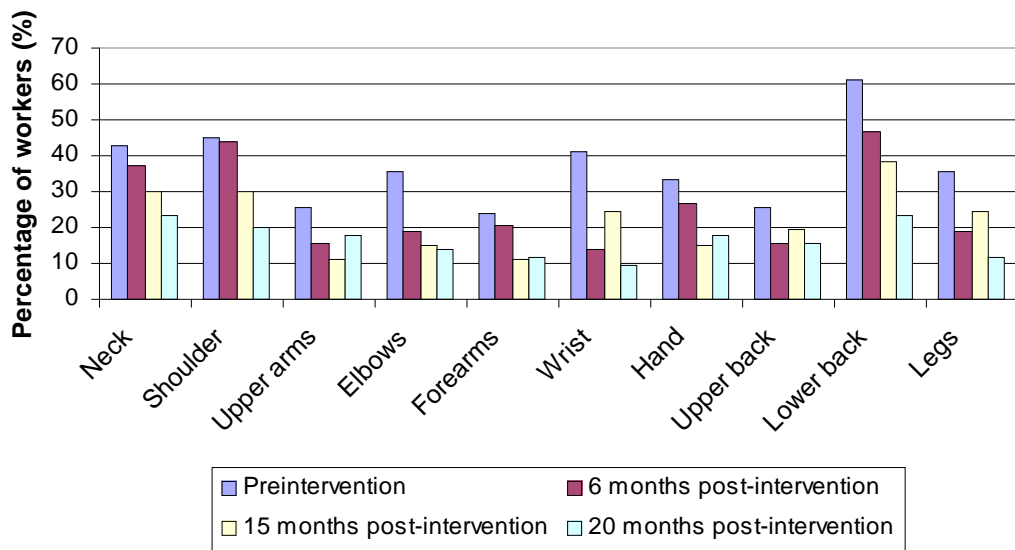


Figure 19 Percentage of respondents experiencing discomfort in the previous 7 days

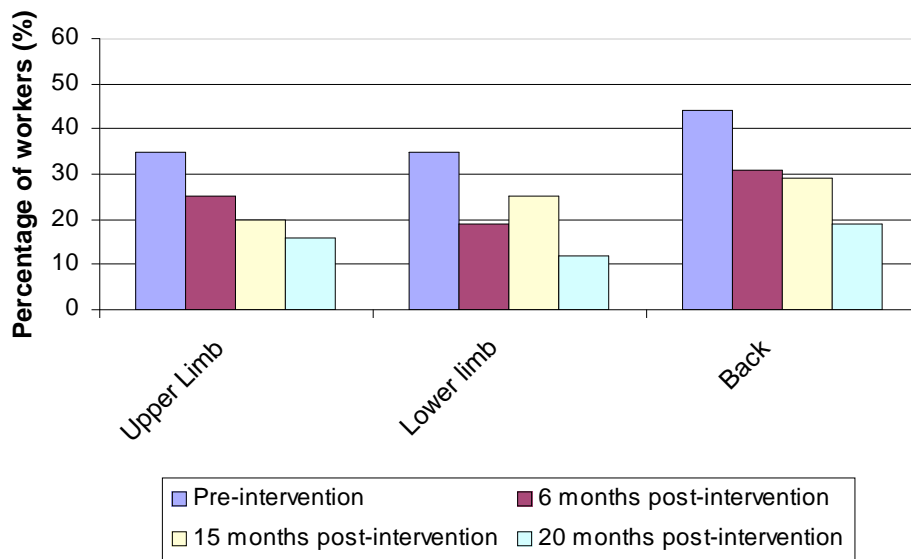


Figure 20 Percentage of respondents experiencing discomfort in the last 7 days (combined body areas)

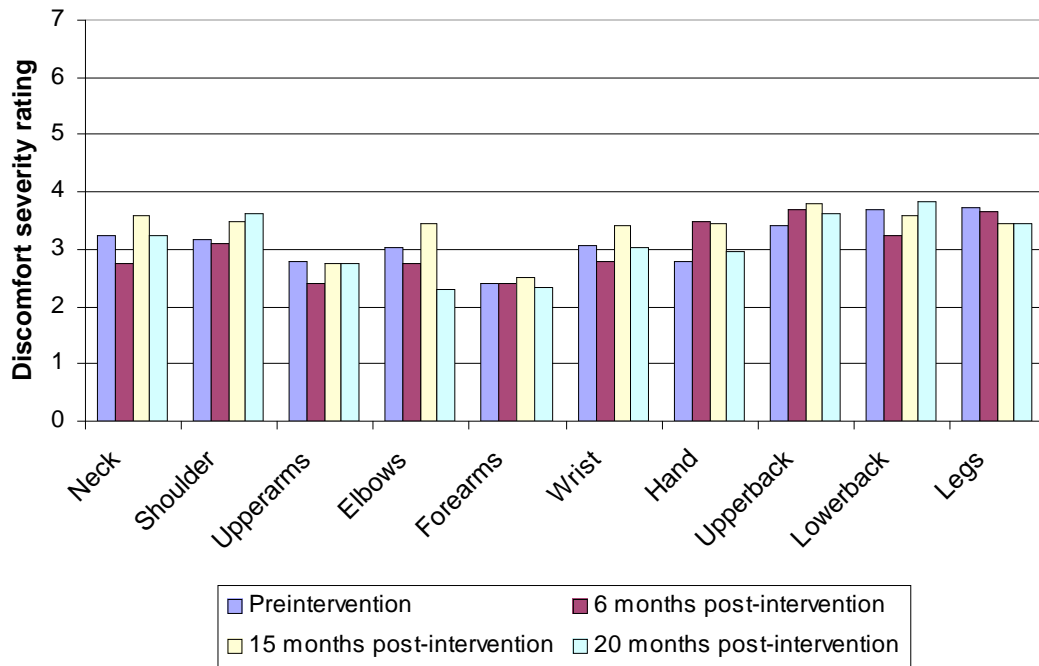


Figure 21 Mean ratings of discomfort severity

4.3.4 Individual body areas

Table 26 Chi-square analysis and significance levels

Follow up	Discomfort area	Chi square	p value
Pre-intervention and 6 months post-intervention	Elbow	5.19	< 0.05
	Wrist	12.98	< 0.001
	Legs	5.19	< 0.05
Pre-intervention and 15 months post-intervention	Shoulder	3.90	< 0.05
	Upper arm	5.79	< 0.05
	Elbow	8.75	< 0.05
	Forearms	4.45	< 0.05
	Wrist	4.80	< 0.05
	Hand	7.22	0.007
	Lower back	8.60	0.003
Pre-intervention and 20 months post-intervention	Neck	7.54	0.006
	Shoulder	12.69	< 0.001
	Elbow	10.73	0.001
	Forearms	4.26	< 0.05
	Wrist	22.92	< 0.001
	Hand	5.70	< 0.05
	Lower Back	25.80	< 0.001
	Legs	13.64	< 0.001
	15 and 20 months post-intervention	Wrist	6.64
	Lower Back	4.08	< 0.05
	Legs	4.48	< 0.05

