



# Persistent musculoskeletal pain and productive employment: A systematic review of interventions

March 2015

## Acknowledgements

This literature review represents collaboration between Arthritis and Osteoporosis Victoria and the Centre for Ergonomics and Human Factors at La Trobe University. Funding to undertake this work was provided by Arthritis and Osteoporosis Victoria through a partnership grant.

## The project team included:

Dr Jodi Oakman  
Ms Natasha Kinsman  
Dr Tessa Keegel  
Assoc Prof Andrew Briggs

## Contact La Trobe University at

Email: [j.oakman@latrobe.edu.au](mailto:j.oakman@latrobe.edu.au)

Phone: + 61 3 9479 3235

## Suggested citation

Oakman J, Kinsman N, Keegel T, Briggs AM (2015): Persistent musculoskeletal pain and productive employment: A systematic review of interventions. Melbourne: Arthritis and Osteoporosis Victoria

## CONTENTS

EXECUTIVE SUMMARY .....	1
What do we currently know about workplace interventions and their effectiveness at keeping people at work? .....	1
How does this systematic review contribute to existing knowledge?.....	1
What is a systematic literature review? .....	1
What types of studies were included in the review? .....	2
What the research says.....	2
Key learnings and insights.....	3
Summing it up.....	4
BACKGROUND.....	5
Purpose .....	5
The impact of persistent MSK pain on employment .....	5
What are workplace interventions? .....	5
The Fit Model.....	6
What do we currently know about workplace interventions and their effectiveness at keeping people at work? .....	7
How does this systematic review contribute to existing knowledge?.....	7
Review objectives .....	7
METHODS.....	8
What was the review? .....	8
Identification of relevant studies.....	8
Selection of the studies.....	8
Review protocol and data management.....	9
Outcome measures.....	9
Quality assessment .....	9
RESULTS .....	12
How were the studies selected?.....	12
Studies included in the review.....	13
Risk of bias analysis.....	18
Grading the evidence.....	19
What were the effects of the interventions? .....	21
Effect of individually focused workplace intervention on employment compared to usual care	22
Effect of individually focused workplace interventions on employment compared to other interventions.....	22

Effect of multilevel focused workplace interventions on employment compared to usual care	23
Characteristics of effective workplace interventions .....	24
Individually focused .....	24
Multilevel focused.....	25
KEY LEARNINGS AND INSIGHTS.....	25
SUMMING IT UP.....	26
REFERENCES.....	28
APPENDIX A: Search strategy.....	33
APPENDIX B: Excluded studies.....	34
APPENDIX C: GRADE assessments .....	35

## TABLES AND FIGURES

Figure 1: Fit Model of a workplace .....	6
Figure 2: Methods Process.....	11
Figure 3: Selection of studies.....	12
Table 1: Outcome measures .....	9
Table 2: Explanation of impact statements (based on Glenton et al. 2010) .....	11
Table 3: Study characteristics. Results are reported as the mean (SD) unless otherwise stated.....	13
Table 4: Summary of risk of bias for RCTs.....	18
Table 5: Risk of bias for non-RCT studies.....	19
Table 6: Summary of findings – GRADE analysis.....	20
Table 7: Summary of outcome effects.....	21

## EXECUTIVE SUMMARY

The purpose of this systematic review was to examine the evidence for the effectiveness of workplace interventions that target employees with persistent musculoskeletal (MSK) pain. Effectiveness was examined in the context of maintaining employment, as well as maximising productivity.

Approximately 6.1 million Australians are affected by arthritis or other musculoskeletal conditions (A&OV, 2013) with persistent pain conditions affecting approximately 3.2 million Australians (MBF 2007). Costs attributed to managing MSK conditions are substantial, through reduced workplace participation, lost tax revenue and medical costs (A&OV 2013). Individuals with persistent pain conditions are at risk of being unable to sustain employment. The current focus on extension of working lives (NSPAC 2012; Oakman & Wells 2013) means that understanding the characteristics of workplace interventions that maximise the ability for those with persistent MSK pain to stay at work (de Vries, Brouwer, Groothoff, Geertzen, & Reneman, 2011) is important. Moreover, the majority of people who live with a painful musculoskeletal condition are of working age (A&OV 2013).

The results of this review can be used to identify opportunities for future strategies to facilitate the productive employment of individuals with persistent MSK pain.

### What do we currently know about workplace interventions and their effectiveness at keeping people at work?

Workplace interventions are complex, can be difficult to implement and measure and often not undertaken using rigorous scientific approaches. The gold standard in scientific measure is considered to be a randomised control trial (RCT). This study design is where participants are randomly allocated to receive a specific pre-determined intervention; their results are compared to those of study participants who did not receive the intervention or who received a different intervention. This can be very difficult to implement in workplaces as organisational requirements often dictate where employees are situated and it may not be possible to randomly assign them to an intervention group. As a result, many studies undertaken in workplace contexts do not use traditional study designs, such as RCTs. Furthermore; many industry interventions are not documented or published in scientific literature. Whilst the evidence base is growing in the area of workplace interventions, gaps still exist in what we know about their effectiveness.

### How does this systematic review contribute to existing knowledge?

This review specifically examines research studies that have focused on individuals who have non-work related symptoms, as distinct from individuals who develop MSK pain through work-related exposure. In some countries, including Australia, individuals in this group are not specifically covered by workers' compensation schemes. This review seeks to analyse and synthesise results from a range of peer-reviewed published studies in order to develop recommendations to assist workplaces in managing employees with non-work related persistent MSK pain.

### What is a systematic literature review?

A systematic literature review attempts to provide an answer to a specific research question through a thorough and documented process of considering the breadth of current literature. In our review, a rigorous systematic approach was undertaken in accordance with guidance from the *Cochrane*

*Handbook for Systematic Reviews of Interventions* (Higgins & Green, 2011). It involved searching for peer-reviewed, published articles about research studies that were related to workplace interventions and employees with persistent MSK pain. The review included findings from RCTs and other studies with pre and post intervention measures, published between January 2000 and March 2014. An electronic search of databases and a cited reference search were conducted. Additional studies were sought through contact with an expert in the field and through examining bibliographies of relevant studies.

The findings from the review were analysed in terms of: the results of the studies (what they are saying) and the quality of the results (can we be sure about what they are saying?). That is, the quality of results (the level of evidence) will determine the certainty about results (Glenton et al., 2010). To determine the certainty about results of studies included in this review, relevant studies were analysed to determine the size of effect and level of evidence for that particular effect using the GRADE approach for grading the quality of evidence, as recommended by the *Cochrane Handbook* (Higgins & Green, 2011). The GRADE approach is Grades of Recommendation, Assessment, Development and Evaluation.

### **What types of studies were included in the review?**

Eighteen articles, describing 14 separate studies representing 11 countries, were included in the review. The studies were focused on individuals with non-work related persistent pain conditions. A decision to focus on this group was made by the research team, as in Australia workers' compensation schemes provide support only for those with work-related conditions. The two groups have different access to support at the workplace. Those with non-work related conditions require greater clarity around the most successful interventions for keeping them at work.

Studies were categorised into those taking an individual focus or a multilevel focus. Individually focused interventions are those that focus on changes targeted at an individual within the workplace. Individually focused interventions might include educational pamphlets or counselling of individuals. A multilevel focus refers to those interventions, which incorporate individual interventions and workplace-focused changes, involving engagement with the employer or supervisor and other external service providers. Examples of multilevel focus interventions included workstation assessments and modifications, consultation with employers and case manager guidance. Of the studies included in this review, nine were individually focused interventions and five were multilevel focused interventions.

### **What the research says**

Key outcomes measured across the 14 studies included: job loss, sick leave, pain, productivity and cost benefit.

Taking into account the findings across the 14 studies, the following conclusions were made.

#### **Individually focused interventions for employees with persistent MSK pain**

- Compared to usual care (no other new intervention initiated as part of the study), individually focused workplace interventions:
  - probably slightly decrease sick leave
  - may make little or no difference to job loss
  - may make little or no difference to cost benefit

- Compared to other interventions (an alternative intervention to the intervention provided as part of the study)
  - probably will decrease job loss
  - may slightly decrease sick leave
  - probably make little or no difference to pain
  - probably slightly increase productivity

#### Multilevel focused interventions for employees with persistent MSK pain

- Compared to usual care (no other new intervention initiated as part of the study), multilevel focused workplace interventions:
  - may slightly decrease sick leave
  - have an unknown effect on productivity
  - may slightly decrease pain
  - probably will increase cost benefit

### Key learnings and insights

In summary, the key messages that emerge from this review are as follows.

- Many gaps exist in our understanding of key characteristics of workplace interventions that provide benefits to individuals with persistent pain to remain in productive employment.
- Interventions need to be considered carefully prior to implementation and measured to ascertain their effectiveness. However, it seems that intervening will provide some benefit but this will differ depending on the nature of the intervention and the level at which it is targeted.
- Individually focused interventions, such as vocational rehabilitation and education for individuals about available support may assist in reducing sick leave for individuals with persistent MSK pain.
- Interventions targeted at individual may assist with reducing job loss, and provide some benefit to productivity
- Multilevel interventions may provide cost benefit for individuals with persistent MSK pain.
- Multilevel interventions may slightly decrease sick leave and pain
- More good quality studies are needed that examine the effectiveness of workplace interventions that aim to enable productive employment for individuals who experience persistent MSK pain.

Putting this review into the context of the broader literature, some future considerations include:

- **Improved engagement with employers to assist them in understanding the benefits of workplace accommodations for people with persistent MSK pain.**

- **Development of educational materials for employers to assist with managing employees with non work-related conditions. Education could include resources about where to access further assistance and links to available government assistance schemes.**
- **Provision of education for individuals with persistent pain conditions about services/resources available to assist with maintaining productive employment.**
- **Development of case studies where workplace accommodations have been undertaken. Case studies might include cost benefit analyses, to provide useful insights to employers who are seeking guidance on how to assist employees to maintain productive employment.**

### Summing it up

A range of interventions targeted at an individual or workplace and individual (multilevel) were assessed in the studies included in the review. Five outcome measures were assessed in the review: sick leave, productivity, pain, cost benefit and job loss. In general, the low quality of the evidence across the studies reduces the certainty about the influence of an intervention on a particular outcome.

Overall, a limited number of studies were identified for this review in this important area of workplace interventions. Workplace interventions are complex, challenging to implement and difficult to measure accurately (Cox, Karanika, Griffiths, & Houdmont, 2007). As a result, workplace interventions targeting challenging areas, such as the one explored in this review, are few in number and, when assessed using rigorous criteria such those applied here, can appear to have limited benefit. We would suggest that the results reported here need to be interpreted whilst taking into account these challenges and that small changes may indicate a worthwhile intervention.



## BACKGROUND

What evidence exists for the characteristics of workplace interventions that allow people with persistent pain conditions to stay at work? Which aspects of workplace interventions are most effective? This review sought to answer these questions using rigorous review methods as recommended by the *Cochrane Handbook* (Higgins & Green, 2011).

### Purpose

The purpose of this systematic review is to research the evidence on the effectiveness of workplace interventions that target employees with persistent pain of musculoskeletal (MSK) origin. In particular the focus was on those individuals who stay at work, and what might assist them to maintain employment. Effectiveness was examined in the context of maintaining employment, as well as maximising productivity. The results of this review can be used to identify opportunities for future strategies to facilitate the productive employment of individuals with persistent MSK pain.

### The impact of persistent MSK pain on employment

Approximately 6.1 million Australians are affected by arthritis or other MSK conditions (A&OV, 2013) with persistent pain conditions affecting approximately 3.2 million Australians (MBF 2007). Substantial economic impacts are associated with persistent pain at societal and individual levels. These include loss of productivity from reduced workforce participation (A&OV 2013), lost income tax and increased government support payments (Schofield et al. 2013).