Summary of changes in discomfort in individual body areas following tailored interventions at 20 months

- At 6 months post-intervention there was a significant reduction in discomfort felt in the elbow, wrist and legs compared to pre-intervention
- At 15 months post-intervention there was a significant reduction in the number of workers experiencing discomfort (compared to pre-intervention) in the shoulder, upper arms, elbows, forearms, wrist, hand and lower back
- At 20 months post-intervention there was a significant reduction in the number of workers experiencing discomfort (compared to pre-intervention) in the neck, shoulder elbow, forearm, wrist, hand, lower back and legs
- For most body areas the data shows further reductions in the percentage of workers reporting discomfort between 15 and 20 months and the reduction was significant for wrist, lower back and legs

4.3.5 Combined body areas

Table 27 Chi square and significance levels

Follow up	Discomfort area	Chi square	p value
Pre-intervention and 6 months post-intervention	Upper limb	12.63	< 0.001
	Lower limb	5.19	< 0.05
	Back	4.84	< 0.05
Pre-intervention and 15 months post-intervention	Upper limb	34.97	< 0.001
	Back	7.66	0.006
Pre-intervention and 20 months post-intervention	Upper limb	58.15	< 0.001
	Lower limb	13.64	< 0.001
	Back	23.77	< 0.001
6 and 20 months post-intervention	Upper limb	12.65	< 0.001
	Back	23.77	< 0.001
15 and 20 months post-intervention	Lower limb	4.48	< 0.05
	Back	3.80	0.05

Summary of changes in discomfort in combined body areas following tailored interventions at 20 months

- At 6 months post-intervention there were significant reductions in the number of workers that reported discomfort in the upper limbs, lower limb area and back compared to pre-intervention
- At 15 months post-intervention there were significant reductions in the number of workers that reported discomfort in the upper limbs and back compared to pre-intervention
- At 20 months post-intervention there were significant reductions in the number of workers that reported discomfort in the upper limbs, lower limb area and back compared to pre-intervention
- There were significant reductions in the number of workers reporting discomfort between 6 and 20 months post-intervention in the upper limbs and back

- There were significant reductions in the number of workers reporting discomfort between 15 and 20 months post-intervention in the lower limb area and back
- There were no significant differences in discomfort severity ratings between pre-intervention, 6, 15 and 20 months post-intervention data

4.4 RESULTS - 20 MONTHS POST-INTERVENTION – MANAGERS

4.4.1 Participant characteristics

In the tailored intervention condition, 20 managers participated in the pre-intervention survey, 9 managers participated 6 months post-intervention, 17 managers participated 15 months post-intervention and 8 managers participated at 20 months post-intervention.

4.4.2 Stage of change

Prior to the implementation of interventions the majority of managers were in the maintenance stage (55%) and at 20 months post-intervention the majority of managers (50%) were in the maintenance stage. Figure 22 shows managerial stage of change. Table 28 shows significant changes over the four time periods.

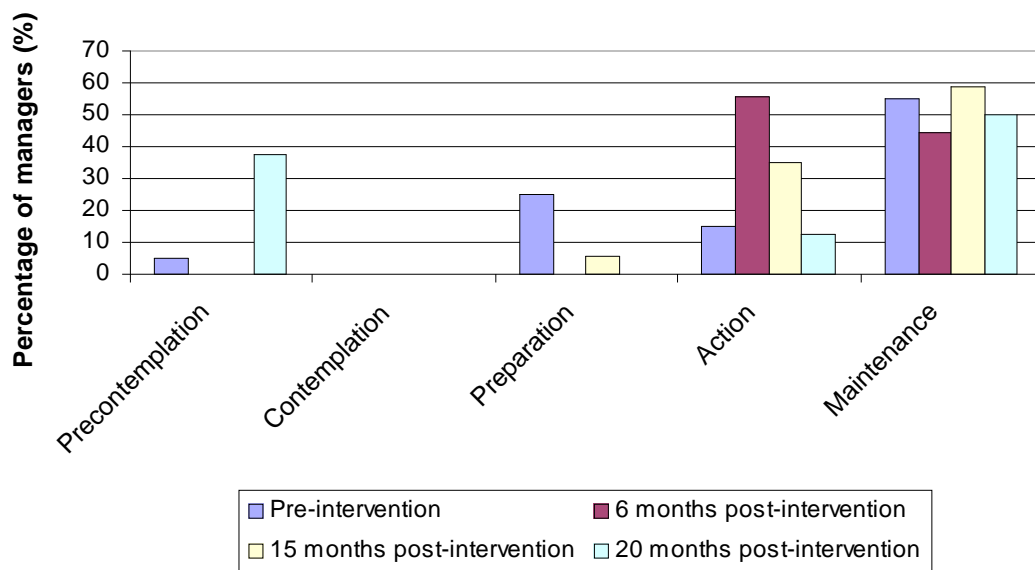


Figure 22 Managerial stage of change (tailored interventions)

Table 28 Chi-square analysis and significance levels

Follow up	Stage	chi square	p value
Pre-intervention and 6 months post-intervention	Action	5.11	< 0.05
Pre-intervention and 20 months post-intervention	Precontemplation	4.93	< 0.05
15 and 20 months post-intervention	Precontemplation	7.24	0.007

Summary of changes in managers' stage of change

- At 6 months there was a significant increase in the number of managers in the action stage compared to pre-intervention
- At 20 months there was a significant increase in the number in precontemplation compared to pre-intervention
- There was a significant increase in the number of managers in precontemplation between 15 and 20 months post-intervention

5 MANAGERIAL INTERVIEWS

5.1 Participant characteristics

A total of 11 interviews were conducted following the implementation of changes. The details of interviewees are displayed in table 29.

Table 29 Interviewee details

Case number	Industry	Role of Interviewee	Tenure with company
1	Manufacturing	Works Manager	6 yrs
2	Manufacturing	Health & Safety Manager	16 yrs
3 & 4	Utilities	Health & Safety Advisor	27 yrs
5	Utilities	Office Manager	16 yrs
6	Manufacturing	Health & Safety Advisor	3 yrs
7	Education	Head Teacher	13 yrs
8	Education	Office Manager	25 yrs
10	Education	Office Manager	3 yrs
12 & 13	Transport	Head of Safety	12 yrs
14	Utilities	Line Manager	6 yrs
15 & 16	Manufacturing and delivery	Occupational Health Advisor	6 yrs

5.2 Barriers to change

The most commonly cited barrier to implementing changes to reduce the risks of MSDs was the resistance of employees to change their behaviour, lack of support from management and the lack of resources and time. The quotes below illustrate these themes.