A recent report estimating the economic impact of persistent musculoskeletal condition in Australia, found that costs attributed to lost productivity far exceeded other costs (NSPAC 2012; A&OV 2013). An increased focus on extension of working lives (NSPAC 2012; Oakman & Wells 2013) means that understanding the characteristics of work interventions that maximise the ability for those with persistent MSK pain to stay at work need clarification (de Vries et al., 2011; van Leeuwen, Blyth, March, Nicholas, & Cousins, 2006).

### What are workplace interventions?

Workplace interventions aimed at supporting people with persistent pain are numerous and varied in their design and how they are targeted. Interventions can be focused on individuals and might include: exercises, fitness training, back school programs, postural retraining, behaviour-based and cognitive approaches and other retraining approaches. Other interventions are multilevel; that is, they aim to intervene at the individual and organisational levels. These include: changes to work schedules, job modifications, multidisciplinary level rehabilitation programs (including physical therapy, cognitive therapy, physician involvement and ergonomic assessments) and other workplace modifications.

Figure 1 provides a framework that the current review used to consider where specific study interventions were targeted. The overall regulatory framework in which organisations operate is important as it can impact the types of assistance that might be offered to individuals in their workplaces.

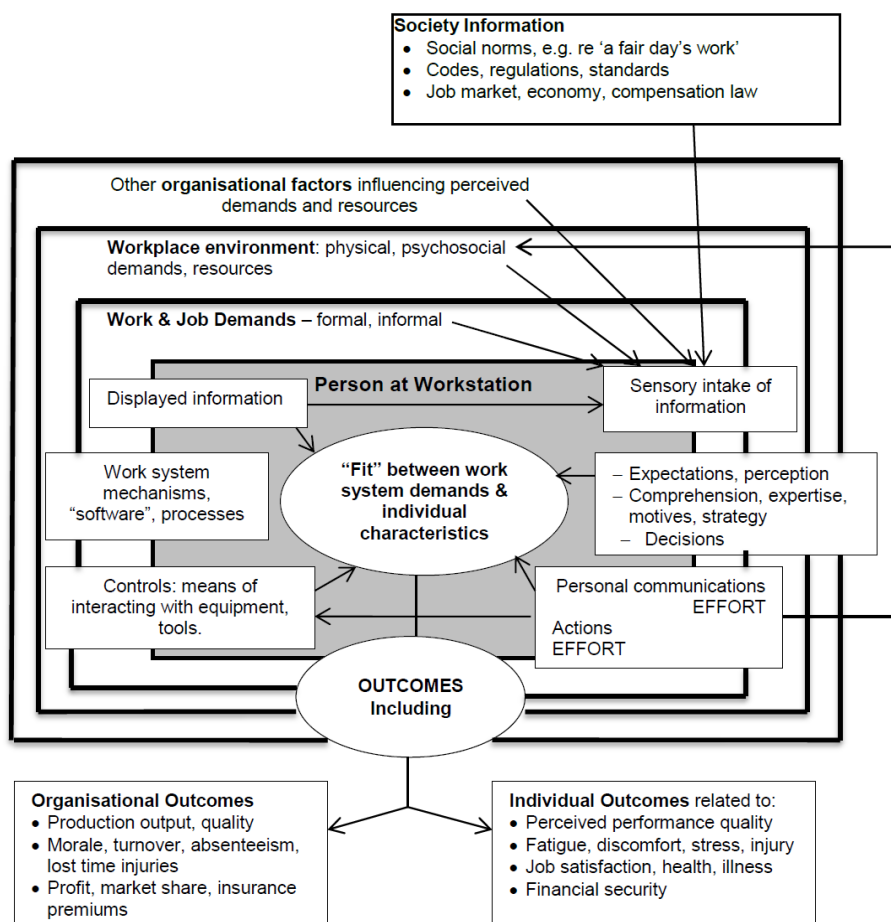
In some countries, work- and non-work related conditions are managed differently in workplaces. In Australia (also the UK, Canada and the USA) for instance, workers' compensation schemes cover only a condition or injury that was sustained or aggravated at work. As a result, those individuals with

non-work related persistent pain conditions are at risk of receiving lower levels of support in the workplace, particularly if they do not disclose their condition to an employer (Gignac & Cao, 2009). In recent research, however, we identified that disclosure was a significant concern to Australian employees with persistent MSK pain (Oakman et al, 2015). Given these issues, understanding what constitutes cost effective interventions that provide productivity benefits to workplaces is highly relevant.

## The Fit Model

This review utilises an ergonomics perspective where the aim of workplace interventions is to improve the match or ‘fit’ between individuals and their work environment (see Figure 1). Improved worker productivity results when individuals are well matched to the inherent requirements of their work, with better outcomes at both individual and organisational levels. This match between individuals and the environment is often referred to as person–environment (Macdonald, 2006). For individuals with persistent pain, maintenance of productive employment can be challenging due to the nature of their condition, specifically its chronicity and variability in symptoms. Ensuring adequate workplace accommodation is particularly important to assist with staying at work. Accommodations need to take into account the multifactorial nature of the condition, and the complexities of the work environment.

Figure 1: Fit Model of a workplace



## What do we currently know about workplace interventions and their effectiveness at keeping people at work?

Few previous systematic reviews have examined the effectiveness of workplace interventions designed to support individuals with persistent MSK pain to maintain productive employment. Van Oostrom et al. (2009) reviewed studies focused on employees who were on sick leave and had any sort of work disability (both work- and non-work related MSK conditions). They found moderate quality evidence for the effectiveness of workplace interventions in reducing sickness absence in employees with MSK disorders but noted difficulties in drawing conclusions due to low numbers of relevant studies. Another systematic review, which focused on employees returning to work (Palmer et al., 2012), found small benefits in workplace-based interventions but also noted the small sample sizes and low quality of evidence. De Vries et al. (2011), reported on a qualitative study, and found that multilevel interventions were an important component in enabling those with persistent pain to stay at work.

Workplace interventions are complex, they can be difficult to implement and measure and they are often not undertaken using a rigorous scientific approach. The gold standard in scientific measurement is considered to be a randomised controlled trial (RCT). This is a study design where participants are randomly allocated to receive a specific pre-determined intervention and their results are compared to study participants who did not receive the intervention or who received a different intervention. In the occupational context this can be difficult to control. RCTs require people to be allocated to a group by chance, but in workplaces this is extremely difficult to achieve, as organisational requirements often dictate where employees are situated. As a result many studies undertaken in workplace environments do not use traditional study designs such as RCTs. Furthermore, many industry interventions are not documented or published in peer-reviewed scientific literature. Whilst the evidence base is growing in the area of workplace interventions, gaps still exist in what we know about the effectiveness of workplace interventions.

## How does this systematic review contribute to existing knowledge?

This review specifically examines studies which focused on individuals with non-work related symptoms, as distinct from individuals with persistent MSK pain caused primarily by occupational exposure. In countries such as Australia these individuals are not specifically covered by workers' compensation schemes. This review seeks to analyse and synthesise results from a range of studies in order to develop recommendations to assist workplaces in managing employees with non-work related persistent MSK pain.

## Review objectives

The objectives of this review were:

1. to examine the characteristics of interventions which target employees with non-work related persistent MSK pain, and
2. to identify which interventions were most effective in supporting productive employment. Interventions were considered in the context of whether they had taken an individual, workplace or multilevel (individual and workplace level) approach.

The following sections provide a brief overview of the methods, key findings and suggested next steps.

## METHODS

### What was the review?

We undertook a systematic review of studies on interventions aimed at assisting people to remain in productive employment. Articles from peer-reviewed journals were selected, and a rigorous systematic approach to the review was undertaken in accordance with guidance from the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins & Green, 2011). The review covered findings from RCTS as well as other studies with pre and post intervention measures with comparison groups.

### Identification of relevant studies

An electronic literature search was limited to English language articles published between January 2000 and March 2014. This time period was selected in order to capture the contemporary work environment. The following electronic databases were searched: Medline, PsychINFO, CINAHL and Embase (refer Appendix A). In addition, we searched the bibliographies of the included articles and conducted a cited reference search of included articles using Web of Science. We also contacted an expert in the field for advice regarding relevant studies.

### Selection of the studies

Inclusion and exclusion criteria covered both the participants and the intervention. For the participants, studies were selected on the basis of the following inclusion criteria.

- Male and female adults from any industry sector or type of job.
- Workers at work or absent from work (on sick leave for a duration of less than a year), but still connected to a workplace by employment agreements (permanent or temporary).
- Workers with reported persistent MSK pain (greater than three months).

We also included studies where persistent MSK pain was not a specific inclusion criterion for the study, but where subgroups with defined MSK pain could be separately analysed.

In relation to the intervention, studies were included if they met the following criteria.

- Interventions included advice about changes in work processes and/or were part of a multidisciplinary intervention. The setting for the intervention was required to be at the workplace, or a component of the intervention targeting the workplace (with the intention to apply the workplace intervention to all participants in the intervention group). Studies with interventions that included more components than described in the definition of a workplace intervention were not excluded (van Oostrom et al., 2009).
- Either group-based or individual interventions conducted at the workplace were included. Interventions could be aimed at modifying the physical environment, work routine, work hours and/or individual coping mechanisms provided they were workplace-based.

Studies were excluded if the persistent MSK pain was considered a workplace injury and the study included participants currently receiving workers' compensation in the United States of America, Australian, Canadian or UK.

Only RCTs and studies with pre and post intervention measures and comparison groups were included. Two reviewers (NK and JO) independently assessed studies for inclusion. The retrieved studies were first selected by title and abstract. In cases of dispute between reviewers, the full text of studies was accessed and consensus was reached. Full text of reports/studies were analysed for inclusion/exclusion and any disputes were resolved through adjudication with a third reviewer (TK).

## Review protocol and data management

A data extraction form was developed and used to record study characteristics. Extracted data included: study design, country, participant details, type of intervention (including whether individual, workplace or multilevel focus<sup>‡</sup>: refer Figure 1: Fit Model of a workplace), outcome measures and results (Table 3). Interventions were classified as having an individual, workplace or multilevel focus.

## Outcome measures

Five outcomes were examined in this study: productivity, sick leave, pain, job loss and cost benefit. The studies included in the review utilised several different scales to measure these outcomes (refer Table 1). Due to the heterogeneity between outcome measures, a meta-analysis was not appropriate.

Table 1: Outcome measures

Outcome	Measures identified in included studies
<b>Productivity</b>	Arthritis Impact Measurement Scale role score (AIMS 2), subjective working capacity, Rheumatoid Arthritis Work Instability Score (RA WIS), Work Ability Index (WAI).
<b>Sick leave</b>	Days over three years, hours over 2 years, mean difference over 10 week period, % participants in full-time work status, days per month over 6 month period, days over 1 year, % participants on sick leave for >30 days, days over 6 months.
<b>Pain</b>	Arthritis Impact Measurement Scale symptom score (AIMS), low back pain intensity scale, researcher-developed questionnaire, Visual Analogue Scale (VAS), changes in AIMS and VAS over 6 months, change in numeric rating scale.
<b>Job Loss</b>	Self reported job loss events either permanent (retirement or disability pension) or temporary (unemployment).
<b>Cost benefit</b>	Health care and rehabilitation program costs and days lost, direct non-healthcare costs plus indirect costs.

## Quality assessment

A range of analyses was undertaken to determine the quality of the studies in this review. These included: assessment of risk of bias and the GRADE approach (Guyatt et al., 2008) to evaluate quality of evidence for each outcome.

<sup>‡</sup> A multilevel focus refers to those interventions which incorporate individually focused changes and changes that may involve the employer, supervisor and external service provider.

### *Assessment of risk of bias*

Individual studies were assessed for risk of bias using the Cochrane Back Review Group checklist as recommended by the *Cochrane Handbook* (Higgins & Green, 2011). Non-RCT studies were assessed using the Cochrane Bias Methods Group criteria (Cochrane-Bias-Methods-Group). Two reviewers (JO, TK) independently assessed the studies, with any differences resolved by consensus. If consensus was not reached, a third reviewer (AB) was called upon to arbitrate. For the RCTs, six areas of bias were assessed: selection, performance, detection, attrition, reporting and 'other'. Each area of bias included several assessment domains. Due to the nature of workplace interventions, which does not allow for blinding, the criteria regarding blinding of participants and of providers (domains within performance bias) was not assessed (Schonstein, Kenny, Keating, Koes, & Herbert, 2003; van Oostrom et al., 2009), leaving a total of ten domains. Each domain was assessed as high, low or unclear risk. The risk of bias associated with intention to treat analysis was assessed as high if there was > 20% loss to follow up and no intention to treat analysis (Fewtrell et al., 2008). Studies with no loss to follow up, or with ≤ 20% loss to follow up that included an intention to treat analysis, were assessed as low risk of bias. Relevant information was requested from study authors if not clearly described in the article. In cases where information was not available, the corresponding risk of bias domain was assessed as unclear. The non-RCT studies were assessed against eight criteria as specified by the Cochrane Bias Methods Group.

### *Grading the level of evidence*

Direction of effect for interventions on each outcome measure (Table 1) were examined and reported. Evidence quality for each outcome was assessed using the GRADE tool (as per the *Cochrane Handbook*) (Atkins et al., 2004; Guyatt et al., 2008). The GRADE tool involves assessing the level of evidence for a group of studies, related to a particular outcome. The six measures used to assess the quality of evidence are: (1) study design, (2) limitations of the studies, (3) consistency of results, (4) directness, (5) precision and (6) publication bias (Guyatt et al., 2011). Each outcome starts with a score of 4, and can be downgraded or upgraded depending on the assessed level of evidence. An overall score was calculated for each outcome assessed in the review, across a suite of studies.

Evidence is considered at the following levels.

- (1) *High quality* – Further research is very unlikely to change our confidence in the estimate of effect or accuracy.
- (2) *Moderate quality* – Further research is likely to have an important impact on our confidence in the estimate of effect or accuracy and may change the estimate.
- (3) *Low quality* – Further research is very likely to have an important impact on our confidence in the estimate of effect or accuracy and is likely to change the estimate.
- (4) *Very low quality* – Any estimate of effect or accuracy is very uncertain.

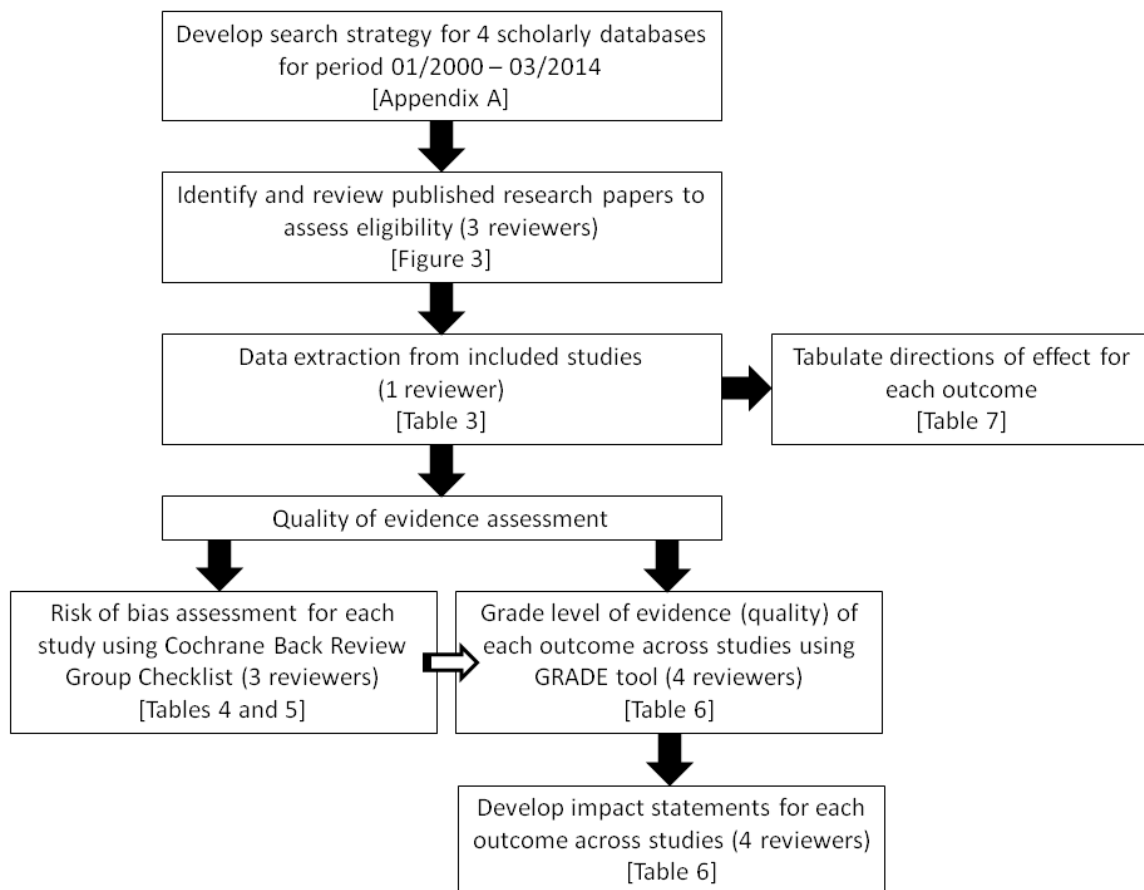
A statement of evidence quality (an impact statement) is then developed, which takes into account the level of evidence and the likely impact on the particular outcome. Impact statements used in this review are based on the standard qualitative statements that were developed by Glenton et al. (2010). An explanation of the strength of each impact statement is provided in Table 2.

A summary of the methodology is provided in Figure 2.

Table 2: Explanation of impact statements (based on Glenton et al. 2010)

Quality of evidence	Magnitude of effect		
	Important benefit/harm	Less important benefit/harm	No effect
1. High quality	'Will' increase/decrease...	'Slightly' increases/decreases...	'Makes little or no' difference...
2. Moderate quality	'Probably will' increase/decrease...	'Probably slightly' increases/decreases...	'Probably' makes little or no difference
3. Low quality	'May' increase/decrease...	'May slightly' increase/decrease...	'May' make little or no difference
4. Very low quality	It is not known whether the intervention increases/decreases...		

Figure 2: Methods Process



## RESULTS

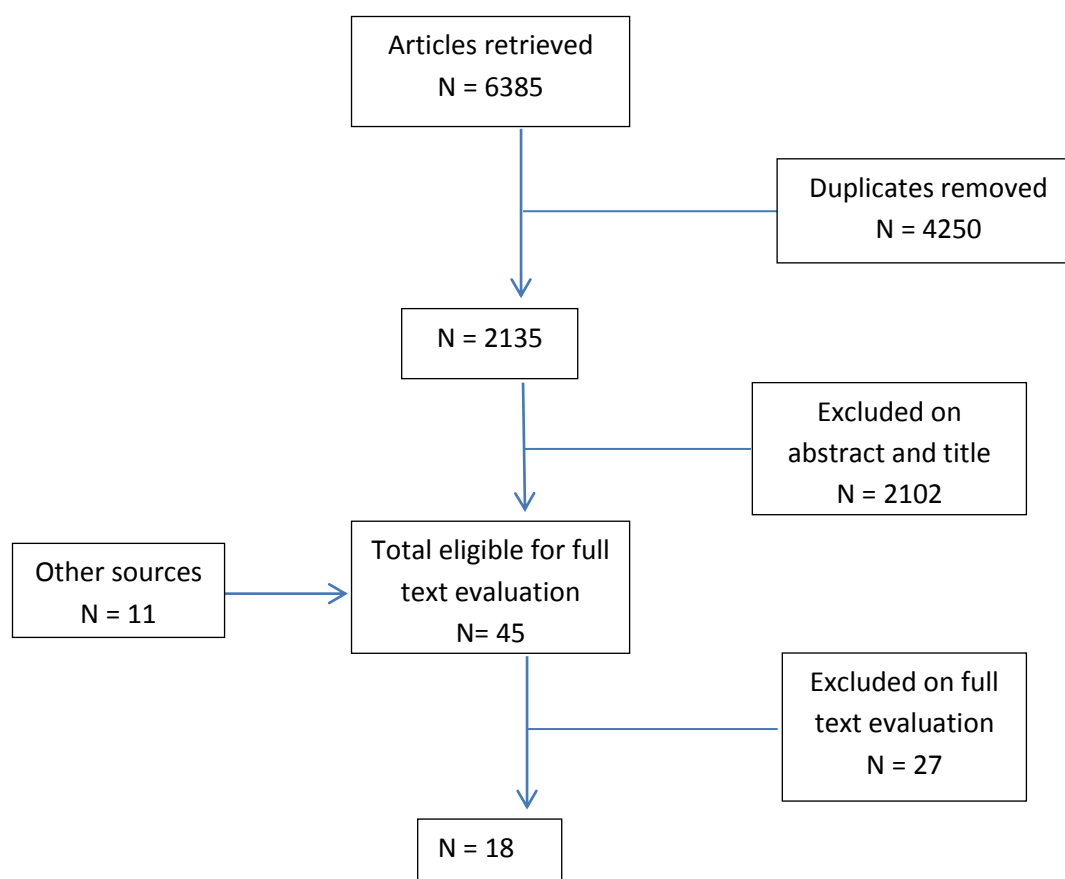
### How were the studies selected?

The electronic literature search produced 6385 references (Medline 1588, PsychInfo 393, CINAHL 699, Embase 3705). After removing duplicates, 2135 references remained. Each was assessed on title and abstract, with 34 references selected for potential inclusion. A bibliographic search of included articles identified another four studies and a citation search via Web of Science identified another three studies. A further four potential studies were added after consultation with an expert in the field, thus adding an additional 11 studies.

After full text examination of the 45 potential articles, 27 were excluded on the basis that they were either not a workplace intervention, had participants who were unemployed, included chronic conditions other than musculoskeletal that couldn't be separately analysed, or had participants whose pain was of less than three months duration (Appendix B).

Eighteen articles (representing 14 unique studies) from 11 countries with a range of policy structures were included in the systematic review. This comprised 12 RCTs and two cohort/pre/post measure intervention studies (refer Figure 3).

Figure 3: Selection of studies





## Studies included in the review

Publication dates for included studies ranged between 2003 and 2014. Of the 14 studies, six compared interventions with usual care <sup>1</sup>and eight compared interventions with other interventions<sup>2</sup>. There were no placebo-controlled trials.

Interventions were categorised into an individual, workplace or multilevel focus. The individual focus interventions refer to those focused on individual-level changes within the workplace, such as educational pamphlets or rehabilitation counselling. A workplace level intervention refers to studies which focus solely on changes to the workplace; i.e. at an organisational-level. No studies which only targeted the workplace were identified for this review. A multilevel focus refers to those interventions which incorporate individually focused changes, and workplace-initiated changes that may involve the employer, supervisor and any other external service provider. Examples of multilevel focus interventions included combinations of OT/ergonomist workplace assessments, workstation assessments, consultation with the employer and case manager guidance. Of the studies included in this review, nine included individually focused interventions and five included multilevel focused interventions. Participants experienced a range of conditions which included: chronic lower back pain, arthritis (rheumatoid arthritis, osteoarthritis, psoriatic arthritis, systemic lupus erythematosus, ankylosing spondylitis) and upper limb pain.