5.2.1 Resistance to change

Employees' resistance to change was the most frequently cited barrier. The difficulties experienced in getting employees to accept change was highlighted by a Head of Safety in the transport industry:

“Staff see change as a threat, staff don't like change. It took time for management to try to convince staff that the changes in baggage weight would not have an adverse impact on queue sizes”

Employee resistance to change was evident in a number of other organisations. The Health and Safety Manager of a manufacturing company stated *‘the problem is that employees have a resistance to change, no one likes change’*. A number of interviewees made similar references stating how important it is for workers to accept changes and not resist them. A Manager of a utilities organisation stated that *‘the individuals concerned have to be on board for the changes to be successful’*

5.2.2 Lack of support from management

A number of interviewees made reference to a lack of support from management being a barrier against change. The Manager of a manufacturing company stated that:

'Lack of support from management has been a problem in the past, if management don't support changes it can be very difficult to get them implemented'

Some interviewees speculated why it is that management may not be supportive of change. A Head of Safety in the Transport Industry stated that *'management can be sceptical of change'*.

5.2.3 Resources and time

Not having the resources available to make the changes happen was mentioned by a few interviewees. An Office Manager in a utilities company explained:

'we have been trying to get some new equipment for a while but we have not been able to find suitable equipment for the task, we are not sure how to find out or who to contact about this'

Time constraints were mentioned as a barrier on a number of occasions. A Teacher stated:

'Time is a constraint, the children need a lot of hands on attention in this school, if there were less time restrictions more time could be spent planning changes and implementing them'

5.3 Factors facilitating the change process

More interviewees cited factors that they believed acted as facilitators to change than the number that cited barriers. The most common facilitators to the change process were a supportive management, change of management and communication. The quotes below illustrate these themes.

5.3.1 Supportive Management

A supportive management was cited as the most common facilitator to change. The Health and Safety Manager from a manufacturing organisation stated:

'The guy at the top, we are a family owned business and the chairman has a big commitment to health and safety. Being led from the top of the organisation has helped us a lot. We've recently had a new managing director with new policies on health and safety. We think about everything we do from a health and safety point of view and we look at current legislation and go one step further'

A number of other interviewees made reference to the importance of management support. One Health and Safety Manager noted that *'support from management is very important'*. An Line Manager from a Utilities company stated that *'management support is the most important facilitator to change'*

5.3.2 Change of management

Change of management was cited as assisting with the change process. A Health and Safety Manager of a Utilities company stated that:

'we have recently got a new Company Director who is very enthusiastic about health and safety and is influencing the company in a positive light'

A Health and Safety Advisor of a manufacturing company stated how he took over the management of health and safety and was able to make a number of improvements:

'I joined the company and took on the role of managing Health and Safety, I set about identifying the problems and searching for solutions and I feel that I took a more proactive approach to health and safety and raised awareness in the company'

5.3.3 Communication

Communication was seen as an important facilitator to change by a number of interviewees. A Health and Safety Advisor from the manufacturing industry stated that:

'Good communication with the workforce is key to affective change, we have a notice board where we have information regarding health and safety and have regular meetings with our staff, keeping our staff aware of planned changes and health and safety procedures facilitates the change process'

Another interviewee commented on the importance of communication. The Line Manager of a utilities company stated that *'communication is paramount to successful change in the workplace'*

5.4 Outcomes of the interventions

When interviewees were asked if they felt that there had been any changes as a result of the interventions, in terms of working practices, absence, or attitudes, interviewees from organisations receiving both standard and tailored interventions described a variety of outcomes.

In terms of the effects of interventions on absence levels a number of interviewees noted that absence levels had decreased since the implementation of the interventions. The Manager of a utilities company stated that:

'Absence has reduced - people tend to be at work more'

A number of interviewees stated that there had been a reduction in symptoms as a result of the interventions. A Health and Safety Advisor in the education sector stated:

'Aches and pains have reduced we now have self issue machines so there are less books coming over the counter'

A Manager of a manufacturing company stated that: *'We have a very low level of manual handling injuries at the moment'*

Some interviewees noted an improvement in safety culture. A Manager of company in the transport and communications sector stated that:

'There is an raised awareness, people will come straight to me'

There was also evidence of improved attitudes among the workforce as a Health and Safety Advisor in the delivery and manufacturing sector stated:

'I think there has been a more accepting view of making changes following an accident or incident'

6 SUMMARY AND CONCLUSIONS

This research project represents the first systematic attempt to apply the stage of change approach to the organisational context to improve health and safety. The aim was to determine if tailoring health and safety interventions according to recipients' stage of change, results in greater effectiveness. The authors developed tools to measure organisational and worker stage of change and employed these tools in practice, to evaluate whether interventions can be made more effective by tailoring approaches according to managerial and worker stage of change.

The first phase of the research (Whysall, Haslam and Haslam, 2005) followed up 24 interventions for up to 6 months. Results showed that interventions tailored to manager and worker stage of change were significantly more effective on a number of levels: promoting risk-awareness, promoting progression through stages of change and reducing self reported musculoskeletal discomfort in a number of body areas. This report is based on longer-term follow-up periods of 15 and 20 months post-intervention.

6.1 STANDARD INTERVENTIONS

The impact of the standard interventions was relatively modest and reductions in symptoms were not manifested until 15 and 20 months

Findings at the 15 month follow up

- At 6 months there were significantly fewer workers in preparation compared to pre-intervention
- There were no significant differences between stages between 6 and 15 months
- At 6 and 15 months there were no significant changes in the proportions of respondents reporting discomfort in individual body areas
- At 15 months there was a significant decrease in the number of workers reporting discomfort in the upper limbs

Findings at 20 month follow up

- There were significantly fewer workers in preparation at 20 months compared to pre-intervention
- There were significantly more workers in action at 20 months compared to 15 months
- At 20 months there were significant reductions in the number of respondents reporting discomfort in the lower back and legs compared to pre-intervention
- At 15 months there were significant reductions in the upper limbs and back and at 20 months in the lower limb and back compared to pre-intervention