**Table 3: Study characteristics (results are reported as the mean (SD) unless otherwise stated)**

Study & design	N employees	Type of intervention (level of intervention) [comparator]	Outcome(s)	Results	Effect estimate
(Allaire, Li, & LaValley, 2003), (Allaire, Niu, & LaValley, 2005) RCT	242	Rehabilitation counsellors (individual focus) [other intervention – provision of pamphlets, flyers about management of health-related employment problems & available resources)	<b>Job loss</b> (job loss events)	25experimental (exp) 48control (con) p = 0.0007	+ve effect
(Arnetz, Sjogren, Rydehn, & Meisel, 2003) RCT	137	Early initiation of rehabilitation process involving: Case manager guidance, OT <sup>†</sup> ergonomist workplace assessment/modifications, employer involvement (multilevel focus) [usual care – rehabilitation without early initiation of process]	<b>Sick leave</b> (mean sick days in 12 month period)  <b>Cost benefit</b> (total reimbursement from health ins. system)	144.9 exp 197.9 con p<0.01  57,564 Swedish Kroner exp. 73,178 Swedish Kroner control p<0.05	+ve effect  +ve effect

<sup>1</sup> when no other intervention was instigated by the researchers, participants continued undertaking their usual program of care, these included physician/medical visits or therapist treatments

<sup>2</sup>interventions were prescribed as part of the research program

<sup>†</sup> OT: occupational therapist

Study & design	N employees	Type of intervention (level of intervention) [comparator]	Outcome(s)	Results	Effect estimate
(Baldwin et al., 2012) RCT	75	Individual workplace assessments/workplace modifications by OT ergonomist (individual focus) [other intervention – provision of resource manual with guides for self-management of arthritis and possible ergonomic workplace interventions]	<b>Pain</b> (*AIMS symptom score at 24 months ** AIMS symptom score change over 24 months)  <b>Productivity</b> (AIMS 2 role score at 24 months)	<i>between group comparison*</i> 4.62 (2.22) exp 4.48 (2.31) con p = 0.42  <i>Within group comparison**</i> -1.25 (2.16) exp p < 0.011 -0.29 (1.94) con p = 0.34  1.49 (1.35) exp 2.16 (1.93) con p < 0.03	no effect    +ve effect  no effect   +ve effect
(de Buck et al., 2005), (van den Hout, de Buck, & Vliet Vlieland, 2007) RCT	112 121	Multidisciplinary rehabilitation (individual focus) [usual care – received usual outpatient rheumatology care/referrals to professionals and information about sick leave/work disability]	<b>Job loss</b> (job loss events over 24 mths)  <b>Sick leave</b> (self-reported days absent in 24 months follow-up)  <b>Economic costs</b> (health care and productivity loss costs)	14 exp 12 con p = 0.89  89.1 (92.6) exp 106.9 (111.1) con p = 0.44  28,638 (24,122) exp 34,506 (29,799) con p = 0.24	no effect  no effect  no effect
(Fleten & Johnsen, 2006) RCT	990	Education package (individual focus) [usual care – exposed to usual activity from general practitioner and National Insurance Office]	<b>Sick leave</b> (number of days over one year)	100.1 exp 102.6 con (weighted mean for low back pain, arthritis and MSK groups combined)  111.4 exp (arthritis group) 179.6 con	no effect for overall MSK group

Study & design	N employees	Type of intervention (level of intervention) [comparator]	Outcome(s)	Results	Effect estimate
				95% CI (-123.3 to -13.3) (arthritis group)	+ve effect for arthritis group
(Gignac & Cao, 2009), (Gignac, Cao, Tang, & Beaton, 2011) cohort	349	Self-disclosure to workplace Self-reported job modifications/accommodations: scheduling changes, gadgets/assistive devices/furniture/equipment help from others, workplace professional consulted (multilevel) [usual care – did not disclose to workplace]	<b>Pain</b> (change in PCS over 4.5 years)  <b>Productivity</b> (% that had WALS ≥9)  <b>Absenteeism</b> (% respondents reporting absenteeism as an arthritis related workplace outcome)	5.0 (11.2) exp 4.6 (10.2) con  29.4% time 1 40.8% time 4 (4.5 years later)  39.4 (T1) 27.8 (T4)	no effect  -ve effect  no effect
(Jousset et al., 2004) RCT	86	Functional rehabilitation including exercise and work simulation (individual focus) [other intervention- active individual therapy protocol devised by researchers]	<b>Sick leave</b> (mean days 6 month follow-up, self-reported confirmed by insurance data)  <b>Pain</b> (VAS at 6 months)	28.7 (44.6) exp 48.3 (66.0) con p = 0.12 unadjusted p = 0.01 (adjusted) <sup>3</sup>  3.1 (2.5) exp 4.0 (2.8) con p = 0.16	+ve effect   no effect
(Kaapa, Frantsi, Sarna, & Malmivaara, 2006) RCT	120	Multidisciplinary rehabilitation including workplace visit/adjustments (individual focus) [other intervention – individual physiotherapy sessions]	<b>Sick leave</b> (% on sick leave for >30 days at 24 months)  <b>Pain</b> (low back pain intensity scale at 24 months)  <b>Productivity</b> (subjective working	12.0 exp. 10.6 con p = 0.74  3.5 (2.6) exp 4.0 (2.9)con p= 0.71  2.9 (2.8) exp 3.5 (2.8) con p= 0.33	no effect  no effect  no effect

<sup>3</sup>control workplaces were more likely to be enrolled in alternative workplace ergonomic intervention program which influenced mean sick days, therefore results adjusted

Study & design	N employees	Type of intervention (level of intervention) [comparator]	Outcome(s)	Results	Effect estimate
			capacity scale at 24 months)		
(Lambeek, van Mechelen, Knol, Loisel, & Anema, 2010), (Lambeek, Bosmans, et al., 2010) RCT	134	Integrated care involving employer, clinicians and OT ergonomists (multilevel focus) [usual care –usual treatment from their medical specialists]	<b>Sick leave</b> (days after 12 months)  <b>Pain</b> (VAS at 12 months)  <b>Costs</b> (direct non-healthcare costs plus indirect costs)	88.5 (95.5) exp 103.4 (102.7) con p = 0.004  1.64 exp 1.85 con p = 0.67  13165 (13600) exp 18475 (13616) con	+ve effect  no effect  +ve effect
(Macedo, Oakley, Panayi, & Kirkham, 2009) RCT	32	OT assessment/workplace modifications and employer involvement (multilevel focus) [usual care – usual rheumatology care with no OT involvement]	<b>Sick leave</b> (days missed per mth - 6 mths)  <b>Productivity</b> (RA WIS)  <b>Pain</b> (changes in AIMS2 and VAS over 6 months)	0.33 (1.29) exp 2.75 (5.46) con p = 0.09  9(5.39) exp 13.67 (5.46) con p =0.03 -2.31 (1.74) exp -0.66 (2.26) con p = 0.03 and -25.31 (24.22) exp -1-13. (22.98) con p = 0.007	no effect  +ve effect  +ve effect
(Meyer, Fransen, Huwiler, Uebelhart, & Klipstein, 2005) RCT	33	Multidisciplinary rehabilitation including workplace visit (individual focus) [other intervention – progressive exercise therapy and advice about work uptake]	<b>Sick leave</b> (% full-time job work status at 32 weeks)  <b>Pain</b> (change in numeric rating scale, at	median (Q1,Q3) 50 (0,50) exp 50 (0,100) con p = 0.167  1 (-1.0,2.0) exp 1. (0.0, 2.0) con	no effect  no effect

Study & design	N employees	Type of intervention (level of intervention) [comparator]	Outcome(s)	Results	Effect estimate
			8 weeks)	p = 0.34	
(Roche-Leboucher et al., 2011) RCT	132	Functional rehabilitation (individual focus) [other intervention – active individual therapy protocol devised by researchers]	<b>Sick leave</b> (mean sick leave days over 12 months - insurance data)  <b>Pain</b> (VAS at 12 month follow-up)	37.3 (67.8) exp 72.0 (109.9) con p= 0.042  2.9 (2.4) exp 3.5 (2.3) con p > 0.05	+ve effect  no effect
(Sundstrup et al., 2014) RCT	66	Workplace strength training (individual focus) [other intervention – ergonomic training and education]	<b>Sick leave</b> (mean difference at 10 weeks)  <b>Productivity</b> (WAI score mean difference at 10 weeks)	-0.2 exp -0.5 con p = 0.47  0.3 exp -2.2 con p = 0.012	no effect  +ve effect
(Weiler et al., 2009) pre/post measure	79	Rehabilitation program involving employer (multilevel focus) [usual care – usual rehabilitation program]	<b>Sick leave</b> (mean days, at 3 yrs - health ins. data)	34.2 (37.3) exp 48.8 (32.8) con p = 0.002	+ve effect

## Risk of bias analysis

The results of the risk of bias analysis for each RCT study are presented in Table 4. For the RCTs and the cohort and pre/post studies the risk of bias ranged from low to high (Table 5).

Table 4: Summary of risk of bias for RCTs

Assessment domain for risk of bias	Sundstrup 2014	Roche-Leboucher 2011	Meyer 2005	Macedo 2009	Lambek (x2) 2010	Kaapa 2006	Jouset 2004	Fleuten 2006	de Buck 2005/ Van den Hout 2007	Baldwin 2012	Arnetz 2003	Allaire 2003/2005
Random sequence generation	Amber	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green
Allocation concealment	Green	Amber	Green	Green	Green	Green	Amber	Green	Green	Green	Green	Green
Blinding of outcome assessors	Green	Red	Green	Amber	Green	Green	Amber	Green	Green	Green	Green	Green
Outcome data complete	Green	Red	Green	Green	Green	Green	Green	Green	Amber	Amber	Green	Green
Selective outcome reporting*	Green	Amber	Amber	Green	Green	Amber	Amber	Amber	Amber	Amber	Amber	Amber
Group similarity at baseline regarding the most important prognostic factors	Green	Green	Green	Green	Green	Green	Red	Red	Green	Green	Green	Green
Co-interventions**	Amber	Green	Green	Amber	Amber	Amber	Amber	Amber	Amber	Amber	Amber	Amber
Compliance in all groups	Amber	Amber	Green	Green	Green	Amber	Green	Green	Red	Amber	Amber	Green
Intention-to-treat analysis	Green	Red	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green
Timing of outcome assessments in groups	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green

Green = low risk, Amber = unclear, Red = high risk.

\***Selective outcome reporting** assessed as unclear if the protocol was not available (ISRCTN register checked and authors contacted if studies not registered). A possible limitation of this assessment: when assessing outcome reporting for studies with multiple articles in languages other than English, some articles may not have been detected in literature search (which was restricted to English) and therefore outcomes assessed as being not reported (resulting in overestimation of the risk).

\*\***Co-intervention** defined as treatment/activity that would not normally be experienced in standard practice. If studies did not explicitly state co-interventions were avoided, an unclear rating was applied.

Table 5: Risk of bias for non-RCT studies

Domain	Gignac 2009	Gignac 2011	Weiler 2009
1. Was the selection of exposed and non-exposed cohorts drawn from the same population?	Low	Low	Low
2. Can we be confident in the assessment of exposure?	Low	Low	Low
3. Can we be confident that the outcome of the interest was not present at start of study?	Low	High	Low
4. Did the study match exposed and unexposed for all variables that are associated with the outcome of interest or did the statistical analysis adjust for these prognostic variables?	Low	Low	Low
5. Can we be confident in the assessment of the presence or absence of prognostic factors?	high	High	Low
6. Can we be confident in the assessment of outcome?	Low	High	Low
7. Was the follow-up of cohorts adequate?	High	High	Unclear
8. Were co-interventions similar between groups?	Low	Low	Low

Green = low risk, Amber = unclear, Red = high risk.

### Grading the evidence

Three ‘summary of findings’ tables were generated on the basis of intervention (individual/multilevel focus) and comparison groups (usual care/other intervention). ‘Usual care’ was defined the situation when no other intervention was instigated by the researchers; participants continued undertaking their usual program of care, which may include physical visits, or other treatments. Other interventions involved interventions prescribed by the research group, such as education or ergonomic training. This might have been a less intense version of the intervention. Placebo groups were not used.

Evidence was downgraded for various reasons (see Table 6). The impact statements reflect the likelihood that the intervention will result in a change to the outcome of interest. An impact statement takes into account the assessed quality of evidence for a particular outcome. See Appendix C for further details on evidence quality.

GRADE analysis and an impact statement for each outcome are shown in Table 6. Overall quality of evidence was low, due to low numbers of studies and numbers of participants.

Table 6: Summary of findings – GRADE analysis

<b>What characteristics of interventions targeting employees with persistent MSK pain, and/or their workplace, are most effective in supporting productive employment?</b>			
<p><b>Patients or population:</b> Working adults connected to workplace by employment agreements (may be on sick leave of duration &lt;1 year) who have persistent MSK pain (&gt;3 months duration)  <b>Settings:</b> Based at the workplace, or addressed workplace processes  <b>Intervention:</b> Individual focus (total of 2 studies)  <b>Comparison:</b> Usual care</p>			
<b>Outcomes</b>	<b>Impact: effect of individually focused workplace intervention on employment</b>	<b>Number of participants (studies)</b>	<b>Quality of evidence (GRADE)</b>
<b>Sick leave</b>	Individually focused interventions probably slightly decrease sick leave in employees with persistent MSK pain	1111 (2 studies)	Moderate <sup>1</sup>
<b>Job loss</b>	Individually focused interventions may make little or no difference in job loss for employees with persistent MSK pain	140 (1 study)	Low <sup>1,2</sup>
<b>Cost benefit</b>	Individually focused interventions may not provide a positive cost benefit	121 (1 study)	Low <sup>1,2</sup>
<p><b>Patients or population:</b> Working adults connected to workplace by employment agreements (may be on sick leave of duration &lt;1 year) who have persistent MSK pain (&gt;3 months duration)  <b>Settings:</b> Based at the workplace, or addressed workplace processes  <b>Intervention:</b> Individual focus (total of 7 studies)  <b>Comparison:</b> Other intervention</p>			
<b>Outcomes</b>	<b>Impact: effect of individually focused workplace intervention on employment</b>	<b>Number of participants (studies)</b>	<b>Quality of evidence (GRADE)</b>
<b>Job loss</b>	Individually focused interventions probably will decrease job loss for employees with persistent MSK pain	242 (1 study)	Moderate <sup>2</sup>
<b>Sick leave</b>	Individually focused interventions may slightly decrease sick leave taken by employees with persistent MSK pain	426 (5 studies)	Low <sup>3,4</sup>
<b>Pain</b>	Individually focused interventions probably make little or no difference to pain levels in employees with persistent MSK pain	413 (5 studies)	Moderate <sup>3</sup>
<b>Productivity</b>	Individually focused interventions probably slightly increase productivity of employees with persistent MSK pain	261 (3 studies)	Moderate <sup>3</sup>
<p><b>Patients or population:</b> Working adults connected to workplace by employment agreements (may be on sick leave of duration &lt;1 year) who have persistent MSK pain (&gt;3 months duration)  <b>Settings:</b> Based at the workplace, or addressed workplace processes  <b>Intervention:</b> Multilevel focus (total of 5 studies)  <b>Comparison:</b> Usual care</p>			
<b>Outcomes</b>	<b>Impact: effect of multilevel focused workplace interventions on employment</b>	<b>Number of participants</b>	<b>Quality of evidence</b>



		(studies)	(GRADE)
<b>Sick leave</b>	Multilevel focused interventions may slightly decrease sick leave taken by employees with persistent MSK pain	721 (5 studies)	low <sup>5,6</sup>
<b>Productivity</b>	It is not known whether multilevel focused interventions will affect productivity of employees with persistent MSK pain	381 (2 studies)	v.low <sup>5,6</sup>
<b>Pain</b>	Multilevel focused interventions may slightly decrease pain amongst employees with persistent MSK pain	505 (3 studies)	low <sup>5,6,7</sup>
<b>Cost benefit</b>	Multilevel focused interventions will probably provide some cost benefit on investment	271 (2 studies)	moderate <sup>4</sup>

<sup>1</sup> High risk of bias – low compliance

<sup>2</sup> Small sample size

<sup>3</sup> High risk of bias for incomplete outcome data, intention-to-treat analysis, blinding of outcome assessors and co-intervention

<sup>4</sup> Imprecision – wide confidence intervals

<sup>5</sup> Includes non-RCT studies

<sup>6</sup> High risk of bias – 4/8 domains assessed as high for one study

<sup>7</sup> Inconsistency of results between studies – one found positive effect, other found negative effect

## What were the effects of the interventions?

Table 7 outlines the direction of effects of the interventions against each outcome analysed in the review. Whilst only one study (Gignac, 2011) reported a negative effect, many studies reported no effect, suggesting a low risk of publication bias across the various outcomes.

**Table 7: Summary of outcome effects**

Outcome	+ve effect	No effect	-ve effect
<b>Sick leave</b>	Arnetz 2003 Weiler 2009 Roche-Leboucher 2011 Fleten 2006 (arthritis subgroup) Lambeek 2010 Jousset 2004 Gignac 2011	Fleten 2006 (all MSK) Van den Hout 2007 Meyer 2005 Macedo 2009 Kaapa 2006 Sundstrup 2014	
<b>Job loss</b>	Allaire 2003/2005	de Buck 2005	
<b>Cost benefits</b>	Arnetz 2003 Lambeek 2010	van den Hout 2007 (inconclusive)	
<b>Pain</b>	Macedo 2009	Roche-Leboucher 2011 Meyer 2005 Lambeek 2010 Kaapa 2006 Baldwin 2012 Jousset 2004 Gignac 2009	
<b>Productivity</b>	Sundstrup 2014 Macedo 2009 Baldwin 2012	Kaapa 2006	Gignac 2011

### **Effect of individually focused workplace intervention on employment compared to usual care**

A total of two studies, represented by three articles (de Buck et al., 2005; Fleten & Johnsen, 2006; van den Hout et al., 2007) investigated the effect of individually focused interventions compared to usual care. Interventions included an education package (Fleten & Johnsen, 2006) and multidisciplinary rehabilitation (de Buck et al., 2005; van den Hout et al., 2007). Three outcomes were assessed: sick leave, job loss and cost benefit. The overall quality of the evidence was low for job loss and cost benefit. Usual care involved referral of individuals to outpatients which occurs as standard practice (de Buck et al., 2005; van den Hout et al., 2007) or being provided with standard written information (Fleten & Johnson, 2006).

For sick leave, the provision of an education package (Fleten & Johnsen, 2006) resulted in employees with arthritis taking less time off work. The education package contained information about return to work options and a questionnaire. The findings support the provision of information to individuals as a low-cost option for reducing sick leave in those with persistent MSK pain due to arthritis. However, the study by van den Hout et al. (2007) concluded that a multidisciplinary rehabilitation intervention had no effect on the sick leave of individuals with persistent MSK pain.

One study (de Buck et al., 2005) assessed the impact of an individually focused intervention on job loss. The rehabilitation program undertaken in the study did not reduce job loss for the study participants, with low quality evidence assessed for this outcome.

Although van den Hout et al. (2007) reported reduced costs of rehabilitation compared to usual care, the findings were not significant and the evidence quality was low. Future studies with larger sample sizes may result in a significant outcome.

Evidence quality was generally low for the effect of individually focused workplace interventions compared to usual care.

### **Effect of individually focused workplace interventions on employment compared to other interventions**

Seven studies, represented by eight articles, (Allaire et al., 2003; Allaire et al., 2005; Baldwin et al., 2012; Jousset et al., 2004; Kaapa et al., 2006; Meyer et al., 2005; Roche-Leboucher et al., 2011; Sundstrup et al., 2014) were identified as comparing individually focused workplace interventions to other interventions. These interventions included multidisciplinary rehabilitation (Allaire et al., 2003; Allaire et al., 2005; Kaapa et al., 2006), ergonomic workplace assessments (Baldwin et al., 2012) and exercise programs (Jousset et al., 2004; Meyer et al., 2005; Roche-Leboucher et al., 2011; Sundstrup et al., 2014).

In some of the studies, the control groups received a minor intervention such as provision of information (Allaire et al., 2003; Allaire et al., 2005; Baldwin et al., 2012). However in the majority of studies the control groups were exposed to active interventions such as individual physiotherapy (Jousset et al., 2004; Kaapa et al., 2006; Roche-Leboucher et al., 2011), therapy with work uptake advice (Meyer et al., 2005) and ergonomic training with education (Sundstrup et al., 2014). A total of four outcomes were assessed: job loss, sick leave, pain and productivity.

Vocational rehabilitation (Allaire et al., 2003; Allaire et al., 2005) offered to individuals at work resulted in significant reductions in job loss, suggesting that early intervention might assist those at risk. The quality of evidence for this outcome was assessed as moderate.

Sick leave was measured in five studies (Jousset et al., 2004; Kaapa et al., 2006; Meyer et al., 2005; Roche-Leboucher et al., 2011; Sundstrup et al., 2014). Exercise-based interventions were used in all studies, with one study making ergonomic modifications, which comprised postural retraining. Two studies (Jousset et al., 2004; Roche-Leboucher et al., 2011) found significant reductions in sick leave following the intervention. However, three studies (Kaapa et al., 2006; Meyer et al., 2005; Sundstrup et al., 2014) reported that sick leave was not significantly reduced. The quality of evidence for the outcome of sick leave was assessed as low.

In relation to reduction of pain, three studies (Jousset et al., 2004; Meyer et al., 2005; Roche-Leboucher et al., 2011) used exercise-based interventions, one (Kaapa et al., 2006) used a rehabilitation approach and one (Baldwin et al., 2012) undertook ergonomic workplace assessments. However, none of the five interventions reported reductions of pain levels that reached statistical significance. The quality of evidence for this outcome was assessed as moderate.

Productivity was measured in three studies (Baldwin et al., 2012; Kaapa et al., 2006; Sundstrup et al., 2014). Ergonomic workplace assessment (Baldwin et al., 2012) and exercise-based rehabilitation (Sundstrup et al., 2014) and rehabilitation (Kaapa et al., 2006) interventions were undertaken. One study (Kaapa et al., 2006) reported no significant changes in productivity measures. Two studies (Baldwin et al., 2012; Sundstrup et al., 2014) reported improvements in productivity measures following their respective interventions. Evidence quality for this outcome was assessed as moderate.

In summary, the data across the studies were of a mixed quality. Interventions that are individually focused may be of some benefit but the impact is highly variable, depending on the outcome of interest.

#### **Effect of multilevel focused workplace interventions on employment compared to usual care**

Five studies described in seven articles (Arnetz et al., 2003; Gignac & Cao, 2009; Gignac et al., 2011; Lambeek, Bosmans, et al., 2010; Lambeek, van Mechelen, et al., 2010; Macedo et al., 2009; Weiler et al., 2009) were identified as comparing a multilevel focused intervention to usual care. Interventions in all studies involved several components including: education, liaison with employers, workplace modifications and participatory approaches.

Three studies included a usual care group which was based in the workplace. These included standard rehabilitation program (Arnetz et al., 2003; Weiler et al., 2009) and condition non-disclosure to workplace (Gignac & Cao, 2009). Two studies had a usual care group which was defined as usual treatment from medical specialists (Lambeek et al., 2010; Macedo et al., 2009). A total of four outcomes were assessed: sick leave, productivity, pain and cost benefit. Overall the evidence quality was low, suggesting higher quality studies are needed in the area.

Sick leave was assessed by five studies (Arnetz et al., 2003; Gignac et al., 2011; Lambeek, van Mechelen, et al., 2010; Macedo et al., 2009; Weiler et al., 2009). One study (Macedo et al., 2009) reported a decrease in sick leave that did not reach statistical significance and three studies (Arnetz

et al., 2003; Lambeek, van Mechelen, et al., 2010; Weiler et al., 2009) reported a statistically significant reduction of sick leave following the multilevel intervention. One study (Gignac et al., 2011) reported a decrease in the amount of sick leave taken following the intervention. Evidence quality was assessed as low for the sick leave outcome, evidence was downgraded as two studies were not RCTs.