6.2 TAILORED INTERVENTIONS

Findings at the 15 month follow up

- At 6 and 15 months there were significantly fewer workers in precontemplation and preparation and significantly more workers in the action and maintenance (compared to pre-intervention)
- There were no significant differences between 6 and 15 months post-intervention suggesting that the impact of the interventions has been maintained
- At 6 and 15 months there were significant reductions in the number of workers reporting discomfort in a wide range of individual body areas

- There were further reductions in discomfort in individual body areas between 6 and 15 although these failed to reach significance
- At 6 and 15 months post-intervention there were significant reductions in the number of workers reporting discomfort in the upper limbs, lower limbs and back
- There was a further significant reduction in discomfort in the upper limbs between 6 and 15 months post-intervention

Findings at the 20 month follow up

- There were significantly fewer workers in precontemplation and preparation and more workers in action and maintenance compared to pre-intervention
- There were significant reductions in the numbers of workers reporting discomfort in three individual body areas at 6 months, 7 individual body areas at 15 months and 8 individual body areas at 20 months
- For most body areas there were further reductions in discomfort between 15 and 20 months post-intervention
- At 6 and 20 months there were significant reductions in discomfort in the upper limbs, legs and back compared to pre-intervention
- At 15 months there were significant reductions in the upper limbs and back compared to pre-intervention
- There were further significant reductions in the number of workers reporting discomfort in the lower limb and back between 15 and 20 months post-intervention

6.3 MANAGER INTERVIEWS

The importance of attitudes and behaviour to the success of interventions was supported by the post-intervention interviews, as the most commonly cited barriers to the implementation of changes were the failure of employees to change their behaviour and the difficulties in obtaining managerial authorisation for intended changes. Similarly, the most commonly cited facilitators to the process of managing the risks of MSDs were management support and effective communication within the organisation.

6.4 WIDER IMPLICATIONS FOR THEORY AND PRACTICE

With regards to the wider implications of this research, having demonstrated the effectiveness of the stage of change approach in relation to reducing the risks of MSDs, potential exists for improving the effectiveness of many other types of health and safety interventions through application of this approach (e.g. stress management, falls from height, violence in the workplace, use of personal protective equipment). Work-related stress is one occupational health problem that may be particularly appropriate, due to the importance of tackling both managerial and workers' perceptions of, and attitudes towards, this issue.

Despite being one of the most common causes of occupational ill-health in this country, stress is an issue that organisations can be reluctant to tackle, perhaps due to scepticism or lack of knowledge regarding how stress can be managed. HSE have taken steps towards helping organisations understand how work-related stress can be reduced, through publication of the management standards. To promote the implementation of the information outlined by these standards, it is crucial that attitudes regarding stress are also tackled, to reduce the scepticism or reluctance that may inhibit some employers from taking action.

It is fundamental to the approach that stage of change can be assessed using just a small number of questions. It should be borne in mind, that the actual questions asked need to be systematically developed and assessed for validity and reliability (Haslam and Haslam, 2000; Whysall, Haslam and Haslam, 2005). An important observation from our research is that the stage of 'contemplation' seems to have less validity in the organisational context than the

other stages. It is notable that throughout this report the bar charts of stage of change across the four data points (pre-intervention, 6, 15 and 20 months post-intervention) show very few workers or managers residing in this stage. While contemplation may be a valid construct in the context of addictive behaviour such as smoking, the construct may fail to translate to the context of health and safety in the workplace. Indeed, in our original call for applying the model to health and safety in the workplace (Haslam and Haslam, 2000) it was envisaged that tailoring interventions in the workplace would involve distinguishing between 2 groups of intervention recipients: those in precontemplation and those in contemplation/preparation. Specifically, workers and managers already considering changing working practices should be provided with information to help them implement the safer working practices (which may involve learning new skills). Workers and managers in the precontemplative stage (not considering changing working practices) would require a two-phase approach. Firstly they would require information about the possible consequences of current working practices for health and safety. The aim would be to facilitate movement into contemplation/preparation. When this transition has been achieved, these individuals would require skills training information to move them to the action stage where they would start to implement improved health and safety measures, see figure 23.

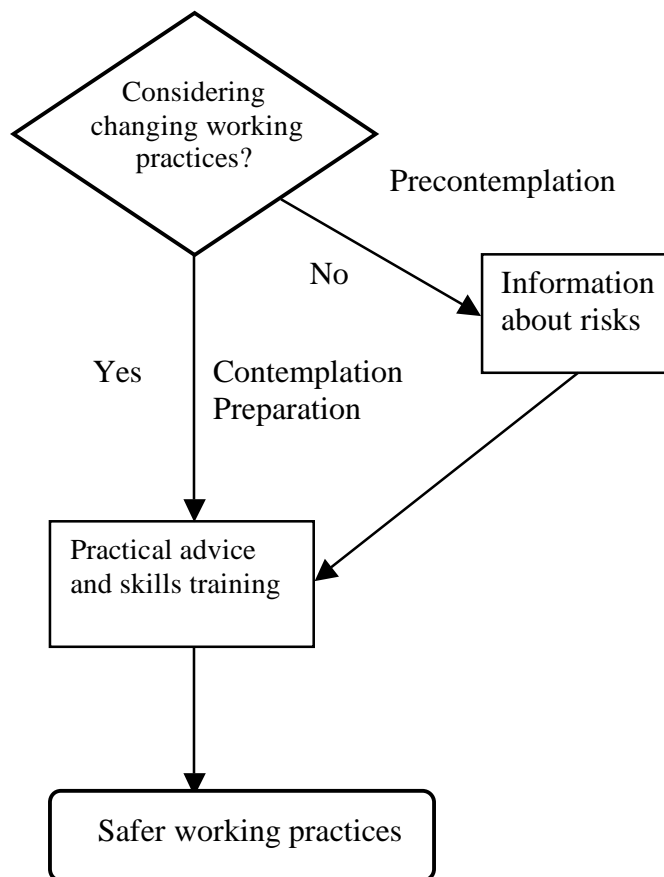


Figure 23 Staged approach to improving health and safety (Haslam and Haslam, 2000)

The results we have obtained to date certainly suggest that in tailoring interventions to improve health and safety in the workplace it is only necessary to distinguishing between 2 groups of intervention recipients: those who do not recognise the health issue and who are not considering change (precontemplation) and those who do recognise the issue and are considering making changes to their working practices (contemplation/preparation). Future research could usefully determine the utility of the construct of contemplation in relation to other occupational health issues. On the basis of the evidence so far it seems that simplifying the stages as described above is a pragmatic approach which would facilitate the implementation of interventions in the organisational context.