Productivity was measured in two studies (Gignac et al., 2011; Macedo et al., 2009). Macedo et al. (2009) reported an improvement in productivity compared to the other interventions. However, Gignac et al. (2011) found that productivity levels worsened over time, with a statistically significant result, although not derived from an RCT design. The quality of evidence was assessed as very low for the productivity outcome and as such no conclusive results can be made.

Three studies measured pain levels (Gignac & Cao, 2009; Lambeek, van Mechelen, et al., 2010; Macedo et al., 2009). Macedo et al. (2009) found pain levels decreased following the intervention. Two studies (Gignac & Cao, 2009; Lambeek, van Mechelen, et al., 2010) found that pain levels did not change significantly following the intervention. Evidence quality was assessed as low for this outcome.

Two studies (Lambeek, Bosmans, et al., 2010; Arnetz et al., 2003) assessed cost benefit of multilevel interventions and demonstrated a positive result on cost benefit. Evidence quality was assessed as moderate for this outcome, suggesting a multilevel approach is likely to be a cost effective intervention.

In summary, the data provided moderate to very low evidence to support multilevel interventions compared to usual care. Key reasons for this include low sample sizes and downgrading for risk of bias due to study design. This does not infer the interventions do not work, rather, the quality of the evidence available to support them is low, highlighting the need for higher quality studies. A compounding issue is the use of other interventions rather than control groups, which may reduce the likelihood of a significant result. The impact of a multilevel intervention did result in reduced sick leave but as two of the studies were not RCTs, evidence was rated as low. In terms of workplace practice, reduction of sick leave is a productivity gain and taking into account the cost of the intervention, it is reasonable to suggest that a multilevel intervention might constitute a reasonable action to take.

## **Characteristics of effective workplace interventions**

Designing an effective workplace intervention is challenging and the current literature in the area is somewhat limited through low numbers of studies and varying quality. However, some characteristics of the studies analysed in this current review provide useful insights for development of workplace interventions.

### **Individually focused**

Rehabilitation of a vocational orientation whilst an individual is still employed appears to be of benefit. Educating individuals with persistent MSK pain about their options in terms of workplace accommodations and any assistance packages is likely to be a useful inclusion in an intervention aimed at keeping individuals, who are experiencing persistent MSK pain, in productive employment. The low cost of this makes it a reasonable option to include in designing an intervention.

Some aspects of interventions appeared to have little impact in relation to the outcomes measured in this review. In cases where interventions were only exercise-based, impact on pain or sick leave taken was limited. It should be noted though that there are many reasons to undertake exercise, particularly with persistent MSK pain, but the examination of these factors were outside the scope of the current study. However, the result is perhaps not unsurprising considering that contemporary understanding of effective interventions for persistent MSK pain supports the targeting of interventions at a range of levels rather than only the individual.

### **Multilevel focused**

Multilevel approaches to interventions appear to provide some cost benefit. These approaches include building functional capacity and abilities, active roles for case managers and involvement of ergonomists in workplace adaptation meetings. Using a range of intervention factors compared to a single approach appears to provide some benefit in enabling productive employment for individuals experiencing persistent MSK pain. This finding aligns with a contemporary understanding of the aetiology of persistent MSK pain and the positive outcomes that can be achieved with multilevel interventions that are tailored to employees and their workplaces.

## **KEY LEARNINGS AND INSIGHTS**

In summary, key messages that emerge from this review are as follows:

- Many gaps exist in our understanding of key characteristics of workplace interventions that provide benefits to individuals with persistent pain to remain in productive employment.
- Interventions need to be considered carefully prior to implementation and measured to ascertain their effectiveness. However, it seems that intervening will provide some benefit but this will differ depending on the nature of the intervention and the level at which it is targeted.
- Individually focused interventions, such as vocational rehabilitation and education for individuals about available support may assist in reducing sick leave for individuals with persistent MSK pain.
- Interventions targeted at individual may assist with reducing job loss, and provide some benefit to productivity.
- Multilevel interventions may provide cost benefit for individuals with persistent MSK pain.
- Multilevel interventions may slightly decrease sick leave and pain.
- More good quality studies are needed that examine the effectiveness of workplace interventions that aim to enable productive employment for individuals who experience persistent MSK pain.

Putting this review into the context of the broader literature, some future considerations for Arthritis and Osteoporosis Victoria and other organisations include the following.

- **Improved engagement with employers to assist them in understanding the benefits of providing workplace accommodations for people with persistent pain.**
- **Development of educational materials for employers to assist them with managing employees with non work-related conditions. Education could include resources about where to access further assistance and links to available government assistance schemes.**
- **Provision of education for individuals with persistent pain conditions about services/resources available to assist with maintaining productive employment.**
- **Development of case studies where workplace accommodations have been undertaken. Case studies might include cost benefit analyses, to provide useful insights to employers who are seeking guidance on how to assist employees to maintain productive employment.**

## SUMMING IT UP

The academic literature is an important starting-point for the development of evidence-informed workplace programs and effective strategies to assist those with persistent pain to remain productively employed. This review examined workplace interventions aimed at assisting those with persistent pain to remain productively employed. Using a framework to analyse interventions targeted at different levels – individual or multilevel – has not been undertaken before in the context of keeping individuals with persistent MSK pain at work. The benefits of choosing a framework such as the one used in this study, enabled the development of a clear understanding of the impact of different interventions, taking into account a range of factors and how they may interact.

Overall, a limited number of studies were identified for this review of workplace interventions. Workplace interventions are complex, challenging to implement and difficult to accurately measure (Cox et al., 2007). As a result, workplace interventions targeting challenging areas, such as the one explored in this review, are few in number and, when assessed using rigorous criteria such as those applied here, can appear to have limited benefit. We would suggest that the results reported here need to be interpreted whilst taking into account these challenges.

A range of interventions targeted at an individual or multilevel were assessed in the various studies included in the review. Outcome measures assessed in the review were: sick leave, productivity, pain, cost benefit and job loss. In general, the low quality of the evidence reduces the certainty about the effects of an intervention on a particular outcome. This means that making definitive recommendations is difficult.

The heterogeneity of the different interventions further reduces the overall quality of the evidence base because statistical pooling of results is not possible. Some impacts were stronger than others and better supported by evidence.

Individual-focused interventions are likely to result in reduced job loss when compared to other interventions. In addition, some evidence was identified for multilevel interventions to reduce sick leave and provide a positive cost benefit. Development of interventions that are multilevel and include liaison with the workplace on adjustments, and ensuring the worker has functional capacity for the role (good person–environment fit) is likely to be cost effective.

Strengths of this review include a systematic search of the literature from January 2000 to March 2014. A rigorous approach was applied to examine study design, biases, outcome measures, methods of analysis and reporting. However, there are limitations with this approach. Firstly, RCTs, cohort studies and studies with pre and post measures were included, and we were limited to studies which were published in English. As a result, studies with alternative designs or in other languages may have been excluded. Only published peer-reviewed studies were included in this review. Grey literature was examined but not included in the review process as it did not meet the specified criteria. Future reviews may consider inclusion of this literature.

Publication bias is a risk and can occur as editors often publish studies with positive results. To assess the risk of publication bias, all studies were compared for each outcome to ascertain the direction of results (see Table 7). Direction of results was mixed, many with no effect, suggesting a low risk of publication bias. Heterogeneity in the outcome measures was an issue and as such it was not possible to conduct a meta-analysis. Study quality and the range of interventions used in the studies were varied. An additional limitation is the different regulatory processes across the different countries of origin of studies included in the review. We specifically examined non-work related conditions; however, the social security systems of some countries do not distinguish between work-related and non work-related conditions; that is, all employees have access to similar systems of support regardless of whether their conditions are considered to be work- or non-work related (Lippel 2012). To minimise the impact of this, studies that included participants with work-related conditions and were from countries where compensation schemes distinguish between work-related and non-work related conditions, were excluded from the review.

The studies included in this review were focused on individuals with non-work related persistent pain conditions. A decision to focus on this group was made by the research team, as in Australia workers' compensation schemes provide support only for those with work-related conditions. Those with non-work related conditions are not specifically covered in workers' compensation schemes but may have access to other schemes depending on their particular condition. An important point to note is that in countries where systems do not distinguish between work- and non-work related conditions, all workers have access to the same workplace accommodations or interventions. That is, the employees in the studies included in the current review are likely to be covered by inclusive schemes regardless of their condition, whether it is work- or non-work related. This was due to the predominance of studies from Scandinavian and European countries that have inclusive compensation/rehabilitation schemes.

This review provides a comprehensive overview of the evidence for the characteristics of interventions targeting employees with persistent MSK pain to support the maintenance of productive employment. Recommendations were developed as a result of this review. On the basis of this review, it seems that some support exists for individual level interventions to reduce job loss, and multilevel interventions to reduce sick leave and have a positive cost benefit.

## REFERENCES

- Arthritis & Osteoporosis Victoria. (2013). A problem worth solving. The rising cost of musculoskeletal conditions in Australia. Melbourne: Arthritis and Osteoporosis Australia with Deloitte Access Economics.
- Abasolo, L., Blanco, M., Bachiller, J., Candelas, G., Collado, P., Lajas, C., . . . Jover, J. A. (2005). A health system program to reduce work disability related to musculoskeletal disorders. *Annals of Internal Medicine*, 143(6), 404-414.
- Agaliotis, M., Fransen, M., Bridgett, L., Nairn, L., Votrubec, M., Jan, S., . . . Mackey, M. (2013). Risk factors associated with reduced work productivity among people with chronic knee pain. *Osteoarthritis & Cartilage*, 21(9), 1160-1169. doi: <http://dx.doi.org/10.1016/j.joca.2013.07.005>
- Allaire, S. H., Li, W., & LaValley, M. P. (2003). Reduction of job loss in persons with rheumatic diseases receiving vocational rehabilitation: A randomized controlled trial. *Arthritis & Rheumatism*, 48(11), 3212-3218. doi: 10.1002/art.11256
- Allaire, S. H., Niu, J., & LaValley, M. P. (2005). Employment and satisfaction outcomes from a job retention intervention delivered to persons with chronic diseases. *Rehabilitation Counseling Bulletin*, 48(2), 100-109. doi: <http://dx.doi.org/10.1177/00343552050480020401>
- Anema, J. R., Cuelenaere, B., van der Beek, A. J., Knol, D. L., de Vet, H. C., & van Mechelen, W. (2004). The effectiveness of ergonomic interventions on return-to-work after low back pain; a prospective two year cohort study in six countries on low back pain patients sicklisted for 3-4 months. *Occupational & Environmental Medicine*, 61(4), 289-294.
- Arnetz, B. B., Sjogren, B., Rydehn, B., & Meisel, R. (2003). Early workplace intervention for employees with musculoskeletal-related absenteeism: A prospective controlled intervention study. *Journal of Occupational & Environmental Medicine*, 45(5), 499-506.
- Atkins, D., Eccles, M., Flottorp, S., Guyatt, G. H., Henry, D., Hill, S., . . . Group, G. W. (2004). Systems for grading the quality of evidence and the strength of recommendations I: Critical appraisal of existing approaches The GRADE Working Group. *BMC Health Services Research*, 4(1), 38. doi: 10.1186/1472-6963-4-38
- Baker, N. A., Rubinstein, E. N., & Rogers, J. C. (2012). Problems and accommodation strategies reported by computer users with rheumatoid arthritis or fibromyalgia. *Journal of Occupational Rehabilitation*, 22(3), 353-362. doi: <http://dx.doi.org/10.1007/s10926-012-9353-5>
- Baldwin, D., Johnstone, B., Ge, B., Hewett, J., Smith, M., & Sharp, G. (2012). Randomized prospective study of a work place ergonomic intervention for individuals with rheumatoid arthritis and osteoarthritis. *Arthritis care & research*, 64(10), 1527-1535. doi: <http://dx.doi.org/10.1002/acr.21699>
- Bultmann, U., Sherson, D., Olsen, J., Hansen, C. L., Lund, T., & Kilsgaard, J. (2009). Coordinated and tailored work rehabilitation: A randomized controlled trial with economic evaluation undertaken with workers on sick leave due to musculoskeletal disorders. *Journal of Occupational Rehabilitation*, 19(1), 81-93. doi: <http://dx.doi.org/10.1007/s10926-009-9162-7>
- Busch, H., Bodin, L., Bergstrom, G., & Jensen, I. B. (2011). Patterns of sickness absence a decade after pain-related multidisciplinary rehabilitation. *Pain*, 152(8), 1727-1733. doi: <http://dx.doi.org/10.1016/j.pain.2011.02.004>
- Byrne, Z., & Hochwarter, W. A. (2006). I get by with a little help from my friends: The interaction of chronic pain and organizational support on performance. *Journal of Occupational Health Psychology*, 11(3), 215-227.



Cochrane-Bias-Methods-Group. (2014). Tools to assess the risk of bias in cohort studies. Retrieved from: <http://bmg.cochrane.org/sites/bmg.cochrane.org/files/uploads/Tool%20to%20Assess%20Risk%20of%20Bias%20in%20Cohort%20Studies.pdf>

Coole, C., Drummond, A., Watson, P. J., Worthington, E., & Hammond, A. (2013). Supporting workers with musculoskeletal conditions: A survey of United Kingdom occupational therapists' communications with clients and their employers. *British Journal of Occupational Therapy*, 76(11), 478-486. doi: 10.4276/030802213X13833255804513

Cox, T., Karanika, M., Griffiths, A., & Houdmont, J. (2007). Evaluating organizational-level work stress interventions: Beyond traditional methods. *Work & Stress*, 21(4), 348-362.

de Buck, P. D., le Cessie, S., van den Hout, W. B., Peeters, A. J., Runday, H. K., Westedt, M. L., . . . Vliet Vlieland, T. P. (2005). Randomized comparison of a multidisciplinary job-retention vocational rehabilitation program with usual outpatient care in patients with chronic arthritis at risk for job loss. *Arthritis & Rheumatism*, 53(5), 682-690.

de Vries, H. J., Brouwer, S., Groothoff, J. W., Geertzen, J. H., & Reneman, M. F. (2011). Staying at work with chronic nonspecific musculoskeletal pain: A qualitative study of workers' experiences. *BMC Musculoskeletal Disorders*, 12, 126. doi: <http://dx.doi.org/10.1186/1471-2474-12-126>

Durand, M., & Loisel, P. (2001). Therapeutic return to work: rehabilitation in the workplace. *Work*, 17(1), 57-63.

Eshoj, P., Tarp, U., & Nielsen, C. V. (2001). Effect of early vocational intervention in a rheumatological outpatient clinic--a randomized study. *International Journal of Rehabilitation Research*, 24(4), 291-297.

Fewtrell, M. S., Kennedy, K., Singhal, A., Martin, R. M., Ness, A., Hadders-Algra, M., . . . Lucas, A. (2008). How much loss to follow-up is acceptable in long-term randomised trials and prospective studies? *Archives of Disease in Childhood*, 93(6), 458-461. doi: 10.1136/adc.2007.127316

Fisker, A., Langberg, H., Petersen, T., & Mortensen, O. S. (2013). Early coordinated multidisciplinary intervention to prevent sickness absence and labour market exclusion in patients with low back pain: Study protocol of a randomized controlled trial. *BMC Musculoskeletal Disorders*, 14, 93. doi: <http://dx.doi.org/10.1186/1471-2474-14-93>

Fleten, N., & Johnsen, R. (2006). Reducing sick leave by minimal postal intervention: A randomised, controlled intervention study. *Occupational & Environmental Medicine*, 63(10), 676-682.

Frost, P., Haahr, J. P., & Andersen, J. H. (2007). Reduction of pain-related disability in working populations: A randomized intervention study of the effects of an educational booklet addressing psychosocial risk factors and screening workplaces for physical health hazards. *Spine*, 32(18), 1949-1954.

Gardner-Harbeck, J. L., & Fisher, T. (2011). Computer workstation analysis: A case study of an occupational therapy intervention. *Work: Journal of Prevention, Assessment & Rehabilitation*, 40(4), 369-374.

Gignac, M., & Cao, X. (2009). "Should I tell my employer and coworkers I have arthritis?" A longitudinal examination of self-disclosure in the work place. *Arthritis & Rheumatism*, 61(12), 1753-1761. doi: <http://dx.doi.org/10.1002/art.24889>

Gignac, M., Cao, X., Tang, K., & Beaton, D. E. (2011). Examination of arthritis-related work place activity limitations and intermittent disability over four-and-a-half years and its relationship to job modifications and outcomes. *Arthritis care & research*, 63(7), 953-962. doi: <http://dx.doi.org/10.1002/acr.20456>

- Gilworth, G., Haigh, R., Tennant, A., Chamberlain, M. A., & Harvey, A. R. (2001). Do rheumatologists recognize their patients' work-related problems? *Rheumatology*, 40(11), 1206-1210.
- Glenton, C., Santesso, N., Rosenbaum, S., Nilsen, E. S., Rader, T., Ciapponi, A., & Dilkes, H. (2010). Presenting the results of Cochrane Systematic Reviews to a consumer audience: a qualitative study. *Med Decis Making*, 30(5), 566-577. doi: 10.1177/0272989X10375853
- Grayson, D., Dale, A. M., Bohr, P., Wolf, L., & Evanoff, B. (2005). Ergonomic evaluation: Part of a treatment protocol for musculoskeletal injuries. *AAOHN Journal*, 53(10), 450-457; quiz 458-459.
- Guyatt, G., Oxman, A. D., Akl, E. A., Kunz, R., Vist, G., Brozek, J., . . . Schunemann, H. J. (2011). GRADE guidelines: 1. Introduction-GRADE evidence profiles and summary of findings tables. *Journal of Clinical Epidemiology*, 64(4), 383-394. doi: 10.1016/j.jclinepi.2010.04.026
- Guyatt, G., Oxman, A. D., Vist, G. E., Kunz, R., Falck-Ytter, Y., Alonso-Coello, P., . . . Group, G. W. (2008). GRADE: an emerging consensus on rating quality of evidence and strength of recommendations. *BMJ*, 336(7650), 924-926. doi: 10.1136/bmj.39489.470347.AD
- Higgins, J., & Green, S. (Eds.). (2011). *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]: The Cochrane Collaboration.*
- Jensen, L. D., Maribo, T., Schiottz-Christensen, B., Madsen, F. H., Gonge, B., Christensen, M., & Frost, P. (2012). Counselling low-back-pain patients in secondary healthcare: A randomised trial addressing experienced workplace barriers and physical activity. *Occupational & Environmental Medicine*, 69(1), 21-28. doi: 10.1136/oem.2010.064055
- Jousset, N., Fanello, S., Bontoux, L., Dubus, V., Billabert, C., Vielle, B., . . . Richard, I. (2004). Effects of functional restoration versus 3 hours per week physical therapy: A randomized controlled study. *Spine (Phila Pa 1976)*, 29(5), 487-493; discussion 494.
- Kaapa, E. H., Frantsi, K., Sarna, S., & Malmivaara, A. (2006). Multidisciplinary group rehabilitation versus individual physiotherapy for chronic nonspecific low back pain: A randomized trial. *Spine (Phila Pa 1976)*, 31(4), 371-376. doi: 10.1097/01.brs.0000200104.90759.8c
- Ketola, R., Toivonen, R., Hakkanen, M., Luukkonen, R., Takala, E. P., Viikari-Juntura, E., & Expert Group in, E. (2002). Effects of ergonomic intervention in work with video display units. *Scandinavian Journal of Work, Environment & Health*, 28(1), 18-24.
- Lacaille, D., White, M. A., Rogers, P. A., Backman, C. L., Gignac, M. A., & Esdaile, J. M. (2008). A proof-of-concept study of the "Employment and Arthritis: Making It Work" program. *Arthritis & Rheumatism*, 59(11), 1647-1655. doi: <http://dx.doi.org/10.1002/art.24197>
- Lambeek, L. C., Bosmans, J. E., Van Royen, B. J., Van Tulder, M. W., Van Mechelen, W., & Anema, J. R. (2010). Effect of integrated care for sick listed patients with chronic low back pain: Economic evaluation alongside a randomised controlled trial. *BMJ*, 341, c6414. doi: 10.1136/bmj.c6414
- Lambeek, L. C., van Mechelen, W., Knol, D. L., Loisel, P., & Anema, J. R. (2010). Randomised controlled trial of integrated care to reduce disability from chronic low back pain in working and private life. *BMJ*, 340, c1035. doi: 10.1136/bmj.c1035
- Landstad, B. J., Ekholm, J., Broman, L., & Schüldt, K. (2000). Working environmental conditions as experienced by women working despite pain: A prospective study with comparison groups of hospital cleaners and home help personnel receiving supportive measures at the workplace. *Work*, 15(3), 141-152.

Larsson, A., Karlqvist, L., & Gard, G. (2008). Effects of work ability and health promoting interventions for women with musculoskeletal symptoms: A 9-month prospective study. *BMC Musculoskeletal Disorders*, 9, 105. doi: <http://dx.doi.org/10.1186/1471-2474-9-105>

Macdonald, W. (2006). Workload, performance, health and wellbeing: A conceptual framework. . In W. Karwowski. (Ed.), *International Encyclopedia of Ergonomics and Human Factors* (pp. 2794 - 2799). London: Taylor and Francis.

Macedo, A. M., Oakley, S. P., Panayi, G. S., & Kirkham, B. W. (2009). Functional and work outcomes improve in patients with rheumatoid arthritis who receive targeted, comprehensive occupational therapy. *Arthritis & Rheumatism*, 61(11), 1522-1530. doi: <http://dx.doi.org/10.1002/art.24563>

Meyer, K., Fransen, J., Huwiler, H., Uebelhart, D., & Klipstein, A. (2005). Feasibility and results of a randomised pilot-study of a work rehabilitation programme. *Journal of Back & Musculoskeletal Rehabilitation*, 18(3-4), 67-78.

Nordmark, B., Blomqvist, P., Andersson, B., Hagerstrom, M., Nordh-Grate, K., Ronnqvist, R., . . . Klareskog, L. (2006). A two-year follow-up of work capacity in early rheumatoid arthritis: a study of multidisciplinary team care with emphasis on vocational support. *Scandinavian Journal of Rheumatology*, 35(1), 7-14.

Oakman, J., Briggs, A., Kinsman, N., Bywaters, L. (2015). Working with pain: what can workplaces do to support employees with persistent musculoskeletal pain to maintain productive employment? *Arthritis and Osteoporosis Victoria Website*.