6.5 CONCLUSIONS

The results presented in this report and our previous 2005 HSE report strongly support the calls for the application of the stage of change approach to occupational settings (e.g. Dejoy, 1996; Haslam & Haslam, 2000; Prochaska et al., 2001). The findings of this research suggest that the positive effects of interventions tailored according to manager and worker stage of change persist over a long period of time. Moreover, the qualitative findings also provide further insight into the specific knowledge, beliefs, and attitudes that are of importance to promoting change towards reducing the risks of MSDs in the workplace.

While the standard interventions demonstrated some impact on symptoms in the long term, tailored interventions had a far greater influence in changing behaviour and reducing MSD symptoms. The findings in this report demonstrate the effectiveness of tailored interventions over standard interventions in promoting behaviour change, attitude change and in reducing musculoskeletal discomfort.

Both behaviour change theory and practical recommendations highlight the need to ensure that change recipients possess the knowledge, attitudes, and beliefs that promote the adoption and maintenance of changes required to prevent MSDs. The work presented in this report and our previous report (Whysall, Haslam and Haslam, 2005) demonstrates that the stage of change model offers a practical framework that can be used to help guide the change process.

This work provides compelling evidence for the increased effectiveness of interventions that are tailored according to the recipient's stage of change. Tailored interventions have been shown to significantly improve behaviour aimed at reducing the risk of MSDs and significantly reduce discomfort related to MSDs. Moreover we have demonstrated that the positive impact on behaviour and MSD symptoms produced by tailored interventions persist over a long-term period of follow-up. Wide-scale adoption of this approach could make a major contribution to reducing prevalence rates and incidence rates for MSDs, leading to substantial cost savings, reduced sickness absence and improvements in working practice.

7 REFERENCES

- Dejoy, D.M. (1996). Theoretical models of health behaviour and workplace self-protective behaviour. *Journal of Safety Research*, 27, 61-72.
- DiClemente, C.C., Prochaska, J.O., Fairhurst, S.K., Velicier, W.F., Velasquez, M.M., & Rossi, J.S. (1991). The process of smoking cessation: An analysis of precontemplation, contemplation, and preparation stages of change. *Journal of Consulting and Clinical Psychology*, 59, 295-304.
- Haslam, C., & Haslam, R. A. (2000). A stage specific approach to improving occupational health and safety. Proceedings of the XIVth Triennial Congress of the International Ergonomics Association and 44th Annual Meeting of the Human Factors and Ergonomics Society, 6, 253-255.
- Health and Safety Commission (2005). *Health and Safety Statistics 2004/2005*. HSE Books: Sudbury, UK.
- Health and Safety Commission (2004). *Health and Safety Statistics Highlights 2003/04*. HSE Books: Sudbury, UK.
- Health and Safety Commission (2001). *Health and Safety Statistics 2000/01*. HSE Books: Sudbury, UK.
- Health and Safety Commission (2000). *Health and Safety Statistics 1999/2000*. HSE Books: Sudbury, UK.
- Health and Safety Executive (2002). *Upper Limb Disorders in the Workplace*. HSE Books: Sudbury, UK.
- Karsh, B-T., Moro, F.B.P., & Smith, M.J. (2001). The efficacy of workplace ergonomic interventions to control musculoskeletal disorders: A critical analysis of the peer-reviewed literature. *Theoretical Issues in Ergonomic Science*, 2, 23-96.
- Melhorn, J.M. (1996). A prospective study for upper-extremity cumulative trauma disorders of workers in aircraft manufacturing. *Journal of Occupational and Environmental Medicine*, 38, 1264-1271.
- Miles, M.B., & Huberman, A.M. (1994). *An Expanded Sourcebook. Qualitative Data Analysis*. Sage: London.
- Prochaska, J.O., & DiClemente, C.C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory Research and Practice*, 19, 276-288.
- Prochaska, J.O., DiClemente, C.C., Velicier, W.F., & Rossi, J.S. (1993). Standardised, individualised, interactive, and personalised self-help programmes for smoking cessation. *Health Psychology*, 12, 399-405.
- Prochaska, J.O., Norcross, J.C., & DiClemente, C.C. (1994). *Changing for good*. William Morrow & Co. Inc.: New York.

Prochaska, J.M., Prochaska, J.O., & Levesque, D.A. (2001). A Transtheoretical approach to changing organisations. *Administration and Policy in Mental Health*, 28, 247-261.

Rakowski, W., Ehrich, B., Goldstein, M.G., Rimer, B.K., Pearlman, D.N., Clark, M.A., Velicier, W.F., & Woolverton, H. (1998). Increasing mammography among women aged 40-74 by use of a stage-matched, tailored intervention. *Preventive Medicine*, 27, 748-756.

Urlings, I. J. M., Nijboer, I.D., & Dul, J. (1990). A method for changing the attitudes and behavior of management and employees to stimulate the implementation of ergonomic improvements. *Ergonomics*, 33, 629-637.

Velicier, W.F., DiClemente, C.C., Prochaska, J.O., & Brandenburg, N. (1985). Decisional balance measure for assessing and predicting smoking status. *Journal of Personality and Social Psychology*, 48, 1279-1289.

Velicier, W.F., DiClemente, C.C., Rossi, & Prochaska, J.O. (1990). Relapse situations and self-efficacy: An integrative model. *Addictive Behaviours*, 15, 271-283.

Westgaard, R.H., & Winkel, J. (1997). Ergonomic intervention research for improved musculoskeletal health: A critical review. *International Journal of Industrial Ergonomics*, 20, 463-500.

Whysall, Z., Haslam, R. and Haslam, C. (2004). Processes, barriers and outcomes described by ergonomics consultants in preventing musculoskeletal disorders. *Applied Ergonomics*, 35, 343-351.

Whysall, Z.J., Haslam, C., & Haslam, R.A. (2005). *A staged approach to reducing musculoskeletal disorders (MSDs) in the Workplace*. HSE Research Report 379. HSE Books: Sudbury, UK.

World Health Organization. (1988). *Health promotion for working populations*. Report of a WHO expert committee, Technical Report Series 765. Geneva: WHO.

APPENDIX 1

STANDARDISED INSTRUCTIONS

Work-Related Musculoskeletal Problems Survey

This survey is part of a study for the Health and Safety Executive, looking at attitudes towards work-related musculoskeletal problems and their management. The study is being conducted by researchers from Loughborough University.

The term 'musculoskeletal problems' refers to a range of problems affecting the affecting the muscles, tendons, and other supporting structures of the body – that is, those affecting the arms and wrists such as repetitive strain injury, and also those affecting the back, neck and shoulders.

Please answer the following questions as accurately as you can.

All information is strictly confidential, and will be used only for research purposes.

Feedback will be given to [name of company] to help assess the causes of aches and pains affecting their employees.