Palmer, K., Harris, E. C., Linaker, C., Barker, M., Lawrence, W., Cooper, C., & Coggon, D. (2012). Effectiveness of community and workplace based interventions to manage musculoskeletal related sickness absence and job loss: a systematic review. *Rheumatology*, 51(2), 230-242. doi: <http://dx.doi.org/10.1093/rheumatology/ker086>

Roche-Leboucher, G., Petit-Lemanac'h, A., Bontoux, L., Dubus-Bausiere, V., Parot-Shinkel, E., Fanello, S., . . . Richard, I. (2011). Multidisciplinary intensive functional restoration versus outpatient active physiotherapy in chronic low back pain: A randomized controlled trial. *Spine*, 36(26), 2235-2242. doi: <http://dx.doi.org/10.1097/BRS.0b013e3182191e13>

Shiri, R., Martimo, K. P., Miranda, H., Ketola, R., Kaila-Kangas, L., Liira, H., . . . Viikari-Juntura, E. (2011). The effect of workplace intervention on pain and sickness absence caused by upper-extremity musculoskeletal disorders. *Scandinavian Journal of Work, Environment & Health*, 37(2), 120-128. doi: <http://dx.doi.org/10.5271/sjweh.3141>

Skouen, J. S., Grasdal, A. L., Haldorsen, E. M., & Ursin, H. (2002). Relative cost-effectiveness of extensive and light multidisciplinary treatment programs versus treatment as usual for patients with chronic low back pain on long-term sick leave: randomized controlled study. *Spine*, 27(9), 901-909; discussion 909-910.

Streibelt, M., & Bethge, M. (2014). Effects of intensified work-related multidisciplinary rehabilitation on occupational participation: A randomized-controlled trial in patients with chronic musculoskeletal disorders. *International Journal of Rehabilitation Research*, 37(1), 61-66. doi: <http://dx.doi.org/10.1097/MRR.0000000000000031>

Sundstrup, E., Jakobsen, M. D., Brandt, M., Jay, K., Persson, R., Aagaard, P., & Andersen, L. L. (2014). Workplace strength training prevents deterioration of work ability among workers with chronic pain and work disability: A randomized controlled trial. *Scandinavian Journal of Work, Environment & Health*, 40(3), 244-251. doi: [10.5271/sjweh.3419](http://dx.doi.org/10.5271/sjweh.3419)

van den Hout, W. B., de Buck, P. D., & Vliet Vlieland, T. P. (2007). Cost-utility analysis of a multidisciplinary job retention vocational rehabilitation program in patients with chronic arthritis at risk of job loss. *Arthritis & Rheumatism*, 57(5), 778-786. doi: 10.1002/art.22786

van Leeuwen, M. T., Blyth, F. M., March, L. M., Nicholas, M. K., & Cousins, M. J. (2006). Chronic pain and reduced work effectiveness: The hidden cost to Australian employers. *European Journal of Pain*, 10(2), 161-166. doi: <http://dx.doi.org/10.1016/j.ejpain.2005.02.007>

van Oostrom, S. H., Driessen, M. T., de Vet, H. C., Franche, R. L., Schonstein, E., Loisel, P., . . . Anema, J. R. (2009). Workplace interventions for preventing work disability. *Cochrane Database of Systematic Reviews*(2), CD006955. doi: <http://dx.doi.org/10.1002/14651858.CD006955.pub2>

Varekamp, I., Krol, B., & van Dijk, F. J. (2011). Empowering employees with chronic diseases: Process evaluation of an intervention aimed at job retention. *International Archives of Occupational & Environmental Health*, 84(1), 35-43. doi: 10.1007/s00420-010-0577-4

Viikari-Juntura, E., Kausto, J., Shiri, R., Kaila-Kangas, L., Takala, E. P., Karppinen, J., . . . Martimo, K. P. (2012). Return to work after early part-time sick leave due to musculoskeletal disorders: A randomized controlled trial. *Scandinavian Journal of Work, Environment & Health*, 38(2), 134-143. doi: <http://dx.doi.org/10.5271/sjweh.3258>

Wahlin, C., Ekberg, K., Persson, J., Bernfort, L., & Oberg, B. (2013). Evaluation of self-reported work ability and usefulness of interventions among sick-listed patients. *Journal of Occupational Rehabilitation*, 23(1), 32-43. doi: <http://dx.doi.org/10.1007/s10926-012-9376-y>

Weiler, S. W., Foeh, K. P., van Mark, A., Touissant, R., Sonntag, N., Gaessler, A., . . . Kessel, R. (2009). Outpatient rehabilitation of workers with musculoskeletal disorders using structured workplace description. *International Archives of Occupational & Environmental Health*, 82(4), 427-434. doi: <http://dx.doi.org/10.1007/s00420-008-0346-9>

## APPENDIX A: Search strategy

In Medline, CINAHL, PsycINFO and Embase, the following keyword searches were conducted with limitations to English language and post 2000.

KEYWORD SEARCHES in Title and Abstract				
arthrit* or 'chronic pain' or musculoskeletal* or 'persistent pain'  [NB 'muscle' conditions included under the exploded subject headings for 'musculoskeletal']	employ* or occupational or work* or job  [TI and AB only search used in CINAHL for this concept)	absenteeism or 'job satisfaction' or presenteeism or 'sick leave' OR (cope or copes or coping) adj3 pain OR Sick* adj3 absen* OR (employ* or job or staff or work*) adj3 (capacity or performance or productiv*)	accommodation* or intervention* or 'pilot project' or 'pilot study' or 'pilot test*' or program* or 'treatment outcome*' or trial*	Children Infant Paediatric Schoolchildren

## APPENDIX B: Excluded studies

Article	Reason for Exclusion
(Anema et al., 2004)	work-related condition
(Abasolo et al., 2005)	non-work intervention
(Agaliotis et al., 2013)	non-work intervention
(Baker, Rubinstein, & Rogers, 2012)	includes unemployed
(Bultmann et al., 2009)	persistent pain less than 3 months
(Busch, Bodin, Bergstrom, & Jensen, 2011)	includes unemployed
(Byrne & Hochwarter, 2006)	not intervention
(Coole, Drummond, Watson, Worthington, & Hammond, 2013)	persistent pain less than 3 months
(Durand & Loisel, 2001)	work-related condition
(Eshoj, Tarp, & Nielsen, 2001)	includes unemployed
(Fisker, Langberg, Petersen, & Mortensen, 2013)	proposal only, no data
(Frost, Haahr, & Andersen, 2007)	not persistent MSK pain
(Gardner-Harbeck & Fisher, 2011)	persistent pain less than 3 months
(Gilworth, Haigh, Tennant, Chamberlain, & Harvey, 2001)	work-related condition
(Grayson, Dale, Bohr, Wolf, & Evanoff, 2005)	work-related condition
(Jensen et al., 2012)	includes mental disorders
(Ketola et al., 2002)	persistent pain less than 3 months
(Lacaille et al., 2008)	not an intervention
(Landstad, Ekholm, Broman, & Schüldt, 2000)	not musculoskeletal pain
(Larsson, Karlqvist, & Gard, 2008)	persistent pain less than 3 months
(Nordmark et al., 2006)	includes unemployed
(Shiri et al., 2011)	persistent pain less than 3 months
(Skouen, Grasdal, Haldorsen, & Ursin, 2002)	persistent pain less than 3 months
(Streibelt & Bethge, 2014)	includes unemployed
(Varekamp, Krol, & van Dijk, 2011)	includes all chronic disease
(Viikari-Juntura et al., 2012)	persistent pain less than 3 months
(Wahlin, Ekberg, Persson, Bernfort, & Oberg, 2013)	persistent pain less than 3 months

## APPENDIX C: GRADE assessments

No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Other	Certainty (overall score)
<b>Outcome:</b> 'Individually focused interventions, compared to usual care, probably slightly decrease sick leave in employees with persistent MSK pain' <b>Sick leave</b>								
2	RCT	-1	-	-	-	-	-	Moderate
Risk of bias – compliance a problem with Van den Hout, drop-out rate high. Inconsistency – Van den Hout suggestive of same result for Fleten so if sufficient sample size, may find effect. Indirectness addressed with table of grouping studies by individual/multilevel etc. Imprecision no downgrade because Fleten has large sample size even though Van Den Hout is imprecise.								
<b>Outcome:</b> 'Individually focused interventions, compared to usual care, may make little or no difference in job loss for employees with persistent MSK pain' <b>Job loss</b>								
1	RCT	-1	N/A	-	-1	-	-	Low
Risk of bias downgrade because compliance is high-risk and being only one study the effect is potentially greater. Imprecision downgrade because only one study and small sample size less than 300.								
<b>Outcome:</b> 'Individually focused interventions, compared to usual care, may make little or no difference to cost benefit.' <b>Cost benefit</b>								
1	RCT	-1	N/A	-	-1	-	-	Low
Risk of bias as above. Imprecision downgraded because small sample size.								
<b>Outcome:</b> 'Individually focused interventions, compared to other interventions, probably will decrease job loss for employees with persistent MSK pain.' <b>Job loss*</b>								
1	RCT	-	N/A	-	-1	-	-	Moderate
Only one study so downgrade 1 due to sparse data – even though less than 300 participants, there are close to significant results so not downgrading by 2. * Although this study looked at temporary and permanent job loss, we included data only for permanent job loss so that there would be some consistency with outcomes in the other studies which looked at permanent job loss only.								
<b>Outcome:</b> 'Individually focused intervention, compared to other interventions, may slightly decrease sick leave taken by employees with persistent MSK pain.' <b>Sick leave</b>								
4	RCT	-1	-	-	-1	-	-	Low
Risk of bias downgrade because Roche-Leboucher (accounts for 1/3 participants of combined studies) has 3 x high-risk bias, including incomplete outcome data, and Kaapa high risk for co-intervention bias. Imprecision downgrade because of wide confidence intervals in Roche-Leboucher, and Kaapa.								
<b>Outcome:</b> 'Individually focused interventions, compared to other interventions, probably make little or no difference to pain levels in employees with persistent MSK pain.' <b>Pain</b>								
4	RCT	-1	-	-	-	-	-	Moderate
Risk of bias downgrade because Roche-Leboucher (accounts for 1/3 participants of combined studies) has 3 x high-risk bias, including incomplete outcome data, and Kaapa high risk for co-intervention bias. * Statement is expressed as 'minimal impact' rather than no effect because the direction of the results of the studies were tending towards an impact rather than no effect.								
<b>Outcome:</b> 'Individually focused interventions, compared to other interventions, probably slightly increase productivity of employees with persistent MSK pain.' <b>Productivity</b>								
3	RCT	-1	-	-	-	-	-	Moderate

No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Publication bias	Other	Certainty (overall score)
Risk of bias high for Kaapa co-interventions. * Statement is expressed as 'minimal impact' rather than no effect because the direction of the results of the studies were tending towards an impact rather than no effect.								
<b>Outcome:</b> 'Multilevel interventions, compared to usual care, may slightly decrease sick leave taken by employees with persistent MSK pain.' <b>Sick leave</b>								
5	-1	-1	-	-	-	-	-	Low
Design downgrade because 2 non-RCTs. Risk of bias downgrade because Gignac was assessed as having a high risk of bias.								
<b>Outcome:</b> 'It is not known whether multilevel focused interventions will affect productivity of employees with persistent MSK pain.' <b>Productivity</b>								
2	-1	-1	-1	-	-	-	-	Very low
Downgraded for inconsistency because studies had different findings.								
<b>Outcome:</b> 'Multilevel interventions, compared to usual care, may slightly decrease pain amongst employees with persistent MSK pain.' <b>Pain</b>								
3	-1	-1	-	-	-	-	-	Low
Downgraded for design because 2 RCTs and 1 non-RCT. Risk of bias because Gignac has high risk of bias assessment.								
<b>Outcome:</b> 'Multilevel interventions, compared to usual care, may increase cost benefit.' <b>Cost benefit</b>								
2	RCT	-	-	-	-1	-	-	Moderate
Downgraded for imprecision because wide confidence intervals.								





 **Arthritis**  
VICTORIA  
inc. OSTEOPOROSIS VICTORIA

ARTHRITIS AND OSTEOPOROSIS VICTORIA  
ABN: 26 811 336 442  
263-265 Kooyong Road, Elsternwick, Victoria, 3185  
P.O. Box 130, Caulfield South, Victoria, 3162  
Tel: 03 8531 8000  
Fax: 03 9530 0228  
Email: [afv@arthritisvic.org.au](mailto:afv@arthritisvic.org.au)  
[www.arthritisvic.org.au](http://www.arthritisvic.org.au)