Thank you

For further information about the study contact:

Kate Shaw, Loughborough University

Tel: 01509 228481 Email: k.shaw@lboro.ac.uk

APPENDIX 2

STAGE OF CHANGE ASSESSMENT TOOLS

MANAGERIAL STAGE OF CHANGE ASSESSMENT

1. Are you concerned about the risk of musculoskeletal problems in your organisation? Y/N

(Circle as appropriate)

2. Are you thinking about taking action to reduce the risk of musculoskeletal problems in the next 6 months? Y/ N (Circle as appropriate)

→ If no - please go to **Question 5**.

3. Do you have a clear idea of what you are going to do to reduce the risk of musculoskeletal problems in your company? Y/ N (Circle as appropriate)

4. Are you considering taking action to reduce the risk of musculoskeletal problems in the next month or two? Y/ N (Circle as appropriate)

5. Have any changes already been made? Y / N (Circle as appropriate)

→ If yes please go to **Question 6**.

→ If no - please go to **Section 3**.

6. Please describe what steps have been taken below (continue on reverse if necessary):

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

7. How long ago were these changes implemented?Yrs / Mths / Wks
(Circle as appropriate)

8. **If more than 6 months ago**, is any further attention to the problem planned? Y / N
(If yes, please describe what is planned)

.....
.....

WORKER STAGE OF CHANGE ASSESSMENT

1. Are you concerned about developing musculoskeletal problems from your work? Y / N
(Circle as appropriate)
2. Do you think changes should be made to reduce the risk of musculoskeletal problems from your work in the next 6 months? Y / N (Circle as appropriate)
3. Do you think changes should be made in the next month or two? Y / N
(Circle as appropriate)
4. Have you got any suggestions for changes that would reduce the strain of your work?
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
5. Has your employer made any changes to reduce the risk of musculoskeletal problems from your work? Y / N (Circle as appropriate)
6. Are you doing or have you done anything to reduce the risk? Y / N
(Circle as appropriate)
7. If yes, please describe what you have done:
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....
.....(Continue on reverse if necessary)
8. How long ago did you make these changes?..... wks / mths / yrs
(Circle as appropriate)
9. **If more than 6 months ago**, do you intend to do anything more? Y / N
(If yes, please describe)
.....
.....

APPENDIX 3

BACKGROUND INFORMATION SHEET

BACKGROUND INFORMATION

1. Were you involved in the previous research conducted by Loughborough University into musculoskeletal problems in your organisation in 2004?
Y/N (circle as appropriate)

2. Do you recall the interventions that were implemented with the aim of reducing musculoskeletal problems?
Y/N (circle as appropriate)

3. If yes can you recall what was involved with the interventions?

.....
.....
.....

4. Have you seen any improvements since the interventions?
Y/N (circle as appropriate)

5. If yes, what improvement (s) have you observed?

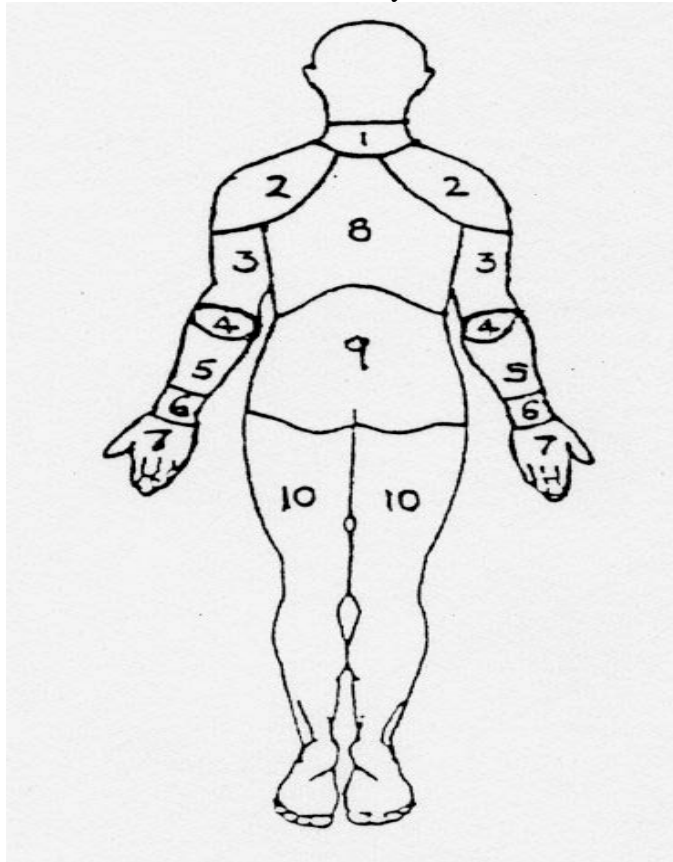
.....
.....
.....

APPENDIX 4

SELF-REPORTED DISCOMFORT SCALE

PAIN/DISCOMFORT RATING

1. Have you felt any discomfort in the last 7 days? Y / N
2. If yes, please mark a cross on the diagram below where you have felt discomfort in the last 7 days.



3. For each part you have marked circle a number on the scales below to show **how much** discomfort you have felt:

If you have not experienced any pain or discomfort, leave this section blank.

	Minimal discomfort				Extreme discomfort		
1) Neck	1	2	3	4	5	6	7
2) Shoulders	1	2	3	4	5	6	7
3) Upper arms	1	2	3	4	5	6	7
4) Elbows	1	2	3	4	5	6	7
5) Forearms	1	2	3	4	5	6	7
6) Wrist	1	2	3	4	5	6	7
7) Hand	1	2	3	4	5	6	7
8) Upper back	1	2	3	4	5	6	7
9) Lower back	1	2	3	4	5	6	7
10) Lower limbs		1	2	3	4	5	6

APPENDIX 5

ATTITUDES TOWARD MSDs

Standard workers – 15-month follow up

	Pre-intervention	6 months post-intervention	15 months post-intervention	Significant differences
The percentage of workers concerned about developing MSDs from their work	71%	65%	61%	No significant differences
The percentage of workers who thought changes should be made to reduce the risk of MSDs in the next 6 months	61%	56%	75%	Pre-intervention and 15 months post-intervention [$\chi^2(1) = 4.43$; $p < 0.05$] 6 and 15 months post-intervention [$\chi^2(1) = 6.75$; $p = 0.009$]
The percentage of workers who thought changes should be made to reduce the risk of MSDs in the next 2 months	55%	39%	67%	Pre-intervention and 6 months post-intervention [$\chi^2(1) = 4.81$; $p < 0.05$] 6 and 15 months post-intervention [$\chi^2(1) = 14.36$; $p < 0.001$]
The percentage of workers who had suggestions for changes that would reduce the strain of the work	52%	40%	43%	No significant differences
The percentage of workers who stated their employer had made changes to reduce the risk of musculoskeletal problems	46%	63%	85%	Pre-intervention and 6 months post-intervention [$\chi^2(1) = 5.05$; $p < 0.05$] Pre-intervention and 15 months post-intervention [$\chi^2(1) = 34.28$; $p < 0.001$] 6 and 15 months post-intervention [$\chi^2(1) = 11.08$; $p = 0.001$]
The percentage of workers that reported having personally made changes to reduce the risk of musculoskeletal problems	46%	49%	33%	6 and 15 months post-intervention [$\chi^2(1) = 4.84$; $p < 0.05$]
The percentage of workers who intended to take further action to reduce the risks of musculoskeletal problems	88%	57%	50%	Pre-intervention and 6 months post-intervention [$\chi^2(1) = 4.32$; $p < 0.05$] Pre-intervention and 15 months post-intervention [$\chi^2(1) = 5.24$; $p < 0.05$]

Standard managers – 15-month sample

	Pre-intervention	6 months post-intervention	15 months post-intervention	Significant differences
The percentage of managers concerned about their employees developing MSDs from their work	81%	60%	69%	Pre-intervention and 6 months post-intervention [$\chi^2 (1) = 14.56$; $p < 0.001$]
The percentage of managers who thought changes should be made to reduce the risk of MSDs in the next 6 months	75%	70%	100%	Pre-intervention and 15 months post-intervention [$\chi^2 (1) = 13.50$; $p < 0.001$]
The percentage of managers who thought changes should be made to reduce the risk of MSDs in the next month or two	63%	50%	88%	6 and 15 months post-intervention [$\chi^2 (1) = 9.91$; $p 0.002$]
The percentage of managers who had specific plans for changes that would reduce the strain of the work	69%	60%	63%	No significant differences
The percentage of managers who stated that steps to reduce the risks had already been taken	63%	90%	88%	No significant differences
The percentage of managers that intended to pay further attention to the issues	100%	88%	88%	No significant differences

Standard workers – 20-month sample

	Pre-intervention	6 months post-intervention	15 months post-intervention	20 months post-intervention	Significant differences
The percentage of workers concerned about developing MSDs from their work	75%	65%	59%	63%	Pre-intervention and 15 months post-intervention [$\chi^2(1) = 5.62$; $p < 0.05$].
The percentage of workers who thought changes should be made to reduce the risk of MSDs in the next 6 months	66%	53%	76%	78%	6 and 15 months post-intervention [$\chi^2(1) = 11.35$; $p = 0.001$] 6 and 20 months post-intervention [$\chi^2(1) = 11.62$; $p = 0.001$]
The percentage of workers who thought changes should be made to reduce the risk of MSDs in the next month or two	60%	37%	66%	78%	6 and 15 months post-intervention [$\chi^2(1) = 28.69$; $p < 0.001$]
The percentage of workers who had suggestions for changes that would reduce the strain of the work	56%	39%	44%	41%	Pre-intervention and 6 months [$\chi^2(1) = 5.16$; $p < 0.05$]
The percentage of workers who stated their employer had made changes to reduce the risk of musculoskeletal problems	43%	67%	85%	52%	Pre-intervention and 6 months post-intervention [$\chi^2(1) = 35.49$; $p < 0.001$] Pre-intervention and 15 months post-intervention [$\chi^2(1) = 10.20$; $p = 0.001$] 15 and 20 months post-intervention [$\chi^2(1) = 22.84$; $p < 0.001$]
The percentage of workers that reported having personally made changes to reduce the risk of musculoskeletal problems	52%	59%	63%	72%	Pre-intervention and 20 month post-intervention [$\chi^2(1) = 7.08$; $p = 0.008$]
The percentage of workers that intended to take further action to reduce the risks of musculoskeletal problems	88%	57%	60%	86%	6 and 20 months post-intervention [$\chi^2(1) = 5.34$; $p < 0.05$]

Standard managers – 20-month sample

	Pre-intervention	6 months post-intervention	15 months post-intervention	20 months post-intervention	Significant differences
The percentage of managers who reported being concerned about the risks of employees developing MSDs	81%	60%	69%	88%	Pre-intervention and 6 months post-intervention [$\chi^2 (1) = 14.56$; $p < 0.001$]
The percentage of managers who stated that they intended to take action to reduce MSDs in the next 6 months	75%	70%	100	65%	Pre-intervention and 15 months post-intervention [$\chi^2 (1) = 13.50$; $p < 0.001$]
The percentage of managers who stated that they intended to take action to reduce MSDs in the next month or two	63%	50%	88%	100%	6 and 15 months post-intervention [$\chi^2 (1) = 9.91$; $p 0.002$]
The percentage of managers who had specific plans for the changes that they intended to make	69%	60%	63%	75%	No significant differences
The percentage of managers who reported that changes had been made to tackle to risks	63%	90%	88%	88%	No significant differences
The percentage of managers who indicated that they intended to continue their attempts to maintain low levels of risk.	100%	88%	88%	88%	No significant differences

Tailored workers – 15-month sample

	Pre-intervention	6 months post-intervention	15 months post-intervention	Significant differences
The percentage of workers concerned about developing MSDs from their work	75%	75%	77%	No significant differences
The percentage of workers who thought changes should be made to reduce the risk of MSDs in the next 6 months	70%	70%	89%	Pre-intervention and 15 months post-intervention [χ^2 (1) = 11.07; p = 0.0001]
The percentage of workers who thought changes should be made to reduce the risk of MSDs in the next month or two	63%	55%	82%	6 and 15 months post-intervention [χ^2 (1) = 15.42; p = 0.0001]
The percentage of workers who had suggestions for changes that would reduce the strain of the work	55%	61%	67%	No significant differences
The percentage of workers who stated their employer had made changes to reduce the risk of musculoskeletal problems	48%	70%	70%	Pre - intervention and 6 months post-intervention [χ^2 (1) = 8.66; p = 0.003] Pre - intervention and 15 months post-intervention [χ^2 (1) = 10.75; p = 0.001]
The percentage of workers who reported having personally made changes to reduce the risk of musculoskeletal problems	31%	69%	66%	Pre - intervention and 6 months post-intervention [χ^2 (1) = 26.64; p < 0.001] Pre - intervention and 15 months post-intervention [χ^2 (1) = 25.99; p < 0.001]
The percentage of workers who intended to take further action to reduce the risks of musculoskeletal problems	67%	93%	89%	Pre-intervention and 6 months post-intervention [χ^2 (1) = 4.67; p < 0.05] Pre-intervention and 15 months post-intervention [χ^2 (1) = 4.00; p < 0.05]

Tailored managers – 15-month sample

	Pre-intervention	6 months post-intervention	15 months post-intervention	Significant differences
The percentage of managers concerned about their employees developing MSDs from their work	95%	89%	82%	No significant differences
The percentage of managers who thought changes should be made to reduce the risk of MSDs in the next 6 months	65%	67%	100%	Pre-intervention and 15 months post-intervention [$\chi^2 (1) = 6.41$; $p < 0.05$]
The percentage of managers who thought changes should be made to reduce the risk of MSDs in the next month or two	45%	73%	100%	Pre-intervention and 15 months post-intervention [$\chi^2 (1) = 4.09$; $p < 0.05$]
The percentage of managers who had specific plans for changes that would reduce the strain of the work	75%	78%	60%	No significant differences
The percentage of managers who stated that steps to reduce the risks had already been taken	70%	100%	77%	No significant differences
The percentage of managers who intended to pay further attention to the issues	100%	100%	100%	No significant differences

Tailored workers – 20-month sample

	Pre-intervention	6 months post-intervention	15 months post-intervention	20 months post-intervention	Significant differences
The percentage of workers concerned about developing MSDs from their work	72%	70%	79%	82%	No significant differences
The percentage of workers who thought changes should be made to reduce the risk of MSDs in the next 6 months	65%	64%	88%	75%	No significant differences
The percentage of workers who thought changes should be made to reduce the risk of MSDs in the next 2 months	58%	47%	81%	67%	6 and 15 months post-intervention was significant [$\chi^2(1) = 19.27$; $p < 0.001$]
The percentage of workers who had suggestions for changes that would reduce the strain of the work	47%	58%	64%	52%	Pre-intervention and 15 months post-intervention [$\chi^2(1) = 5.14$; $p < 0.05$] Pre-intervention and 6 months post-intervention [$\chi^2(1) = 9.08$; $p = 0.003$]
The percentage of workers who stated their employer had made changes to reduce the risk of musculoskeletal problems	51%	75%	66%	62%	Pre-intervention and 6 months post-intervention [$\chi^2(1) = 9.08$; $p = 0.003$]
The percentage of workers that reported having personally made changes to reduce the risk of musculoskeletal problems	33%	73%	61%	71%	Pre-intervention and 6 months post-intervention [$\chi^2(1) = 22.93$; $p < 0.001$] Pre- and 15 months post-intervention [$\chi^2(1) = 13.30$; $p < 0.001$] Pre and 20 months post-intervention [$\chi^2(1) = 24.67$; $p < 0.001$].
The percentage of workers that intended to take further action to reduce the risks of MSDs	77%	92%	89%	86%	No significant differences

Tailored managers – 20 month sample

	Pre-intervention	6 months post-intervention	15 months post-intervention	20 months post-intervention	Significant differences
The percentage of managers that reported being concerned about the risks of employees developing MSDs	95%	89%	82%	88%	No significant differences
The percentage of managers who stated that they intended to take action to reduce MSDs in the next 6 months	65%	67%	100%	63%	Pre-intervention and 15 months post-intervention [$\chi^2 (1) = 6.41$; $p < 0.05$]
The percentage of managers who stated that they intended to take action to reduce MSDs in the next month or two	45%	73%	100%	100%	Pre-intervention and 15 months post-intervention [$\chi^2 (1) = 4.09$; $p < 0.05$]
The percentage of managers who had specific plans for the changes that they intended to make	65%	78%	60%	50%	No significant differences
The percentage of managers who reported that changes had been made to tackle MSDs	70%	100%	77%	83%	No significant differences
The percentage of managers who indicated that they intended to continue their attempts to maintain low levels of risk.	100%	100%	100%	100%	No significant differences

APPENDIX 6

GUIDELINES FOR TAILORING INTERVENTIONS

Staged Interventions

Key beliefs	Key barriers	Key messages to convey	Materials/Approaches
1. Precontemplation (not even considering changing)			
No need to change – not a great risk	Lack of awareness of risks	Raising awareness of risks: severity & susceptibility Highlighting consequences: ill-health & productivity/profit	Graphic information Probability of illness/injury Significance of injury/illness Case studies: claims/production/ absence Photographs
2. Contemplation (thinking about changing)			
May be a need to change	No sense of urgency	Reinforce need for change Efficacy of interventions Benefits of change (cost etc)	Benefits of change Case studies/statistics – successful changes (reduced absence/increased production)
3. Preparation (making definite plans to change)			
Making definite efforts to change	Lack of knowledge of the changes that should be made Scepticism – change efficacy Fear of change	Practical advice on change process Value of large scale changes Skills training Efficacy of interventions/own ability	Advice on range of approaches Most efficacious approach Reducing barriers (participation etc) Specific & realistic plans of action
4. Action (actually engaged in changing behaviour)			
Engaged in change efforts	Perceived cost Resistance to change	Ongoing advice Skills training Performance feedback & support May be an initial increase in cases	Participation Feedback Assistance with tools/equipment
5. Maintenance (working to prevent relapse or consolidate gains made)			
Working to keep the changes/improvements	Complacency Belief that problem is solved	Continual efforts must be made to prevent relapse Risks are continually changing	Reinforcement Ongoing relationship with advisors

A staged approach to reducing musculoskeletal disorders (MSDs) in the workplace

A long term follow-up

Musculoskeletal disorders (MSDs) remain the most common form of occupational ill-health in Great Britain. Recent research by the authors (Whysall, Haslam and Haslam, 2005) involved the development and evaluation of a new and innovative approach to reducing MSDs. These authors applied a model from health psychology (stage of change model) to develop interventions more closely matched to worker and manager stage of change. Twenty four interventions were monitored within a variety of organisations for up to six months. Tailored interventions (matched to stage of change) were found to be more effective in promoting risk-awareness, promoting behaviour change aimed at reducing risks, and in reducing self-reported musculoskeletal discomfort in a number of body areas.

The study described in this report involved a longer-term follow-up at 15 months post-intervention and at 20 months post-intervention to ascertain whether the improvements seen at 6 months persist in the longer term. The results show that the benefits in behaviour change and symptom reduction persist over a longer period of follow-up. Tailored interventions were found to be more effective in promoting behaviour change and reducing self-reported musculoskeletal discomfort over a 20 month follow-up period.

These findings suggest that scope exists for improving the success of interventions by tailoring advice according to stage of change. This approach increases the uptake, implementation, and maintenance of risk-reducing measures.

This report and the work it describes were funded by the Health and Safety Executive (HSE). Its contents, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy.