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EVALUATING THE IMPACT OF BACK, NECK AND UPPER LIMB PAIN ON WORK PERFORMANCE AND ABSENCE: A SYSTEMATIC REVIEW

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Executive summary

Background

Ill-health is a major cost to the UK at approximately £13.4billion annually and a specific burden borne by employers in terms of sickness absence and reduced performance. Musculoskeletal conditions in the workplace principally back, neck and upper limb pain, make up approximately half the total reported ill-health, the resulting outcome is that employers lose approximately 9.5 million working days in staff absences per year (1). Although there have been a number of studies assessing the impact of musculoskeletal conditions on absence and performance there have been no comprehensive reviews assessing both the methodology of the studies or the quality of the reporting. In summary a systematic review is needed to assess all relevant publications in a comprehensive and systematic manner, ensuring that the results are reported within the context of the area as a whole, and not as isolated studies of varying value.

Aim

The purpose of this systematic review is to critically appraise and summarise the available evidence on the impact of back, neck and upper limb pain in adults, aged 18 years or over, on their performance or absence in the workplace. Within this broad remit we have developed a number of specific objectives.

Methods

Searching the literature

The main source of literature was a systematic bibliography of employee health and work performance developed in the previous phase of this project (research project BOHRF 227E05 carried out in 2006/2007). The bibliography contains over 1700 citations to publications covering a very broad range of health conditions and does not focus solely on musculoskeletal conditions. A search of the bibliography to identify those papers that related to back, neck and upper limb pain was undertaken. In addition to the search of the electronic bibliography searches of electronic databases were carried out. Furthermore, twenty-six organisations were contacted that we considered might have had relevant information for this review, either company reports or internal research reports.

Appraisal and quality assessment of the studies

All 1521 papers identified through the searches were assessed for their relevance to the review, a total of 156 papers met the inclusion criteria and were quality assessed using a standardised quality assessment tool. To enable the main results of the review to be easily interpreted the RCGPs three star system was used to indicate the strength of the evidence in the following way, * Limited or contradictory evidence; ** Moderate evidence; *** Strong evidence.

Results

Of the 154 papers included in the review the majority (n=113) reported on back pain. Most publications reported on work absence alone (n=139); only 41 papers focused on work performance and 27 reported on both absence and performance. The predominant type of study was a cohort (89 papers) followed by cross sectional studies and systematic reviews. The results of quality assessment showed that many studies had the following shortcomings; poor reporting of methods with data only partly presented or unclear reporting. A summary of the evidence regarding the impact of back, neck and upper limb pain on work absence and performance is presented as evidence statements below.

Back pain

- The incidence of sickness absence attributable to back pain in workforces is 2.3 – 5.6% per year (higher figure for shorter absence definition) **** Moderate evidence**
- Job type influences whether individuals with back pain take absence from work. ***Limited evidence**
- From studies in the workplace the majority of people with back pain don't take sick leave ***Limited evidence**
- Absence from work over the past 12-months as a result of back pain was reported by 11% to 26% of study participants ****Strong evidence**
- 2/3 – 4/5 of those who do go off sick will RTW in one month. This appears to be similar regardless of whether recruited from workplace or healthcare setting ***Moderate evidence**
- Modifiable predictors of shorter periods absence with at least moderate (**) evidence are
    - Earlier treatment
    - Less disability
    - Psychological factors – more so cognitive / illness perceptions than depression / anxiety (the latter possibly having a greater effect upon presenteeism than RTW).
    - job modification
    - perceived work stressors
- If compensation / insurance claims are made then the median time off is around one month (22-43 days) ***Moderate evidence**
- 10-20% will still be off at 3 months (higher figure for those identified by longer absence initially) ***Moderate evidence**
- Recurrence of sickness absence secondary to back pain within 3 years 15-35% (higher figure for shorter absence) ****Strong evidence**
- Up to one in five individuals with back pain report that pain has had an adverse effect on work performance, either through modified or reduced duties ****Strong evidence.**

Neck pain

- Neck pain and discomfort is common with a twelve-month period prevalence of between 5% and 20% ***Limited evidence**
- Across a range of settings about 1 in 20 people take sick leave for neck pain per year *****Strong evidence**
- Most sick leave attributed to neck pain lasts less than 7 days **Moderate evidence
- 20% of those taking sickness absence for neck pain will be off sick at 3 months ***Limited evidence**
- The presence of workers compensation and attribution has a strong effect upon sickness absence duration ***Limited evidence**
- There is **very** limited evidence for an adverse effect of neck pain upon work performance ***Limited evidence**

Upper limb pain

- Individuals with upper limb pain take very little sickness absence. ****Moderate evidence**
- The costs of sickness absence for upper limb pain are high. ***Limited evidence**
- Reports on the separate conditions are not common. ***Limited evidence**
- No indication of the impact of upper limb pain on performance. **–No scientific evidence**

Back pain with upper limb pain

- The mean number of workdays missed due to back pain with upper limb pain was moderate. *Limited evidence
- Return to work after an episode of back pain with upper limb pain was achieved by a small majority of individuals. *Limited evidence

Back pain with neck pain

- Sickness absence as a result of back pain with neck pain in the previous 12-months was common. *Limited evidence
- Functional limitation persists over time affecting work performance. *Limited evidence
- Functional impairment affects women to a greater degree than men. *Limited evidence

Neck pain with upper limb pain

- Sickness absence in the previous 12-months was reported by the minority of individuals suffering neck pain with upper limb pain. **Moderate evidence
- Activity limitation and productivity loss was frequent in individuals reporting neck pain with upper limb pain. **Moderate evidence

Back pain with neck pain and with upper limb pain

- Absence as a result of back pain with both neck and upper limb pain was longer-term. *Limited evidence
- High proportions of non-return to work were reported in individuals who had back pain with both neck and upper limb pain. *Limited evidence

Strengths and limitations of review

One of the main strengths of this review is the broad scope of literature that was included; the review includes evidence from different types of studies (cohort, reviews, cross-sectional studies), for different types of musculoskeletal problems, and focuses on both absence and performance. All publications were assessed for methodological quality using a standardised, recently developed tool, and a systematic approach was used to summarize the evidence. There are some limitations when conducting a review of this size. Data management and interpretation of results from a large number of studies that vary in terms of design, populations and measurements was difficult, and it was not possible to report results from individual studies in detail. Furthermore, there is the potential for publication bias in all systematic reviews, and the risk is likely to be higher in observational research.

Conclusions

In conclusion this review has highlighted the large impact of back, neck and upper limb pain, on absence and performance in the workplace. The length of absence varies considerably between settings and occupations, but in general the majority of workers return to work fairly soon; only a small proportion of individuals have long-term absence. This indicates that the large impact of musculoskeletal pain on absence and performance is mainly the result of the high prevalence of these conditions in the working population, and the large proportion of workers taking (some) time off work. It also confirms the suggestion that it may be more efficient to target a wider population of workers early with brief low cost interventions than to expend considerable time and resources on rehabilitating the smaller group of pain patients who have become incapacitated by chronic pain. The review shows that both absence and performance are influenced not just by the pain problem and its severity, but also by the culture and communication within the workplace.

The review has identified a number of issues that need to be considered by both employers and researchers. However the review also shows that measurement of absence and performance needs to be improved. There was also a clear lack of research on neck and upper limb pain both of which were demonstrated to have an adverse effect on work performance. The proportion of studies that recruited participants from the workplace was surprisingly low, given that this is where the

impact of these conditions is greatest there is a great need for good quality research on absence and performance that is carried out in the workplace.

The findings of this review can be considered in the context of governmental and occupational health recommendations. Firstly, the fit for work initiative advocates employers taking on some of the responsibility for managing health care making, very clearly, the business case for introducing wellness programmes. There are a range of occupational health guidelines available providing guidance and advice on the management of ill-health in the workplace, these guidelines are targeted not just at employers but also at employees and health professionals. Improving the uptake and adherence to these guidelines is paramount to improving occupational health.

1. BACKGROUND

1.1 Costs of ill-health to employers

Ill-health is a major cost to the U.K. at £13.4 billion annually (2) and a specific burden borne by employers in terms of sickness absence and reduced performance. Traditionally both injury prevention and work rehabilitation have been addressed primarily from an ergonomic or biomechanical perspective. However, it is known that psychosocial working conditions affect not only health outcomes but also levels of sickness absence (3;4).

1.1.1 Presenteeism and absenteeism

Health risk factors and disease not only affect absence but also adversely affect worker productivity (5) and it has been estimated that 3-11 hours of productivity per week per employee is lost to employers due to ill health. The Employer's Health Coalition (6) based on an analysis of seventeen diseases found that lost productivity due to presenteeism, defined as being at work in spite of illness, was on average 7.5 times greater than lost productivity due to absenteeism. Stewart *et al* (2003) (7) reporting the results of the American Productivity Audit of almost 29,000 US workers found that 38.3% of employees reported unproductive work time on at least one day in the previous 2 weeks due to ill-health. For some conditions, notably allergies, arthritis, heart disease, migraine, and neck/back/spine pain this lost productivity as a result of presenteeism was even greater (8). Collins *et al* (2005)(9) also found that allergies, arthritis conditions and back or neck disorders were the most common chronic conditions reported by employees. Furthermore Collins *et al* (2005)(9) found that absenteeism associated with chronic disease in the workplace ranged from 0.9 to 5.9 hours over four weeks with on the job impairment ranging from 17.8% to a 36.4% decrement in ability to function at work.

1.1.2 Musculoskeletal conditions and absenteeism

Musculoskeletal conditions in the workplace principally back, neck and upper limb pain, make up approximately half the total reported ill-health, the resulting outcome is that employers lose approximately 9.5 million working days in staff absences per year (1). In 2005/6 back pain accounted for 3.77 million days lost from the workplace averaging 15.7 days absence per episode. Neck and upper limb pain accounted for

almost as many days lost at 3654 thousand days, but the average number of days of work absence per case was greater than that for back pain at 17.2 days per case (1). The rate of days lost due to musculoskeletal disorders is 2400 per 100,000 ever employed compared to headache, for example, where the rate is just 75 per 100,000 ever employed (1). These figures demonstrate the considerable impact that musculoskeletal conditions have on employee health when compared to other health conditions that are perhaps seen as more "high profile".

1.2 Costs of back pain to employers

In a recent study by Ricci *et al* (10) the 2-week period prevalence of back pain defined as pain everyday in the past 2-weeks was 15%; 42% of these individuals experienced pain exacerbations over this 2-week period. Workers with exacerbations were significantly more likely than those without to report back pain related lost productive time (22% vs. 13%). Back pain associated lost productive time in workers aged 40 to 65 years costs US employers an estimated $7.4 billion/year, those with back pain exacerbations account for 72% of this cost (10). Average annual productivity losses per worker due to chronic back pain have been calculated at $1,230 per male worker and $773 per female worker in 1996. These figures translate into aggregate annual productivity losses from chronic back pain of approximately $28 billion in the United States (11). The picture in the U.K. workforce is similar with an estimated cost of £9,090 million in lost productivity due to absence and presenteeism as a result of back pain (12).

1.3 Costs of neck and upper limb pain to employers

Neck and upper limb pain are also very common conditions in the workplace with a reported 12-month prevalence of 56%(13). Furthermore of those with neck and upper limb symptoms 62% have recurrent *pain* at 6 months with approximately 30% of employees reporting recurrent *sick leave* (13). With a similar prevalence to back pain the costs associated with lost productivity and absence from neck and upper limb pain are likely to be close to those reported in the back pain literature.

Neck pain has a point prevalence of 10% to 15% in the general population; the prevalence of shoulder pain varies from 20% to 48%, whilst arm/wrist/hand conditions have reported prevalence's of up to 41% (14). Palmer (15) reviewed the clinical literature around pain in the forearm, wrist and hand, and noted that although prevalence rates vary dependent upon case definition and age, estimates range from 5% to 26%. Macfarlane *et al* (16) found the one-month period prevalence of forearm pain to be 10% in adults of working age. These upper extremity disorders, which encompass a wide range of specific conditions (such as Carpel Tunnel Syndrome), are a major cause of sickness absence and disability for employees (17). Forearm pain is one of the most commonly reported upper limb disorders in the workplace (18) and there have been many "epidemics" of such conditions documented in the literature (19). Upper limb pain is associated with significant morbidity and can have a large impact on work incapacity (17).

1.4 Musculoskeletal pain in the workplace

Although there are a number of studies assessing the costs to employers of these musculoskeletal conditions, the widely varying prevalence's, definitions and samples make interpretation difficult for employers and organisations. In particular there have been no comprehensive reviews assessing both the methodology of the studies or the quality of the reporting. It is important to assess all the research in a comprehensive and systematic manner, to ensure that the results are reported within the context of the area as a whole, and not as isolated studies of varying value.

In summary it is appropriate to suggest a primary focus on musculoskeletal disorders, looking in detail at back pain, neck pain and upper limb pain, as these are the conditions that have the biggest impact on performance and absence in the workplace. By focussing on these musculoskeletal conditions this review will serve to provide the largest gains to employers in employee wellbeing and return on investment, by informing the design, development and evaluation of focussed interventions to improve poor health.

2. PURPOSE

The purpose of this systematic review is to critically appraise and summarise the available evidence on the impact of back, neck or upper limb pain in adults, aged 18 years or over, on their performance or absence in the workplace. Within this broad remit we have developed a number of specific objectives to ensure that questions relevant to U.K. organisations are addressed.

2.1 Specific objectives

1) Identify the available evidence evaluating the effect of back, neck or upper limb pain on performance or absence at work.

2) Critically appraise and assess the methodological quality of the included studies.

3) Summarise the evidence on the overall impact of back, neck and upper limb pain on work performance and absence.

4) Assess the separate impacts of back, neck and upper limb pain on work performance and absence.

5) Describe the range of outcome measures, used to assess work performance for people with these conditions.

6) Evaluate the measures found in terms of their reliability and validity.

7) Assess the objectivity of the work performance measures identified within the review.

8) To develop evidence based recommendations for employers to assess the impact of back, neck and upper limb pain on work absence and performance

3. STUDY DESIGN AND METHODOLOGY

3.1 Inclusion Criteria

3.1.1 Types of studies

The aim of this study was to systematically review and appraise the currently available evidence relevant to our research questions. Different research questions require different types of studies to provide meaningful answers. Cohort studies, or prognostic studies, are specifically designed to observe the impact that a risk factor or prognostic factor has on a specific outcome, in this instance the impact back, neck and upper limb pain have on absence and performance, whilst taking into account the temporal relation between the factor and the outcome. They assess the impact of possible "confounders" or other factors, which may have influenced the results. Therefore, to address the main issue of the impact of back, neck and upper limb pain on work performance, we summarised the best evidence, or 'gold standard' from cohort studies, or systematic reviews of cohort studies where these exist already. For areas of the review where this evidence was not available we assessed the next best available research for prognosis questions according to the levels of evidence adapted from the Oxford Centre for Evidence Based Medicine (Table 1).

3.1.2 Types of employees included in the studies

The population of interest for this review was adults in paid employment with non-specific or mechanical back, neck or upper limb pain (including shoulder, elbow, forearm, wrist and hand pain). Our primary interest was on performance or absence in the workplace, and therefore this review did not include studies conducted solely in health care settings, such as GP surgeries or outpatient clinics, unless the focus of the study was specifically on work outcomes, or the study participants had been recruited from a specific workplace and the impact on that workplace was considered.

Table 1: Quality assessment of prognosis studies

Level	Type of study*
1a	Systematic review of homogeneous inception cohort studies
1b	Individual inception cohort study with >=80% follow-up
1c	Case-series where there is overwhelming evidence of an association
2a	Systematic review (homogeneity) of either retrospective cohort studies or untreated control groups in RCTs
2b	Retrospective cohort studies or follow up of untreated control groups in an RCT
2c	"Outcomes" Research
3a	~ (No criteria reported for Prognosis questions)
3b	~ (No criteria reported for Prognosis questions)
4	Case-series or poor quality prognostic cohort studies
5	Expert opinion without explicit critical appraisal, or based on physiology, bench research or "first principles"

*Adapted from CEBM website - http://www.cebm.net/index.aspx?o=1025

3.1.3 Types of outcome measures

i) Work Performance: These ranged from task-specific objective measures of productivity (for example number of phone calls answered in a call centre) to more subjective measures based on employee self-assessment (e.g. work cut-back days). All the measures used were described in as much detail as the original studies allowed. Papers on the reliability and validity of the included measures also were sought and reviewed.

ii) Work absence: This is often used as a proxy for work performance. We included both objectively assessed and self-reported measures of work absence in this review.

iii) Cost of illness: Where included studies evaluated cost measures these were summarised and included in the results sections of this review.

3.2 Identification of studies

The main source of literature was a systematic bibliography of employee health and work performance developed in the previous phase of this project (research project BOHRF 227E05 carried out during 2006/2007). The aims of this bibliography were to carry out a systematic search of published and unpublished health care and occupational health literature in order to develop a balanced, comprehensive bibliography on employee health and occupational performance. The review covered a very broad range of health conditions and did not focus solely on musculoskeletal conditions, the full list of search terms used to conduct this review can be seen in Appendix 1. All 1763 papers in the bibliography were assigned key words relating to their topic to ensure that they could easily be searched. The key words were then used to search the bibliography to identify those papers that related to back, neck and upper limb pain; Table 2 reports key words that were included.

Table 2: Key words used to search the systematic bibliography of the relationship between employee health and occupational performance

Back pain keywords	Neck pain key words	Upper limb pain key words	General musculoskeletal key words	Absence and performance key words
Back pain Back disorders	Neck	Upper extremity Hand pain Wrist pain Shoulder	Musculoskeletal disorders Musculoskeletal injuries	Work absence Work performance

Searches of electronic databases (Medline, EMBASE, CINAHL, AMED, PsycInfo, DHData, King's Fund Database and Web of Science databases) were then carried out using an adapted version of the search strategy designed for the bibliography, these searches focussed on back, neck and upper limb pain and absence and performance, the full search strategy is reported in Appendix 2. The electronic database searches were updated at the end of the review process (May 2009) to enable us to include the most recently published literature. In addition to searching the bibliography and

electronic databases we also contacted twenty-six organisations that we considered may have had relevant information for this review, either company reports or internal research reports.

The findings of these searches and the numbers of identified papers are reported fully in section 4.

3.3 Appraisal of the identified studies

Two reviewers independently assessed the titles and abstracts of potentially relevant papers identified from the search strategy against the inclusion criteria. All remaining papers were obtained and reviewed in full before a final decision was made on inclusion or exclusion in the review. Each included study was quality assessed and the data extracted by two reviewers. A third reviewer was consulted to resolve any disagreements.

3.4 Quality assessment & data extraction

A quality assessment checklist was used to judge whether a study was of high or low methodological quality and to highlight any serious flaws. We did not exclude any study that was of poor quality, but in that event, we have drawn attention to the methodological issues and offered our analysis of how this may have affected the overall level of evidence. In assessing the quality of studies we have used the framework suggested by Hayden *et al* (2006)(20)(Figure 1). Although this framework does not provide a "score" by which to judge studies, by identifying potential factors which may have led to bias it allows the overall quality of the research to be comprehensively evaluated. Studies are classified as being at high risk of bias when the majority of domains are presented as a "no" i.e. the methodological quality of that domain was poor. Where studies are classified at moderate risk of bias the majority of domains are presented as "unclear" or "partly" i.e. the reporting of the methodological quality does not provide sufficient detail or clarity to fully assess the risk introducing bias into the study. Lastly, where studies are classified as being at low risk of bias the majority of domains are presented as "yes" i.e. the reporting of the methodological quality is sufficient to exclude the possibility of bias in the study.

Figure 1: Quality assessment framework domains (Hayden *et al* 2006):

1. Study participation
2. Study attrition
3. Prognostic factor measurement (for this review this will be a measure of the severity of the back, neck or upper limb condition for example pain and/or disability)
4. Outcome measurement (work performance and absence)
5. Confounding measurement and account (including age, gender, psychosocial factors)
6. Statistical analysis

To ensure that the data was systematically collated electronic forms were developed in Microsoft Access to record the quality assessment under the headings in Figure 1. The full quality assessment of each study may be seen in Appendix 5. In addition to the quality assessment data the Access records included specific details about each study included in the review; workplace, employees, methods of the study and outcomes (absence or performance results), these details are also reported in Appendix 5.

A narrative summary of the main results of the included studies is presented in sections 6, 7, 8 and 9. These results sections consider back, neck and upper limb conditions separately, if possible, or combinations of conditions that appear together in the research, in relation to work absence and work performance. Evidence summaries are presented for each section, which take account of the quality of each paper using the QUIPS quality assessment (20).

3.5 Statistical Analysis

Due to differences in study participants, workplace settings and measured outcomes quantitative pooling of the results was not possible in this review.

3.6 Strength of evidence

3.5.1 Cohort studies

The strength of evidence for the findings of this review have been classified using the RCGP's three-star system, as used in the occupational health guidelines for low back pain by Waddell and Burton (21)

*** Strong evidence – provided by generally consistent findings in multiple, high quality scientific studies.
** Moderate evidence - provided by generally consistent findings in fewer, smaller or lower quality scientific studies.
* Limited or contradictory evidence - provided by one scientific study or inconsistent findings in multiple scientific studies.
- No scientific evidence – based on clinical studies, theoretical considerations and/or clinical consensus

3.7 Reporting

The final report of the systematic review follows the guidelines recommended by Stroup *et al* (22) which recommend structured reporting of the background, search strategy, methods and discussion. These guidelines are based on the statement for improving the quality of reports of meta-analyses of randomised controlled trials (the QUOROM statement) (23).

4. RESULTS – IDENTIFICATION OF PAPERS

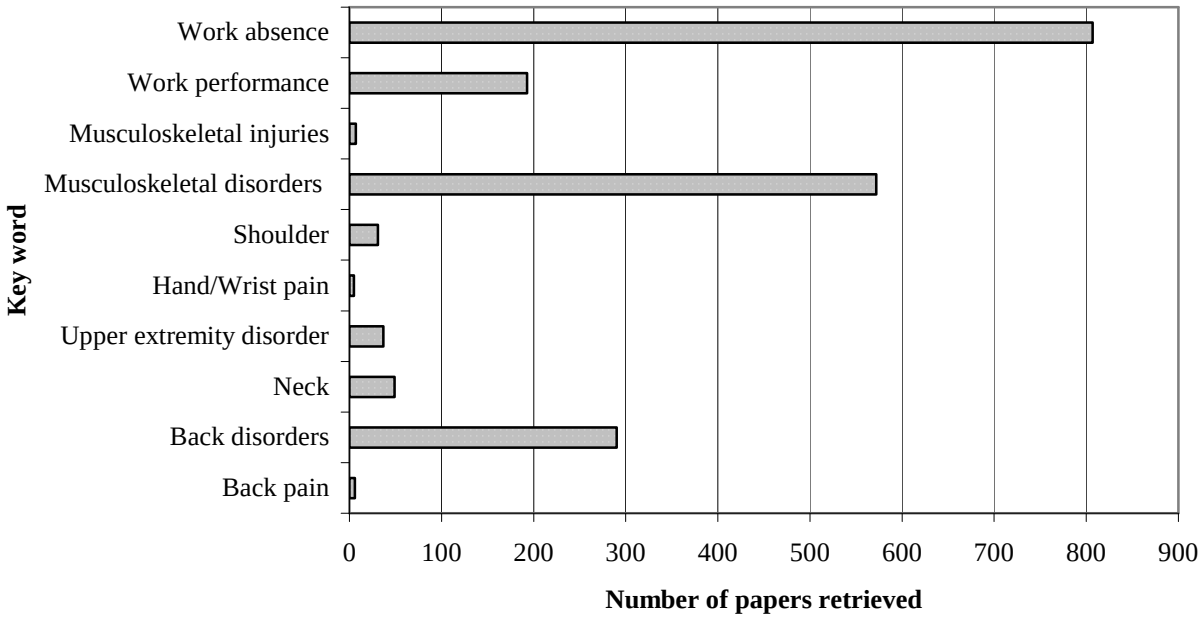
4.1 Identifying studies for the systematic review

4.1.1 Identification of papers from the systematic bibliography

The majority of papers identified from the systematic bibliography covered the broad range of musculoskeletal disorders: the most common single specific condition being back disorders. This finding is to be expected as back pain is recognised as the most costly musculoskeletal condition for employers, and therefore there is a predominance of research in this area (95% of papers). There were fewer papers assessing neck pain and upper limb pain. However in combination these papers account for a useful proportion of all the papers identified (5%). Papers on upper limb pain provide information on shoulder, hand and wrist pain as well as general upper extremity disorders. The number of papers identified from the bibliography that related to work absence was almost four times as many as those related to work performance (807 versus 193). It is likely that the difference in the number of papers relating to absence compared to performance is due to the ease of measuring work absence, as it is a definable/quantifiable event, and it is only in recent years that reduced performance has been recognised as costly to employers and as an important outcome measure in occupational research (Figure 2).

Combining the key words to search the bibliography (Table 2) generated a total of 1173 unique papers (from the 1763 abstracts stored in the bibliography). Two reviewers independently assessed the titles of these papers and at this stage 435 titles were excluded, as they did not match the inclusion criteria. Two reviewers then looked through the abstracts of the remaining 738 titles that related to back, neck and upper limb pain. Where agreement could not be reached a third reviewer was brought in to arbitrate.

Figure 2: Relevant keywords allocated to records in the systematic bibliography of the impact of health on work performance



4.1.2 Updated search strategy

The search strategies from the first phase of the project on the bibliographic databases (Medline, EMBASE, CINAHL, AMED, PsycInfo, DHData, King's Fund Database and Web of Science databases) were re-run from the last date that each search was conducted to 9th or 10th July 2008. To reflect the more focussed nature of the current review only the terms relating to back, neck and upper limb pain were included in the search strategies and linked with the terms for occupational health and work performance or absence. The full search strategy for Medline is given in Appendix 2. The systematic searches were then run again in May 2009 to ensure that recent publications were also included in the systematic review. Figure 3 demonstrates the flow of papers through the study, from the original systematic bibliography through to the current review of back, neck and upper limb pain.

Over a thousand additional references (1074) were found and downloaded from the bibliographic databases for this review since the last searches were conducted in April 2007. These were imported into Reference Manager bibliographic software and duplicates removed. After checking these results against those originally downloaded for the Phase 1 bibliography, 601 references remained (Table 3). The large number of

references remaining represents the importance of the topic in research terms and also the sensitivity of the search strategy employed.

Figure 3: Flow chart of papers identified for inclusion in the systematic review

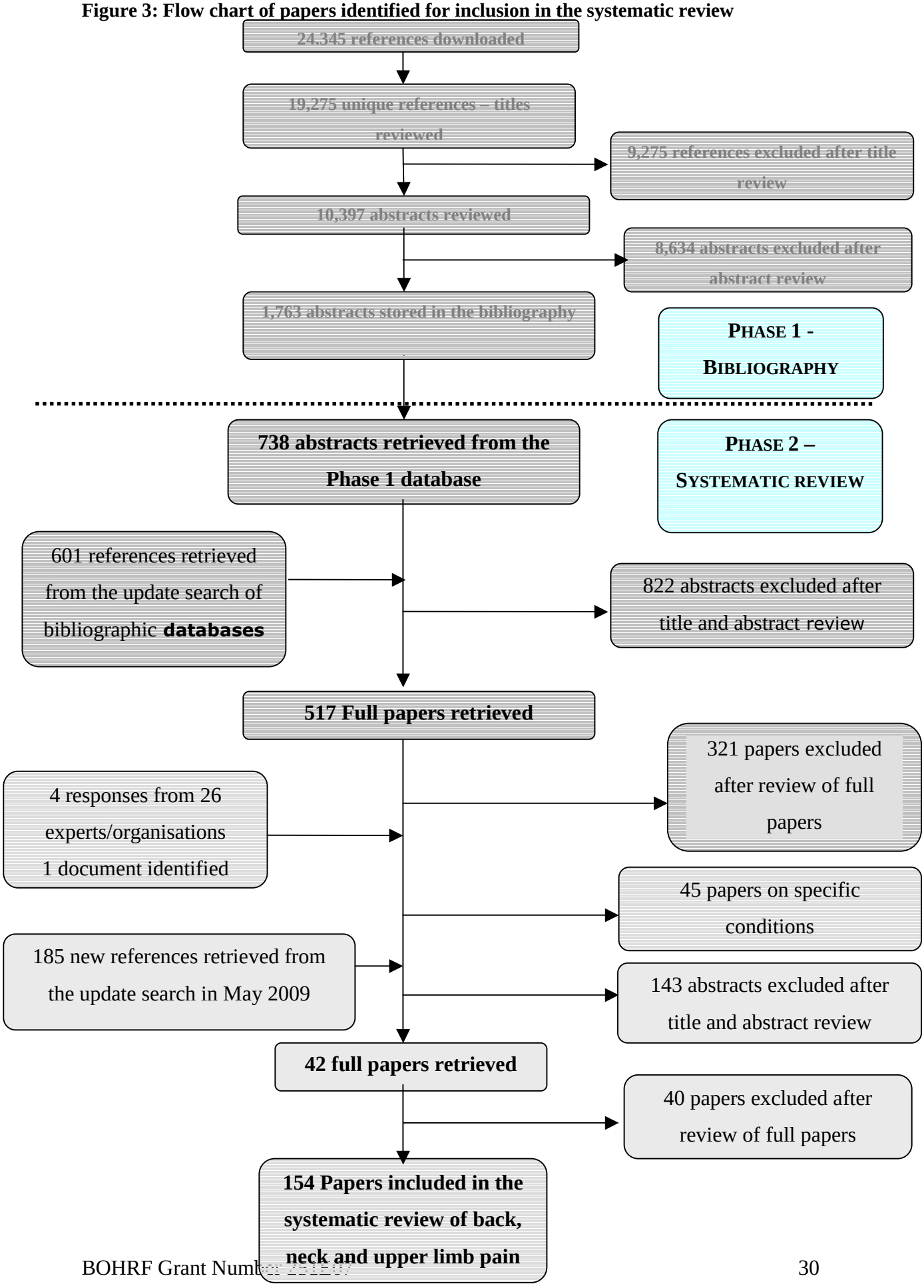


Table 3: The results of the systematic searches for each bibliographic database

Database	Number of records downloaded	Number of new references
Medline	211	199
Embase	54	53
CINAHL	140	94
AMED	55	47
PsycInfo	128	49
DHData	3	2
King's Fund	0	0
BNI	3	3
Web of Science	480	331
Total number of references	1074	601*

* This is the total number of unique references after duplicates from more than one database have been removed

4.1.3 Overall results of search strategy

In total, there were 1339 references identified from the updated search and the Phase 1 bibliography. The titles and abstracts of these references were sifted to eliminate any that were not of the specified population or that were definitely not assessing the impact of back, neck or upper limb pain on work performance or work absence. A total of 517 references remained, which were obtained as full papers from local libraries or through inter-library loan. Following updating of the searches 185 additional papers were retrieved and reviewed leading to the inclusion of a further 2 papers in the review.

4.2 Contacting organisations

It was expected that some literature might not be in the public domain and therefore not identified by searching electronic databases. In order to generate further articles and documents that may not be included in the electronic databases experts in the fields of health and work, both in research and business, were identified and contacted to elicit unpublished and/or unlisted reports. In order to identify this "grey literature"

a number of experts and individual organisations were contacted to request information related to the study (Appendix 3). In total 26 organisations were contacted to request information, these organisations were selected as they are all large UK employers. Responses were received from four of the organisations, one provided reports but these did not meet eligibility criteria, and another organisation stated that they were in the process of conducting research that was not available at the time, with the other two reporting that they had no relevant information. All organisations were re-contacted in May 2009 and one report was identified which could be included in the review.

5. RESULTS – REVIEW OF IDENTIFIED PAPERS

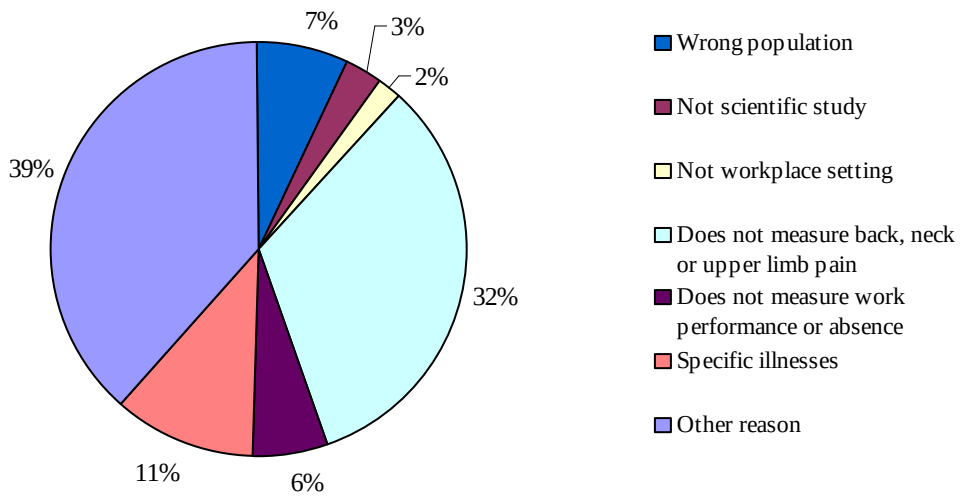
Of the 559 papers initially identified for review (original and updated searches), a total of 531 papers could be reviewed and assessed for possible inclusion, two people reviewed all papers. Of the remaining 28 papers not reviewed, 4 were titles only and could not be tracked, and 24 were foreign language papers. Following review of the 531 retrieved papers 154 were retained for inclusion in the critical appraisal stage, see Figure 3.

5.1 Reasons for exclusions

Figure 4 presents the reasons for exclusion at the initial review stage. The majority of the excluded papers did not report data specifically on back, neck or upper limb pain a total of 132 papers (37%), and a further 24 papers (6%) did not report any absence or work performance data.

There were 44 (12%) papers that reported specific illnesses such as rheumatoid arthritis and fibromyalgia. These have been excluded from this review, as they do not specifically relate to back, neck or upper limb pain. It may be possible to carry out more focused systematic reviews on these in the future. Of the studies that were excluded for other reasons a total of 32 were intervention studies and therefore did not fit the remit of this review.

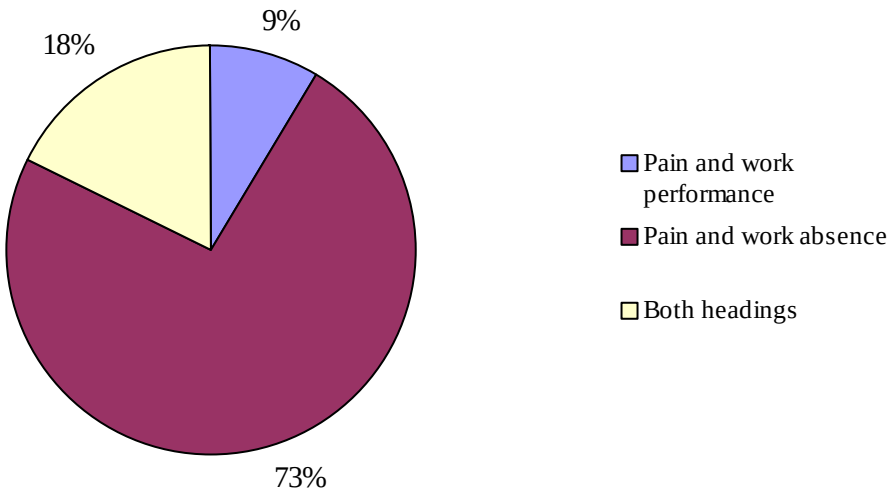
Figure 4: Reasons for exclusion from the systematic review



5.2 Number of papers reporting absence and performance data

Of the 155 included papers the majority 113 (73%) reported on absence, with a small proportion reporting data work performance 13 papers (9%) (Figure 5). There were also 27 papers (18%) that reported both work performance and work absence.

Figure 5: Number of papers reporting absence and/or work performance

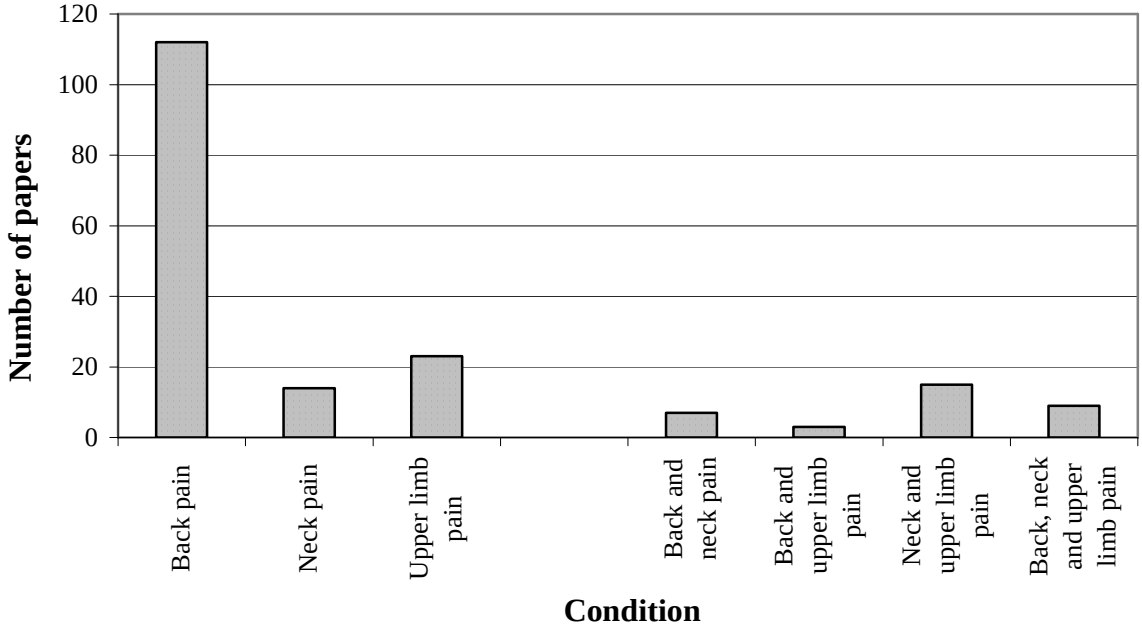


5.3 Number of papers reporting back, neck or upper limb pain

The majority of papers report data on back pain (*n*=113); substantially fewer papers reported neck and upper limb pain data. A total of 34 papers reported on more than one condition, neck pain with upper limb pain, and back pain with neck pain combined were the most common (

Figure 6). This is not unexpected as these conditions often co-occur in individuals with musculoskeletal pain.

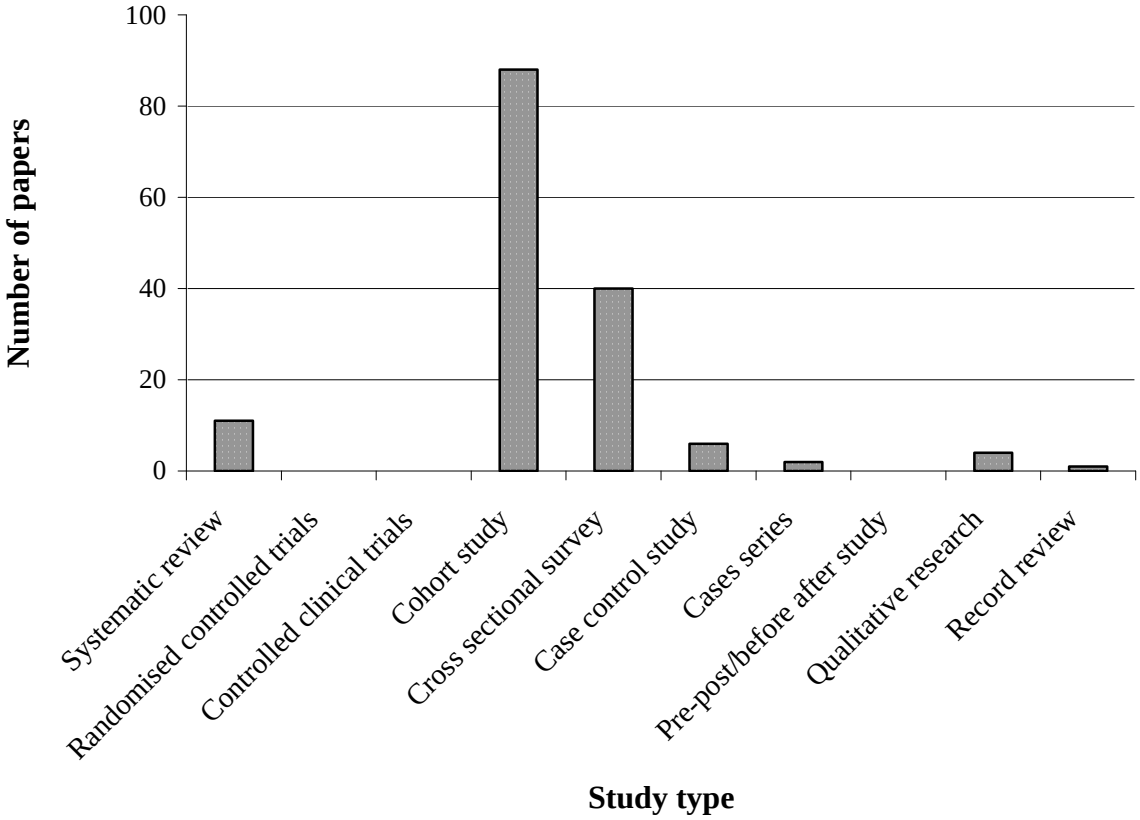
Figure 6: Number of papers reporting by condition



5.4 Number of papers reporting by study type

Although the range of studies is broad, cohort studies made up the majority of study types with 89 papers in total. 40 papers reported cross sectional studies; there were no relevant randomised controlled trials, 6 case control studies, 11 systematic reviews and 4 qualitative studies (Figure 7).

Figure 7: Number of papers reported by study type



5.5 Performance measures

Of the 153 papers identified for inclusion in the review a total of 41 (27%) reported some measure of performance in the work place. Twenty-one of the 41 papers used validated scales to measure performance; the Work Productivity Activity Impairment questionnaire (24), the Work Limitations Questionnaire (25), the Work Ability Index (26) the Quality and Quantity scale (27) and the modified Nordic Questionnaire (28). The most frequently used scale was the Work Limitations Questionnaire. The other twenty papers used various non-standardised methods to assess work performance, including questions about reduction of activities or hours in the work place to functional capacity evaluations to assess ability to carry out specific tasks. Further examination of these performance measures was carried out in relation to specific musculoskeletal conditions.

5.6 Absence measures

Of the 153 papers included in the review 139 (91%) reported some measure of absence. The measures were very varied with the majority of papers asking single questions of participants, usually were you absent over the previous 2-weeks/1-month/6-months/1-year. However, a proportion did use validated measures, these were generally included in questionnaires designed to assess pain and disability as a result of musculoskeletal conditions. The most frequent measure of absence reported as part of a validated questionnaire was derived from the Nordic Musculoskeletal Questionnaire. Absence data identified from databases provided the most diverse absence measures including length of absence or disability, return to work status, number of compensation days, recurrence of sickness absence, and in one study GP certified sickness certificates, in addition to self-reported absence. The Nordic Musculoskeletal Questionnaire was most frequently used in cohort studies conducted in the workplace, furthermore workplace studies were able to report the amount of "paid lost time from work" which may be used to calculated the costs to employers,

6. RESULTS – THE IMPACT OF BACK PAIN ON WORK ABSENCE AND PERFORMANCE

6.1 Results and measures of absence

The results for back pain and absence will be reported in the following order; systematic reviews, cohort studies which will be divided into those recruiting from databases, those conducted in a health care setting and those conducted in the workplace, followed by cohorts that analysed population survey data. Cross sectional studies are reported next, followed by case control studies and finally those employing a qualitative approach.

6.1.1 Systematic reviews

Out of the 103 papers that reported on back pain and work absence, eight were systematic reviews, Table 4 reports the quality appraisal of these papers. Table 5 reports the findings of these systematic reviews. One review investigated the costs of back pain (29). One systematic review by Pengel *et al* (2003) (30) pooled data from 15 studies and estimated that 82% of people with back pain who are initially off sick will return to work within one month (30). This ranged from 68% and 86% in the studies included in the review. There were six systematic reviews that looked into prognostic factors for the course of back pain and work disability (31-36). Four reviews found older age to be a predictor of not returning to work or being on sick leave. Crook *et al* (2002)(31) reported from their review of 19 papers that functional disability and gender were strong predictors for whether the individual with back pain was not working and the duration of work absence. Factors speeding up return to work included job modification being available, referral to specialist occupational injury clinics and faster treatment. Iles *et al* (2008)(35) reported that recovery expectation was a strong predictor of work absence and that depression, stress and job satisfaction did not predict work absence. Both these reviews stated that the evidence for workers' compensation influencing work status was conflicting and conclusions could not be made. However, Steenstra *et al* (2005)(33)reported that receiving higher compensation was a predictor of longer sick leave. These authors also concluded that being involved in heavy work, higher disability levels, female gender, more social dysfunction and isolation were predictors of longer work absence. Truchon *et al*

(2000)(34) looked into studies that reported on biopsychosocial determinants of work disability related to low back pain. History of low back pain, having negative beliefs about ability to work, and dissatisfaction with work all appeared to be indicators for work disability. Kuijer *et al* (2006)(36) conducted a systematic review to investigate predictors of sickness absence and found that being involved with less varied work, having less skill discretion, and previous sick leave were all associated with more sick leave days in the future. Participants in the included studies with expectations for their own recovery had less sick leave.

Table 4: Quality appraisal of systematic reviews reporting back pain and absence or performance

Study	Described characteristics of included studies	Prognostic factors clearly described for included studies	Outcomes clearly described for included studies	Confounders clearly described for included study	Analysis and Results	Overall Risk of Bias
Crook *et al* (2002)(31)	Partly	Unclear	Unclear	Unclear	Yes	**Moderate**
Dagenais *et al* (2008) (29)	Partly	Partly	Yes	Partly	No	**Moderate**
Iles *et al* (2008)(35)	Yes	Unclear	Unclear	Unclear	Yes	**Moderate**
Kuijer *et al* (2006) (36)	Yes	No	No	Unclear	Yes	**Moderate**
Pengel *et al* (2003) (30)	Unclear	No	Partly	No	Unclear	**High**
Slebus *et al* (2007) (32)	Partly	Yes	Unclear	Unclear	Yes	**Moderate**
Steenstra *et al* (2005)(33)	Partly	No	No	Partly	Yes	**Moderate**
Truchon *et al* (2000)(34)	Partly	No	Partly	Partly	Partly	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate=moderate risk of bias in the study;

Low= low risk of bias in the study

Table 5: Systematic reviews investigating the impact of back pain and work absence

Study	Sample Size – number of papers in each review	Description of Studies	Absence Reported
Crook *et al* (2002)(31)	19 studies	Prognostic indicators of work disability in those with occupational back pain	4 studies predictors for non-RTW: older age, female, functional disability, more children living at home, locus of control, low control over work. 8 studies time to RTW: older age, female, psychological distress, functional disability, problems with job or colleagues, radiating pain, pain on standing or lying, previous hospitalisation, or BP. Faster RTW: modified jobs, light mobilisation, occupational injury clinics, faster treatment, >2 years in job. Workers compensation depended on type of claim as to whether positive or negative effect.
Dagenais *et al* (2008) (29)	27 studies	Direct and indirect costs of low back pain	Cost of sick leave reported in 18 studies, in 9 allocation of costs just to sick leave.
Iles *et al* (2008)(35)	24 studies	Investigated the psychosocial predictors of return to work in those with non-chronic non-specific low back pain	Fear avoidance beliefs (moderate evidence), recovery expectation (strong) are predictive of work absence outcome (varied between studies). Depression (strong), stress (strong), anxiety (moderate), job satisfaction (strong) not predictive of work absence outcome. Insufficient evidence on effect of compensation due to different systems.
Kuijer *et al* (2006) (36)	17 studies	Predictors of sickness absence in patients with chronic low back pain	Consistent evidence for own expectations of recovery taking less SL. Limited evidence of higher consumption of analgesics, previous BP, worse transition score, more fatigue at end of working day associated with more sick leave.

			Limited evidence for more bodily pain & musculoskeletal complaints, worse health transition score, less varied work, lower expectations, employer expectations associated with more sick leave days
Pengel *et al* (2003) (30)	15 studies	Describing the course of low back pain and any clinically important prognostic factors	Between 68% and 86% of participants initially off work will return to work within one month (pooled estimate 82% [95% CI 73% to 91%])
Slebus *et al* (2007) (32)	2 studies of CLBP	Prognostic factors for work ability in sicklisted employees with chronic diseases (MI or CLBP).	2 papers reported on back pain. Younger age was a prognostic factor for RTW in both studies. Both studies recruited participants who were off work due to LBP (N= 328, N=2752) Hansson – lower age, male, no treatment for BP before SL, surgery in first year, lower physical & psychological work demands, Higher decision latitude. Van der Giezen – Lower age, being breadwinner, less pain, better general health, more job satisfaction
Steenstra *et al* (2005)(33)	18 publications from 14 studies	Prognostic factors for the duration of sick leave in patients who are sick listed with acute low back pain	Specific LBP, higher disability levels, older age, female, more social dysfunction, more social isolation, heavier work, receiving higher compensation predictors of longer duration of SL.
Truchon *et al* (2000)(34)	18 studies	Biopsychosocial determinants of chronic disability and low back pain	LBP history, negative beliefs about ability to work and job dissatisfaction appear to be indicators for work disability (defined as job status)

6.1.2 Cohort studies

6.1.2.i Insurance databases

Table 6 reports the quality appraisal of those cohort studies that used insurance databases to identify participants; Table 7 reports the findings of cohort studies where data was gathered from insurance databases. There were 22 cohort studies using data, or recruiting people with back pain from insurance or social security office databases. These included workers' compensation databases (37), public health insurance offices (38), or national insurance databases which used in the study by Hashemi *et al* (1997:1998)(39;40). The majority of databases used were North American compensation databases, which were used in 13 studies (eight from the United States and five from Canada). Three studies were based in Scandinavia (one in Sweden (38) and two in Norway (41-43)). Studies were also conducted in Belgium (44), The Netherlands (45), South Korea (46), and Japan (47). There was one study from United Kingdom, which used the Social Security database in Jersey to calculate compensated work absence (48).

Two studies reported incidence, Hagen *et al* (1998)(41) reported the 1-year incidence of 2 weeks compensated absence to be 2.27%. Watson *et al* (1998)(48) reported the annual incidence of new claims to be 5.62% and the annual prevalence to be 6.28%. Abenhaim *et al* (1997:1998)(49;50) reported that the one-year prevalence of absence due to back pain was 1.37% of the workforce was absent from work with at least one episode of occupational back pain in 1981.

Out of the 22 studies that obtained their data from insurance databases, there were 12 that investigated the length of work absences. The average length of work absence reported in the studies varied greatly depending on how the calculations were made. Authors of the studies commented on the skewness of the data and report median values instead or as well as means. The median values ranged between 22 days and 43 days. There were two outlying values, Hashemi *et al* (1998)(40) reported a median of zero, where zero-cost claims were included and another study by Pranskey *et al* (2006) (51) reported a median of 188 days. The mean number of days on sick leave for these studies ranged between 32 days (49;50;52;53) and 337 days (54). Andersson *et al* (1993)(38) reported the number of sickness absence periods from their sample of 940 individuals which was 1588 separate episodes that were related to back pain.

Return to work or numbers still on leave at study follow-up were reported in 15 of the 22 studies. Three studies reported percentages of participants who had less than one-week work absence and these varied greatly; Hashemi *et al* (1997)(39) reported 68%, Hashemi *et al* (1998)(40) reported 75%, and Krause *et al* (1999)(54) reported 21% (178 participants). Studies reporting people who had more than one-week of work absence found similar results to each other; Watson *et al* (1998)(48) reported that 1290 (56%) of their participants took greater than one-week for their first absence and 286 (68%) had greater than one week for their second absence. Absence of greater than eight weeks was reported by Watson *et al* (1998)(48) for 8% of participants on their first absence for back pain with Tellnes *et al* (1989)(42;43) reporting that 33% of their participants took greater than 8 weeks of work absence. In study by Hazard *et al* (1996)(55) only 10% remained off work at three months compared to 38 (20%) reported by Du Bois *et al* (2008)(44) and 102 (47%) reported by Schultz *et al* (2002)(56). At six-months 7% of those in the Abenhaim *et al* (1997:1998)(49;50) study were receiving compensation. However, 114 (39%) of the participants in the study by Soucy *et al* (2006)(57) had not returned to work by six-months and 134 (32%) had not returned to work in the Canadian study by Bültmann et al (58). The reported absence figures at 1 year range from 2% in the Tellnes *et* al (1989)(42;43) study to 29% reported by Van der Giezen *et al* (2000)(59).

Seven studies that use insurance databases have estimated the cost of work absence for back pain. The two studies by Hashemi *et al* (1997:1998)(39;40) reported the total cost of back pain for the insurance company in 1992 and 1996 as over $700 million and $417 million respectively, with 15% and 12% of claims each costing over $5000. McElligott *et al* (1989)(60) reported that the total cost of lost work time for occupational back injury claims was $138,300, and for non-occupational back injuries this was $363,600. Van Tulder et al estimated the total costs of absenteeism due to back pain in 1991 in the Netherlands, based on 118,032,761 recorded sick days to be US $3.1 billion (61). Kim *et al* (2006)(46) reported that 102 (43%) of the people in their study received less than two million Korean Won (about $1900), with 136 (57%) receiving more than two million Korean Won. In Japan Shinohara *et al* (1998) (47). calculated the total cost of work lost in 64 people to be 2,07100 Japanese Yen. Watson *et al* (1998)(48) reported the total cost of benefits in 1994 for back pain in Jersey to be £1,287,204.

Recurrences in work absence following a return to work were reported in two studies. Van der Giezen *et al* (2000)(59) reported 31 (14%) of those returned to work on sick leave at one year follow-up. Recurrence was also reported by 850 (37%) of those in the study by Abenhaim *et al* (1997:1998)(49;50). In the study by Wasiak *et al* (2006)(62), the authors observed 321 (17%) recurrences in three years.

Table 6: Quality assessment of cohort studies investigating the impact of back pain on work absence – recruited from insurance claims databases

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Abenhaim *et al* (1987:1988) (49;50)	Partly	Yes	Yes	Yes	Yes	Yes	**Low**
Andersson *et al* (1983)(38)	Unclear	N/A- record review	Partly	Unclear	No	Unclear	**High**
Bültmann *et al* 2007(58)	Partly	Yes	Yes	Yes	Yes	Yes	**Low**
Chen *et al* (2007)(37)	Partly	Partly	No	Partly	No	Yes	**Moderate**
Crook *et al* (1994)(63)	No	No	No	No	No	Unclear	**High**
Du Bois *et al* (2008)(44)	Partly	Unclear	Partly	Yes	Unclear	Yes	**Moderate**
Hagen *et al* (1998)(41)	Partly	Yes	No	No	No	Yes	**Moderate**
Hashemi *et al* (1997)(39)	Partly	N/A- record review	Yes	Yes	No	Yes	**Moderate**
Hashemi *et al* (1998)(40)	Yes	N/A- record review	Unclear	Yes	No	Partly	**Moderate**
Hazard *et al* (1996)(55)	Partly	Yes	Partly	Unclear	Unclear	Yes	**Moderate**
Kim *et al* (2006) (46)	Partly	Partly	Unclear	Partly	Partly	Yes	**Moderate**

Krause *et al* (1999)(54)	Yes	Yes	Partly	Yes	No	Yes	**Moderate**
McElligott *et al* (1989)(60)	Yes	N/A- record review	Yes	Yes	Partly	Yes	**Low**
Oleinick *et al* (1996)(64)	Unclear	Partly	Unclear	Unclear	Partly	Yes	**Moderate**
Pransky *et al* (2006)(65)	Partly	Yes	Partly	Yes	Yes	Yes	**Low**
Schultz *et al* (2002:2004)(56;66)	Yes	Partly	Partly	Yes	Yes	Yes	**Low**
Shinohara *et al* (1998)(47)	Partly	N/A- record review	No	Unclear	No	Unclear	**High**
Soucy *et al* (2006)(57)	No	No	No	Partly	Partly	Yes	**Moderate**
Tellnes *et al* (1989)(42;43)	Yes	Yes	Yes	Yes	Partly	Yes	**Low**
Van der Giezen *et al* (2000)(59)	Partly	Partly	Partly	Partly	Yes	Yes	**Moderate**
Van Tulder *et al* (1995)(61)	Unclear	Secondary analysis	No	Yes	No	Yes	**Moderate**
Wasiak *et al* (2006)(62) **(includes 2003 & 2004)**	Yes	Yes	Yes	Yes	Partly	Yes	**Low**

Watson *et al* (1998)(48)	Yes	N/A- record review	Yes	Yes	No	Yes	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

Table 7: Cohort studies investigating the impact of back pain on work absence – recruited from insurance claims databases

Study	Number of participants	Outcome	Time period	Reported results
Hagen *et al* (1998)(41)	89190	Incidence of 2 weeks compensated absence due to BP	1 year	2.27%
Watson *et al* (1998)(48)	2822	Annual incidence of new social security claims for BP Annual prevalence of BP cases	1 year	5.62% 6.28%
Abenhaim *et al* (1988) (50)	2342	Prevalence of work absence due to BP	1 year	1.37%
Hashemi *et al* (1997)(39)	106961	Proportion absent from work	<= 1 week	68%
Hashemi *et al* (1998)(40)	21338		<=1 week	75%
Krause *et al* (1999)(54)	850		<1 week	178 (21%)
Watson *et al* (1998)(48)	2822		>1 week >60 days	1290 (56%) 1st absence 286 (68%) 2nd absence 183 (8%) 1st absence 79 (19%) 2nd absence
Hashemi *et al* (1997)(39)	106961		>8 weeks	15%
Oleinick *et al* (1996)(64)	11891		>8 weeks	2184 (18%)
Tellnes *et al* (1989)(42)	5042		>8 weeks	33%
Hagen *et al* (1998)(41)	89190		<3 months	70%
Schultz *et al* (2004)(66)	253		<3 months >3 months	112 (52%) 102 (47%)
Du Bois *et al* (2008)(44)	186		>3 months	38 (20%)
Hazard *et al* (1996)(55)	211		>3 months	16 (10%)
Hashemi *et al* (1997)(39)	106961		>16 weeks	11%
Hashemi *et al* (1998)(40)	21338		>16 weeks	8%

Study	Number of participants	Outcome	Time period	Reported results
Abenhaim *et al* (1987) (49)	2342		>6 months	7.4%
Bültmann *et al* (2007) (58)	632 (418 with BP)		>6 months	134 (32%)
Soucy *et al* (2006)(57)	1686		>6 months	114 (39%)
Chen *et al* (2007)(37)	678		>1 year	27 (4%)
Hagen *et al* (1998)(41)	89190		>1 year	6%
Tellnes *et al* (1989)(42)	5042		>1 year	2%
Van der Giezen *et al* (2000)(59)	298		>1 year	69 (29%)
Oleinick *et al* (1996)(64)	11891		> 3 ½ years (end of study)	11%
Abenhaim *et al* (1987) (49)	2342	Compensated lost workdays	1 year	Mean 31.5 days
Chen *et al* (2007)(37)	678		1 year	Mean 47 days – fluctuating pain Mean 150 days – continuous high pain
Hagen *et al* (1998)(41)	89190		1 year	Median 43 days
Hashemi *et al* (1997)(39)	106961		3.5 years	Median 39 days
Hashemi *et al* (1998)(40)	21338		2.5 years	Mean 61 days (incl. Zero lost workday claims)
Hazard *et al* (1996)(55)	211		3 months	Mean 34 days
Krause *et al* (1999)(54)	850		3 years	Mean 75 to 337 days Median 22 to 31 days
Pransky *et al* (2006)(65)	494		1.5 years	Median 188 days
Shinohara *et al* (1998)(47)	353		5 years	Mean 1.2 months

Study	Number of participants	Outcome	Time period	Reported results
Soucy *et al* (2006)(57)	1686		6 months	Mean 177 days (range 48-264)
Tellnes *et al* (1989)(42)	5042		1 month	Mean 49 days
Van der Giezen *et al* (2000)(59)	298	Time out of work	1 year	Mean 217 days – those RTW Mean 329 days – non-RTW by FU
Hagen *et al* (1998)(41)	89190	Number of absences	1 year	74% had 1 absence 19% had 2 absences 7% had >=3 absences
Bültmann *et al* (2007) (58)	632 (418 with BP)	Recurrence of work absence	6 months	134/418 (32%)
Van der Giezen *et al* (2000)(59)	298		1 year	31 (14%)
Abenhaim *et al* (1988) (50)	2923		3 years	850 (36.5%)
Wasiak *et al* (2006)(62)	1867		3 years	321 (17%)
Watson *et al* (**1998)**(48)	2822	Total cost of benefit claims for BP	1 year - 1994	£1,287,204
Hashemi *et al* (1997)(39)	106961	Total cost of lost workday claims for BP	1 year - 1992	>$700 million 15% >$5000 per claim
Hashemi *et al* (1998)(40)	21338		1 year - 1996	$417 million 12% >$5000 per claim
	273	Total cost of lost work time claim for occupational back injuries Total cost of lost work time claim for non-occupational back injuries		$138,300 26% of total cost $363,600 92% of total cost
Kim *et al* (2006) (46)	238	Total cost of lost work time		102 (43%) <2 million Korean Won

Study	Number of participants	Outcome	Time period	Reported results
				136 (57%) >=2 million Korean Won
Shinohara *et al* (1998) (47)	353	Compensated lost workdays	5 years	207,100 Japanese Yen

Key: WC – Workers' Compensation; BP – Back Pain

6.1.2.ii Workplace

Table 9 reports the findings of cohort studies where participants were recruited from workplaces, with Table 8 reporting the quality appraisal for these studies. There were 11 cohort studies that recruited participants from a workplace setting (67-77). Of the four studies conducted in the United States (67;70-72), two were in cohorts of workers from several organisations, one was a study of carpenters recruited from a union, and another was conducted in a utility company. The study from Sweden (69) recruited men at entry into the military. The French study by Niedhammer *et al* (1994)(73) was a cohort of nurses, as was the study by Smedley *et al* (1997)(74) conducted in the UK. The other UK study recruited participants from 3 different large industries in the North West (77). There were two cohorts of workers from the Netherlands one incuding healthcare workers and the other industrial workers (76;78). The cohort study by Gheldof *et al* (2005)(68) was conducted in 10 industries across Belgium and the Netherlands. The types of workplaces varied considerably with two studies investigating workers from multiple work places (67;79). Two of the studies recruited their sample from industrial manufacturing (68;72) and three of the studies recruited hospital workers or nursing staff (73;74;76).

For the two studies recruiting an industrial population, there were a number of measures of absence used. Gheldof *et al* (2005)(68) used the Nordic Questionnaire (68) and reported that 234 (27%) workers with back pain reported short term sick leave (between one and 30 days) and 74 (8%) reported long term sick leave (over 30 days). In the other study recruiting from an industrial workplace, 29 (15%) employees reported that they had taken time off work due to a recurrence in back pain in answer to a single question (72).

The three studies that recruited nursing and medical staff as their sample all used single questions relating to work absence, however these questions investigated different aspects of work absence. Smedley *et al* (1997)(74) asked nurses in the study whether their back pain had led to time off work. The average length of absence in the healthcare workers was a median of 6 days in the 6-month study by Steenstra *et al* (2005)(76) and an average of 44 days was reported in the previous year by nurses in the study by Niedhammer *et al* (1994)(73). The latter study reported that 93 (11%) of nurses had taken sick leave due to back pain in the 2-year follow up, whereas

Neidhammer *et al* (1994)(73) reported 23 (7%) of the nurses had taken sick leave for back pain in the 12 months before entering the study.

When all of the cohort studies that recruited their samples from a workplace setting were investigated as a whole, the lengths of absence and the number in the population who experience work absence vary greatly. The length of follow up ranged from 6 months (76) to 15 years (71). The cohorts were also different, because they were from a variety of occupations and organisations. The average duration of work absence was measured in four of the cohort studies and varied from 6 days (76) to 44 days (73). Short term sick leave of up to 1 month was reported to be between 20% in the first year of the study by Troup et al, and 27% (68). Long-term sick leave varied from 3% (69) and 24% from the first year of follow up in Troup et al's study. The proportion of workers who took sick leave in the studies ranged from 7% in 12 months to (40% in Lipscomb but is this a database study?) and 11% in 2 years of follow up (74). Sick leave, or lost work time due to recurrent back pain was reported to be between 10% to 15% in the study by Marras *et al* (2007)(72) depending on whether absence was self-reported or obtained from employer records. Van der Heuvel *et al* (2007)(78) also reported 18% of the episodes of recurrent back pain resulted in sick leave.

Hiebert *et al* (2003)(70) reported 223 (99%) of participants taking leave returned to any work, either restricted or unrestricted, within a year.

Cote *et al* (2008)(67) categorised work absence and found that after 12 months follow up 34% of the workers did not take any sick leave, 33% had one episode of sick leave then stayed at work, 30% had multiple spells of sick leave and 3% had not returned from sick leave.

Table 8: Quality appraisal of cohort studies investigating the impact of back pain on work absence – workplace settings

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Cote *et al* (2008) (67)1)	Partly	No	Partly	Partly	Partly	Yes	**Moderate**
Gheldof *et al* (2005) (68)2)	Partly	No	Partly	Partly	Partly	Yes	**Moderate**
Hellsing *et al* (1994) (69)3)	No	Partly	No	Partly	Partly	Partly	**Moderate**
Hiebert *et al* (2003) (70)4)	Yes	N/A -record review	Yes	Yes	Partly	Yes	**Low**
Lipscomb *et al* (2008) (71)5)	Partly	Unclear	Partly	Unclear	No	Unclear	**Moderate**
Marras *et al* (2007) (72)6)	Partly	Partly	Partly	Partly	Yes	Yes	**Moderate**
Niedhammer *et al* (1994) (73)7)	Yes	Partly	No	No	No	Yes	**Moderate**
Smedley *et al* (1997) (74)8)	Partly	Partly	Unclear	No	No	Yes	**Moderate**
Steenstra *et al* (2005) (76)0)	Partly	Partly	Partly	Yes	Partly	Yes	**Moderate**
Troup *et al* (1981) (68)2)	Unclear	Unclear	Yes	Partly	No	Unclear	**Moderate**
Van der Heuvel *et al* (2004) (78)	No	No	Yes	Unclear	Unclear	Yes	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

Table 9: Cohort studies investigating the impact of back pain on work absence – workplace settings

Study	Number of participants	Outcome	Time period	Reported results
Hiebert *et al* (2003) (70)	240 with LBP	Proportion on sick leave	1 year	225/240 (94%)
Lipscomb *et al* (2008) (71)	4138		15 years	1681/4138 (40%)
Niedhammer *et al* (1994) (73)	469		1 year	23/310 (7.4%)
Smedley *et al* (1997) (74)	322 with BP		2 years	93/322 (11%) 21/92 (23%) of those who had BP in year before study
Gheldof *et al* (2005) (68)	890 with LBP		1-30 days >30 days	234 (27%) 74 (8%)
Hellsing *et al* (1994) (69)	934		1-30 days >30 days	145/653 (23%) 18/633 (3%)
Troup *et al* (1981) (68)	503		Year 1: 1-2 weeks 3-4 weeks 5-13 weeks 14+ weeks	 48/503 (9.5%) 53 (10.5%) 76 (15.1%) 46 (9.2%)
	177		Year 2: 1-2 weeks 3-4 weeks 5-13 weeks 14+ weeks	 16/177 (9%) 10 (5.6%) 19 (10.7%) 10 (5.6%)
Steenstra *et al* (2005) (76)	615	Sick leave	<28 days <91 days	86.5% 94%
Lipscomb *et al* (2008)	1681 taking leave	Number of absences	15 years	1227 (73%) of those taking

Study	Number of participants	Outcome	Time period	Reported results
(71)				leave had 1 absence
Hiebert *et al* (2003) (70)	16000	Return to any work	1 year	223/225 (99%) of those taking leave
Hiebert *et al* (2003) (70)	16000	Time to return to any work Time to return to unrestricted work	1 year	Median 14 days Median 15 days
Steenstra *et al* (2005) (76)	615	Time to RTW for >1 day Time to RTW for >4 weeks (lasting RTW) Total length of sick leave	26 weeks	Median 5 days (IQR 2-12) Median 6 days (IQR 3-13) Median 6 days (IQR 3-13)
Marras *et al* (2007) (72)	206	Time to RTW previous sick leave	1 year	Mean 12.7 (SD=43.4) days
Niedhammer *et al* (1994) (73)	469	Length of sick leave in previous 12 months	1 year	44.3 days
Van der Heuvel *et al* (2004) (78)		Sick leave for recurrent BP	3 years	113 (18%)
Marras *et al* (2007) (72)	206		1 year	29/196 (15%) self-reported 20/196 (20%) confirmed by work records

6.1.2.iii Health care settings

Among the cohort studies there were 17 studies reported in 18 papers that recruited their participants from a healthcare setting (80-96) (Table 11), the quality appraisal of these studies is reported in Table 10. As in previous sections of this review, the most common continent for studies to originate from was North America, with seven studies from the United States (84;88;90;93;94;97;98), and two from Canada (81;86;87). The other eight studies were conducted in Europe, three in the Netherlands (85;91;95), two in the United Kingdom (80;96), and one each in Spain (89), Denmark (92) and Norway (83).

In the studies that recruited their participants from a health care setting there were a number of measures used to determine work absence due to back pain. All except for two of the studies recruiting from healthcare, measured self-reported work absence, usually as a single question in the questionnaires or interviews. One study used the Spanish social security database to verify sick leave (89) and the study by Shaw *et al* (2007)(94) of military personnel, used employers records to obtain work status. The measured period of absence reported in the cohort studies varied from 2 weeks (84) to 7 years (91), with participants being followed up in the studies for 3 months (85;88;93;98) to 4 years (in addition to another 3 or 4 years retrospectively in this study) (91).

The reported absence from work at one month ranged from 12 (11%) in the study by Grotle *et al* (2007)(83) to 68 (24%) reported by Kapoor *et al* (2006)(88). Results at three months varied, with Grotle *et al* (2007)(83) reporting that 10 (9%) were absent from work and 51 (18%) reported not returned to work by Kapoor *et al* (2006)(88). In the study by Dionne *et al* (2007)(81), 203 (22%) either failed to return to work or were on sick leave again after resuming work after 3 months. This study measured return to work in good health rather than any return to full work, which made the proportions on leave consistently slightly higher than in some of the other studies. Work absence rates for people with back pain after one year were 7% in the study by Wynne-Jones *et al* (2008)(96), 9% reported by Grotle *et al* (2007)(83) and Dionne *et al* (2007)(81) reported 18% still absent from work. The study by Dunn *et al* (2006)(80) found that absence varied according to the type of back pain; absence in those in the recovering group was 1%, in people with mild persistent pain it was 15%,

18% for those whose pain fluctuated and 54% in the people with severe chronic back pain. Dionne *et al* (2007)(81) reported that after 2 years in the study, 165 (19%) had yet to return to work in good health. After 270 days of follow up in the study by Infante-Rivard *et al* (1996)(87) 20 people (6.5%) had not returned to work.

Return to work was assessed over various time periods in seven of the studies (84;86-90;92;94;98). Lehmann *et al* (1993)(90) and Kapoor *et al* (2006)(88) both reported people who had returned to work by one month. However, Lehmann *et al* (1993)(90) reported that 7 (12.7%) of the study participants, who had acute back pain prior had resumed work at the one-month follow up, whereas Kapoor *et al* (2006)(88) reported 156 (57%) people with compensation claims for acute work-related back pain had returned to full duty after one month. At three months follow up, Kapoor *et al* (2006)(88) reported 202 (74%) of the study participants had returned to work and 417 (80%) had returned to work in the study by Shaw *et al* (2009)(98). Schmidt *et al* (2008)(92) reported 549 (92%) people with back pain had returned to work and Shaw *et al* (2007)(94) found that 88 (62.9%) of the military personnel in the study had resumed full duties at 1 year follow up. 230 (74.5%) of the people being treated for a compensated back pain episode in the study by Infante-Rivard *et al* (1996)(87) had returned to work by 40 months. Miedema *et al* (1998)(91) followed people for four years retrospectively and three to four years prospectively and found that 68% of those with non chronic back pain and 59% of the people with chronic back pain had returned to work within 7 years.

Three studies reported the average length of work absence (84;86;87;95) Hadler *et al* (1995)(84) found that those patients who had compensation insurance took on average 0.6 (3.2 days versus 2.6 days) more days off from work in the 30 days prior to the study than those who were not insured. Infante-Rivard *et al* (1996)(87) reported the mean time before return to work as 126 days (range from 4 days to 1228 days). A median time to return to work of 56 days was reported by Van der Weide *et al* (1999)(99).

Recurrence of back pain and sick leave was reported in one study (100). In this study it found that 41 (64%) of those with a recurring back injury reported lost work time and 77% of these were working by one year.

Table 10: Quality appraisal of cohort studies investigating the impact of back pain on work absence – health care settings

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Dionne *et al* (2007) (81)	Yes	No	Unclear	Yes	Partly	Yes	**Moderate**
Dunn *et al* (2006) (80)	Partly	No	Partly	Yes	No	Yes	**Moderate**
Garcy *et al* (1994) (100)	**Not assessed as only abstract available**						
Grotle *et al* (2007)(83)	Partly	No	Partly	Partly	Partly	Yes	**Moderate**
Hadler *et al* (1995) (84)	Partly	Partly	Yes	Unclear	Yes	Yes	**Moderate**
Heneweer *et al* (2007)(85)	Partly	Yes	Partly	Partly	Partly	Yes	**Moderate**
Infante-Rivard *et al* (1996) (87)	Partly	Partly	No	No	No	Yes	**Moderate**
Kapoor *et al* (2006) (88)	Partly	Partly	Yes	Unclear	Partly	Yes	**Moderate**
Kovacs *et al* (2007) (89)	Partly	Yes	Yes	Yes	Yes	Yes	**Low**
Lehmann *et al* (1993) (90)	Partly	Partly	Partly	No	Partly	No	**Moderate**
Miedema *et al* (1998) (91)	Yes	Yes	No	Unclear	Yes	Yes	**Low**
Schmidt *et al*	Partly	Partly	Yes	Partly	Yes	Yes	**Low**

(2008) (92)							
Shaw *et al* (2007) (93)	Partly	Partly	Partly	Yes	Yes	Yes	**Low**
Shaw *et al* (2007) (94)	Partly	No	Partly	Partly	Yes	Yes	**Moderate**
Shaw *et al* (2009) (98)	Partly	Partly	Yes	Partly	Yes	Yes	**Low**
Van der Weide *et al* (1999) (101)	Partly	Partly	Partly	Yes	Yes	Yes	**Low**
Wynne-Jones *et al* (2008) (96)	Yes	Unclear	Partly	Partly	Partly	Partly	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

Table 11: Cohort studies investigating the impact of back pain on work absence – health care settings

Study	Number of participants	Outcome	Time period	Reported results
Kapoor *et al* (2006) (88)	300	Proportion RTW	1 month	156 (57%)
Lehmann *et al* (1993) (90)	55			12.7%
Hadler *et al* (1995) (84)	1366		2 months	98.6% workers' compensation 99.1% non- workers' compensation
Lehmann *et al* (1993) (90)	55			40%
Kovacs *et al* (2007) (89)	165			46 (28%)
Kapoor *et al* (2006) (88)	300		3 months	74%
Shaw *et al* (2009) (98)	573			417 (80%)
Hadler *et al* (1995) (84)	1366		6 months	99.6% workers' compensation 99.7% non- workers' compensation
Shaw *et al* (2007) (94)	148			82 (58.6%)
Kapoor *et al* (2006) (88)	300		7 months	83.6%
Schmidt *et al* (2008) (92)	793		1 year	549 (92%)
Shaw *et al* (2007) (94)	148			88 (62.9%)
Infante-Rivard *et al* (1996) (87)	305		40 months	230 (75%)
Miedema *et al* (1998) (91)	444		7 years	68% non-chronic BP 59% chronic BP
Grotle *et al* (2007)(83)	112	Proportion absent from work	1 month	12 (11%)
Shaw *et al* (2007) (93)	568			91 (17.2%)
Kapoor *et al* (2006) (88)	300			68 (24%)
Dionne *et al* (2007) (81)	1007		6 weeks	255 (27.7%) – 4.7% after attempt to RTW & 23% no RTW

Study	Number of participants	Outcome	Time period	Reported results
Kovacs *et al* (2007) (89)	165		60 days	42 (25%)
Dionne *et al* (2007) (81)	1007		12 weeks/ 3 months	203 (22.4%) – 7.7% after attempt to RTW & 14.7% no RTW
Heneweer *et al* (2007)(85)	56			7 (12.5%)
Kapoor *et al* (2006) (88)	300			51 (18%)
Shaw *et al* (2007) (93)	568			69 (13%)
Infante-Rivard *et al* (1996) (87)	305		112 days	50%
Grotle *et al* (2007)(83)	112		6 months	7 (7%)
Lehmann *et al* (1993) (90)	55			16.4%
Infante-Rivard *et al* (1996) (87)	305		270 days	11%
Dionne *et al* (2007) (81)	1007		1 year	161 (17.6%) – 8.4% after attempt to RTW & 9.2% no RTW
Dunn *et al* (2006) (80)	342			1% recovering group 15% mild persistent group 18% fluctuating group 54% severe chronic group
Grotle *et al* (2007)(83)	112			9 (9%)
Wynne-Jones *et al* (2008) (96)	923			17 (7%)
Infante-Rivard *et al* (1996) (87)	305		40 months	20 (6.5%)
Hadler *et al* (1995) (84)	1366	Length of sick leave	12 months	3.2 days workers' compensation 2.6 days non-workers' compensation

Study	Number of participants	Outcome	Time period	Reported results
Infante-Rivard *et al* (1996) (87)	305	Time to RTW		Mean 126 days (SD 137)
Van der Weide *et al* (1999) (102)	120	Time to RTW Duration of sick leave		Median 56 days Mean 18 days
Garcy *et al* (1994) (100)	1204	Work absence for re-injury RTW	1 year	41 (64%) 77%

6.1.2.iv General population studies

Only one cohort study was found that recruited people from the general population (103), the quality appraisal is reported in Table 12 and the results are reported in Table 13. The study participants were people reporting back and, or neck pain and working more than 50% of full time from a Swedish population-based study (103). Of the 817 included in the study, 120 (15%) had only low back pain without neck pain. In this group, the authors report that 50 (42%) had sickness absence from work for low back pain. Other results from this study merged the group with only low back pain with those with only neck pain and are reported in the relevant section of this review, see section 9.

Table 12: Quality appraisal of cohort studies investigating the impact of back pain on work absence – general population settings

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Nyman 2007	Unclear	No	Partly	Yes	Yes	Yes	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study.

Table 13: Cohort studies investigating the impact of back pain on work absence – general population settings

Study	Number of participants	Outcome	Time period	Reported results
Nyman *et al* (2007)(103)	120 with LBP only	Sick leave	5 years	50 (42%)

6.1.3 Case control studies

Two case control studies investigated the relationship between back pain and work absence (Table 15 and Table 14). These studies were both conducted in Sweden (104;105). The participants in these studies were from differing settings, one included working farmers and non-farming rural control group (104), another patients with back pain and controls without back pain from a health care setting (105). Holmberg *et al* (2004)(104) reported that farmers had significantly less sick leave than the controls (29% versus 36%). Seferlis *et al* (1999)(105) found that the median number of days off work for back pain in the group with back pain was significantly higher than those without back pain (5 days versus 0 days) and for days off work for other illness was a median of 20.5 days in people with back pain and zero in the non back pain control group.

Table 14: Quality appraisal of case control studies investigating the impact of back pain on work absence

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Holmberg *et al* (2004) (104)	Yes	N/A	Yes	Yes	Yes	Yes	**Low**
Seferlis *et al* (1999) (105)	Partly	N/A	Partly	Partly	Partly	Partly	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study.

Table 15: Case control studies investigating the impact of back pain on work absence

Study	Number of participants	Outcome	Time period	Reported results
Holmberg *et al* (2004) (104)	1013 farmers	Sick leave	At any time	28.7%
	769 referents	Sick leave	At any time	28.7%
Seferlis *et al* (1999) (105)	180 consulters with LBP	Sick leave	2 years	Mean number of episodes of sick leave: 1.4 (median=1)
	447 controls	Sick leave	2 years	Mean number of episodes of sick leave: 0.3 (median=0) controls

6.1.4 Qualitative studies

From the 112 papers reporting on back pain and work absence only one used qualitative research methods (Table 16). Shaw *et al* (2005)(106) used content analysis to analyse responses of participants in focus groups and semi-structured interviews. The authors reported that amongst those in their sample the length of time off work varied between a week and up to a year. Shaw *et al* (2005)(106) found self-efficacy for resuming work was one of two primary constructs for self-efficacy. A number of factors were important in resuming work, including pain control, obtaining help and being able to meet demands of the job.

Table 16: Qualitative study investigating the impact of back pain on work absence

Study	Sample Size	Measure of Absence	Rate of Absence
Shaw *et al* (2005)(106) Newspaper advert & health care USA	51 (28 recently returned & 23 about to return to work)	Self-reported work absence and factors affecting return to work (focus groups and interviews)	Time off work due to BP varied from 1 week to 1 year (median 23 days). Constructs for self-efficacy for resuming work included pain control, obtaining help and meeting job demands. Outcome expectancy included financial security, re-injury, workplace support, self-image.

6.2 Performance

6.2.1 Study designs

One systematic review (29;94) and twenty-two studies report on the impact of back pain on work performance. There were nine cohort studies (59;81;88;91;93;94;96;107;108), one case-control study, 12 cross-sectional surveys (65;109-120), and a qualitative research study (121). Follow up in these studies ranged from one month (88) to seven years (91).

6.2.2 Settings and participants

Nine of the studies reporting on back pain and its impact on work performance were conducted in a workplace setting. There was a wide variation in the type of employment, which included healthcare employees (110;117), family care workers (119), electric power supply workers (120), construction workers (118) and aircraft assembly workers (107). Twelve of the studies recruited their participants from a health care setting and six studies recruited their population from claims databases. The included studies were conducted in ten different countries; six studies from the US, four from Canada, three from The Netherlands, two from the UK, two from Australia and one each from Japan, Sweden, France, Tunisia and South Africa. The sample sizes in the observational studies varied from 88 (114) to 7010 (109). The qualitative research study included 26 people

6.3 Results and measures of performance

6.3.1 Systematic review

Dagenais *et al* (2008)(29) investigated the international direct and indirect cost of low back pain. The authors searched Medline for relevant studies conducted between 1997 and 2007 and included 27 studies in the review (quality appraisal is reported in Table 17). From the systematic review three studies (two national US estimates, one from Sweden) included a proportion of the indirect costs attributed to presenteeism. Dagenais *et al* (2008)(29) reported that the methods used to calculate the costs in these studies varied making comparability a problem. The authors of the systematic review found no data reported for the Swedish cost study. The two national US

studies report $19.8 billion and $7.4 billion for total indirect cost of LBP, of which 70% and 85% were allocated to presenteeism.

Table 17: Quality appraisal of the systematic review investigating the impact of back pain on work performance

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Dagenais *et al* (2008)(29)	Partly	N/A	Partly	Yes	Partly	No	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

6.3.2 Cohort studies

The quality of the cohort studies is reported in Table 18. The cohort studies used similar measures of work performance (Table 19). The majority of included studies reported the proportion of participants who were working less (fewer hours, modified, reduced or alternate duties, work restrictions, limited work) than they had before the episode of back pain started. Van der Giezen (2000)(59) reported that of the 198 people available at the one year follow up, 42 (21%) reported working fewer hours and being less productive. Rossignol *et al* (1993)(107) found that 72 (28%) workers reported a limitation in performing their work. Shaw *et al* (2007)(94) reported that 14 (10%) and 6 (4%) military personnel in the study had work modifications at 6 months and 1 year respectively. However, many were working without restrictions, 82 (59%) at 6 months and 88 (63%) at 1 year, after initially consulting for back pain. Wynne-Jones *et al* (2008)(96) in the UK reported that 63 (11%) of the 597 (65%) who were employed were working reduced duties at the start of the study, with eight of these still on reduced duties after 12 months.

Two US studies used the Back Disability Risk Questionnaire (88;93). It is reported that at one month follow up between 18.4% (93) and 57% (88) had resumed full duty work, and between 16.3% (93) and 19% (88) were working modified or alternate duty.

Dionne *et al* (2007)(81) used ‘return to work in good health’ as an outcome measure. On this measure, ‘partial success’, where the person has returned to work with possible functional limitations, could be used as a measure of presenteeism. After 6 weeks 55% of respondents were classed as a partial success, 26%, 28% and 24% at 12 weeks, 1-year and 2-year follow-up.

The study by Stang *et al* (1998)(108) reported that 994 (18%) of the back pain patients were unable to obtain or keep full time employment as a result of their back pain in the previous year.

In the study conducted by Miedema *et al* (1998)(91) it was reported that of people with back pain, consulting their GP between 1987 and 1988, and in paid employment, 93 (28%) had difficulties performing duties at work at follow-up in 1991. The authors also found that there was a significantly higher risk of developing chronic back problems in 1994 in those having difficulties in performance in 1991.

Table 18: Quality appraisal of cohort studies investigating the impact of back pain on work performance

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Rossignol *et al* (1993) (107)	Partly	Partly	Yes	Yes	Yes	Yes	**Low**
Van der Giezen *et al* (2000) (59)	Partly	Partly	Partly	Partly	Yes	Yes	**Moderate**
Dionne *et al* (2007) (81)	Yes	No	Unclear	Yes	Partly	Yes	**Moderate**
Kapoor *et al* (2006) (88)	Partly	Partly	Yes	Unclear	Partly	Yes	**Moderate**
Miedema *et al* (1998) (91)	Yes	Yes	No	Unclear	Yes	Yes	**Low**
Shaw *et al* (2007) (94)	Partly	Partly	Partly	Yes	Yes	Yes	**Low**
Shaw *et al* (2007) (93)	Partly	No	Partly	Partly	Yes	Yes	**Moderate**
Stang *et al* (1998) (108)	No	No	Unclear	Unclear	Unclear	Yes	**Moderate**
Wynne-Jones *et al* (2008) (96)	Yes	Unclear	Partly	Partly	Partly	Partly	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study;

Low = low risk of bias in the study

Table 19: Cohort studies investigating the impact of back pain on work performance

Study	Number of participants	Outcome	Time period	Reported results
Rossignol *et al* (1993) (107)	256	Limitation in performing work	1 year	72 (28.1%)
Miedema *et al* (1998) (91)	444	Difficulties performing work	1 year	93/333 (28%) of employed during FU 60/126 (48%) of employed with symptoms at start of study
Van der Giezen *et al* (2000) (59)	298	Working less hours and or less productive	1 year	21%
Wynne-Jones *et al* (2008) (96)	923	Reduced duties	Baseline 1 year	63/597 (11%) 16 (6%)
Shaw *et al* (2007) (94)	148	Work modifications	6 months 1 year	14 (10%) 6 (4.3%)
		Alternate work	6 months 1 year	26 (18.6%) 8 (5.7%)
		Working without restrictions	6 months 1 year	82 (58.6%) 88 (62.9%)
Dionne *et al* (2007) (81)	1007	Partial success in RTW, possibly with functional limitation	6 weeks 12 weeks 1 year 2 years	504/923 (54.6%) 237/907 (26.1%) 253/913 (27.7%) 209/864 (24.2%)
Kapoor *et al* (2006) (88)	300	Back Disability Questionnaire: working modified or alternate duty	1 month 3 months	51/275 (19%) 21/274 (8%)
Shaw *et al* (2007) (93)	568		1 month 3 months	86 (16.3%) 33 (6.3%)
Stang *et al* (1998)	1686	Able to obtain or keep full time	2 years	994 (18.4%) all BP patients

(108)		employment		561 (8.6%) those with good outcome 287 (22.7%) those with mixed outcome 146 (48%) those with poor outcome

6.3.3 Other observational studies

The quality appraisal of these studies is reported in Table 20, with the full results reported in Appendix 5. There was one case control study included in the review that investigated work performance in people with and those without back pain (115). The authors of this study reported 16.8% of workers with back pain had lost productive time (LPT) in the previous 2 weeks, with 15.56% lost time as presenteeism. The average LPT per employee with back pain was 5.50 hours per week, of which 4.38 hours (80%) was due to presenteeism. The average weekly cost of presenteeism per employee was $73.07, amounting to a total annual cost of $6.32 billion.

Twelve of the studies reporting on work performance and back pain were cross-sectional surveys (65;109;110;112-120). One of these studies reported lost work days in workers at an automotive metal stamping plant with back pain (114). The authors reported an average of 3.4 lost workdays, but did not give separate results for those on restricted work and the workers on sick leave. Four studies developed questionnaires based on, or comparable with the Nordic Musculoskeletal Questionnaire (109;111;118;119). However, the results of these studies are reported differently. Alcouffe *et al* (1999) found that 258 (7%) employees reported occupational consequences due to their back pain, including enhancement of their workstation or change in their job. A reduction in work activities was reported by 463 (12%) of participants reporting back symptoms. Holmström *et al* (1991)(118) stated that more than 8 days of inability to do normal work was reported by 33 (16%) construction workers with back pain, with eight (6%) reporting they were unable to do normal work for more than 30 days. The study by Moens *et al* (1993)(119) reported that 304 (11%) the family workers with back pain had asked for adaptation to their current job, which 184 (72.1%) had obtained. Forcier *et al* (2008)(111) used a French version of the Standardised Nordic Questionnaire. Of the 122 respondents with back pain, 32 (26%) reported that their problem prevented them from carrying out their regular work.

Two of the studies reported that a standardised measure was used however there is no record of what these were (117;120). Bejia *et al* (2005)(117) reported that 17 (10%) of the hospital workers had to restrict some of their laborious work due to low back pain and 19 (11%) reported a repercussion on performance at work. In a study conducted

in 1979 by Nagira *et al*(120), it was reported that 521 (8%) of the electric power supply workers in Japan required occasional rest whilst they were working as a result of pain. This differed depending on the tasks carried out; 187 (14%) of those doing outdoor wiring, 243 (9%) of those involved in indoor wiring and only 35 (2%) of the clerks needing occasional rests at work.

In the study by Kopec *et al* (1998)(116) the people seeking health professional advice for back pain reported a number of work-related problems; including 82 (60%) working more slowly due to their back pain, 70 (51%) taking more frequent or regular breaks from their work, and 67 (49%) cutting down on any extra work or overtime duties.

The two studies by Musich *et al* (both 2006)(112;113) used a health risk assessment score (the score included the impact of stress levels, physical or emotional health on hours worked, proper use of equipment, ability to concentrate, work effectively with others and work to the best of their ability) to summarise presenteeism. The authors found that back pain was associated with increased odds of presenteeism.

Denis *et al* (2007)(110) used the Work Limitations Questionnaire(25) and found that 40 (63%) of the nursing staff who were in regular work despite back pain had never had work limitations. Self-reported disability and pain due to low back pain were associated with being increasingly limited in their work as nursing staff.

Pransky *et al* (2002)(65) reported changes in work capacity or ability in US professional, manual and service workers. Of those who returned to work after back pain injury 66% reported that their ability to do their job was not affected by the injury.

Table 20: Quality appraisal of other observational studies investigating the impact of back pain on work performance

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Alcouffe *et al* (1999) (109)	Partly	N/A	Yes	Unclear	Unclear	Yes	**Moderate**
Bejia *et al* (2005) (117)	Yes	N/A	Yes	Partly	Yes	Partly	**Low**
Denis *et al* 2007 (110)	Partly	N/A	Partly	Partly	No	Yes	**Moderate**
Forcier *et al* 2008 (111)	Partly	N/A	Partly	Partly	No	Unclear	**Moderate**
Holmström *et al* (1991) (118)	No	N/A	Yes	Unclear	No	Partly	**Moderate**
Kopec *et al* (1998) (116)	Partly	N/A	Yes	Yes	Yes	Yes	**Low**
Moens *et al* (1993) (119)	Partly	N/A	Partly	Unclear	Partly	Yes	**Moderate**
Musich *et al* (2006) (112)	Partly	N/A	Partly	Yes	Yes	Yes	**Low**
Musich *et al* (2006)(113)	Partly	N/A	Partly	Yes	Yes	Yes	**Low**
Nagira *et al* (1979) (120)	Unclear	N/A	Unclear	Unclear	Unclear	Unclear	**High**
Oleske *et al* (2000) (114)	Yes	N/A	Yes	Unclear	Yes	Yes	**Low**
Pransky *et al* (2002) (65)	Yes	N/A	Partly	Yes	Yes	Yes	**Low**
Ricci *et al* (2006) (115)	Partly	N/A	Yes	Unclear	Yes	Yes	**Low**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

6.3.4 Qualitative studies

One study investigated the relationship between back pain and work performance using a qualitative approach (121) (Table 21). Shaheed *et al* (2008)(121) recruited their sample from an occupational therapy clinic. The authors investigated factors that prevented people from resuming their work, which included job stressors and inadequate policies in the workplace relating to injuries.

Table 21: Qualitative studies investigating the impact of back pain on work performance

Study	Sample size and follow-up	Measure of performance	Reported Performance
Shaheed *et al* (2008)(121) Occupational therapy clinic	26	Focus groups asking about the perceptions and experiences of their worker roles	Factors that prevented these individuals from resuming their work included physical and psychological stressors of the job, a lack of education by the employer, and inadequate workplace policy.

6.4 Evidence statements

- The incidence of sickness absence attributable to back pain in workforces is 2.3 – 5.6% per year (higher figure for shorter absence definition) ****Moderate evidence**
- Job type influences whether individuals with back pain take absence from work. ***Limited evidence**
- From studies in the workplace the majority of people with back pain don't take sick leave****Moderate evidence**
- Absence from work over the past 12-months as a result of back pain was reported by 11% to 26% of study participants *****Strong evidence**
- 2/3 – 4/5 of those who do go off sick will RTW in one month. This appears to be similar regardless of whether recruited from workplace or healthcare setting ****Moderate evidence**

- Modifiable predictors of shorter periods absence with at least moderate (**) evidence are
    - Earlier treatment
    - Less disability
    - Psychological factors – more so cognitive / illness perceptions than depression / anxiety (the latter possibly having a greater effect upon presenteeism than RTW).
    - job modification
    - perceived work stressors
- If compensation / insurance claims are made then the median time off is around one month (22-43 days) ****Moderate evidence**
- 10-20% will still be off at 3 months (higher figure for those identified by longer absence initially) ****Moderate evidence**
- Recurrence of sickness absence secondary to back pain within 3 years 15-35% (higher figure for shorter absence) *****Strong evidence**
- Up to one in five individuals with back pain report that pain has had an adverse effect on work performance, either through modified or reduced duties *****Strong evidence.**

7. RESULTS – THE IMPACT OF NECK PAIN ON WORK ABSENCE AND PERFORMANCE

Of the 153 studies included in the review ten investigated the relationship between neck pain and work absence (122-131), Table 22 reports the quality appraisal of these studies and Table 23 reports the results.

7.1 Absence

7.1.1 Study designs

Carroll *et al* (2008)(122) carried out a systematic review into the course and prognosis of neck pain as part of a large best evidence synthesis conducted by the Task Force on Neck Pain and its associated disorders.

Four papers since the systematic review by Carroll *et al* (2008)(122) have reported cohort studies of neck pain and absence from work (124;125);(123). A study by Tsauo *et al*. (2007)(124) had six months follow up, whereas Vos *et al*. (2008)(125) followed up participants at 6, 12, 26 and 52 weeks. The third study, conducted by Scuderi *et al*. (2005)(123) followed up people with symptomatic cervical disc herniation until they returned to work, reached maximum medical improvement or were lost to follow up after two years. The cohort study by Buitenhuis *et al* (2009)(132) followed people with whiplash associated disorder up at 6 and 12 months. One paper by Gillen *et al* (2007)(131) reported a case control study of the association of socioeconomic status and workplace factors with musculoskeletal injury in hospital workers. The remaining five studies were cross-sectional and did not follow-up participants in their studies (126-130).

Table 22: Quality appraisal of studies reporting the relationship between neck pain and work absence

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Alexopoulos *et al* (2006)(126)	Yes	N/A	Yes	Unclear	Yes	Yes	**Low**
Carroll e*t al* 2008(122)	Partly	N/A	Unclear	Unclear	No	No	**High**
Choobineh *et al* (2007)(127)	Partly	N/A	Yes	Partly	Yes	Yes	**Low**
d'Almeida *et al* (2008) (128)	Yes	N/A	Yes	Yes	Partly	Yes	**Low**
Gillen *et al* (2007)(131)	Unclear	Unclear	No	Unclear	Partly	Partly	**High**
Madan *et al* (2008)(129)	Partly	N/A	Yes	Yes	Yes	Yes	**Low**
Merlino *et al* (2003)(130)	Partly	Partly	Yes	Unclear	Partly	Yes	**Moderate**
Vos *et al* 2008(125)	Partly	Partly	Partly	No	No	Partly	**Moderate**
Scuderi *et al* (2005) (123)	Yes	No	Yes	No	Unclear	Partly	**Moderate**
Buitenhuis *et al* (2009) (132)	Yes	Yes	Yes	Yes	Yes	Yes	**Low**
Tsauo *et al* (2007)(124)	No	Partly	Partly	Partly	Partly	Yes	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study;

Low = low risk of bias in the study

Table 23: Studies reporting the relationship between neck pain and work absence

Study	Number of participants	Outcome	Time period	Reported results
Scuderi *et al* (2005) (123)	296	Total workdays lost	3 months 2 years	2262 days for workers' compensation 1093 days for private insurance 7107 days for workers' compensation 6206 days for private insurance
Scuderi *et al* (2005) (123)	61 235 61 216	Workdays lost per person	3 months 2 years	37.1 days for workers' compensation 4.7 days for private insurance 131.6 days for workers' compensation 28.7 days for private insurance
Carroll e*t al* 2008(122)	2854 (3 studies)	Length of work absence	1 year	Mean 74.5 (SD 12.6) days
d'Almeida *et al* (2008) (128)	134,255	Length of sickness days	5 years	Mean 16.4 days
Carroll e*t al* 2008(122)	2854 (3 studies)	Number of work days lost	2 years	Mean 14.6 days
Gillen *et al* (2007)(131)	90		4 weeks	Mean 4 (SD 6.4) days
Carroll e*t al* 2008(122)	2854 (3 studies)	Length of sick leave	1-3 days >3 days	10% 18%
Vos *et al* 2008(125)	187	Sick leave	Baseline 6 weeks 12 weeks 26 weeks 52 weeks	52/148 (25%) 26 (28%) 14 (20%) 7 (11%) 4 (5%)
Alexopoulos *et al* (2006)(126)	853	Nordic questionnaire: sick leave in previous 12 months	1 year	23 (6%) Dutch nurses 18 (5%) Greek nurses

Study	Number of participants	Outcome	Time period	Reported results
Choobineh *et al* (2007)(127)	454			26 (5.7%)
Merlino *et al* (2003)(130)	996			16 (1.6%)
Madan *et al* (2008)(129)		Sick leave in previous year	1 year	9 (5%) UK office workers 11 (7%) UK manual workers 2 (3%) UK of Indian origin office workers 3 (4%) UK of Indian origin manual workers 5 (3%) Indian office workers 6 (3%) Indian manual workers
Tsauo *et al* (2007)(124)	157 (89 with prevalent neck pain)	Loss of work time in previous year		10/89 (11.2%)
Buitenhuis *et al* (2009) (132)	733	Work disability (includes working fewer hours)	Baseline 6 months 12 months	247/733 (33.7%) total, 13/247 (5.3%) self-employed, 152/234 (65%) paid blue collar employees 138/733 (18.9%) total, 9/138 (6.5%) self-employed, 78/129 (60.5%) paid blue collar employees 92/733 (12.6%) total, 7/92 (7.6%) self-employed, 51/85 (60%) paid blue collar employees

7.1.2 Settings and participants

The most relevant section of the Neck Pain Task Force systematic review looked at neck pain in workers (122). Fourteen studies on the course and prognosis of neck pain were included in this review. Only four of the included studies reported the impact of neck pain on work absence, these were: a random sample of 2342 Canadian workers claiming compensation for a back disorder, including neck pain: 38 male welders and metal workers with neck pain in construction companies in the Netherlands; and a cohort of 474 workers (blue and white collar) with neck or shoulder pain from the forestry industry in Finland.

Two of the subsequent studies found by the search strategy in our review recruited participants from healthcare settings. Scuderi *et al* (2005)(123) recruited their participants as they were referred to a single spine specialist in the USA with a diagnosis of neck pain as a result of a motor vehicle accident. Five hundred and thiry-one people were screened, of these 296 (56%), who had not responded to conservative treatment and had a single or two-level disc herniation confirmed by MRI, were included in the study. Vos *et al* (2008)(125) invited 249 patients consulting a general practitioner in The Netherlands with non-specific neck pain to take part in the study. Of the 190 who responded, 187 (75%) formed the inception cohort.

Five of the studies recruited their participants from the workplace. Tsauo *et al*. (2007)(124) aimed to assess prevalence and incidence of neck discomfort in sedentary workers from a computer technology company in Taiwan. Eighty-nine (57%) of the 157 study participants formed the prevalent subjects, with neck discomfort at the beginning of the study. The workers without neck discomfort at baseline were followed up over 6 months, with 12 (18%) developing neck discomfort and 17 (25%) being lost during follow up. Alexopoulos *et al* (2006)(126) and Gillen *et al* (2007)(131) recruited nursing personal and other hospital workers in Greece and The Netherlands, and the United States respectively. In the sample recruited by Alexopoulous *et al* (2006)(126), of the 393 Dutch and 351 Greek personnel, there were 152 Dutch personnel (39%) who reported neck complaints, and 165 Greek personnel (47%) who reported neck complaints in the previous 12 months. Gillen *et al* (2007)(131) conducted a case control study recruiting 166 hospital workers reporting a musculoskeletal disorder, there were a total of three referents to every case, with

166 of the controls being matched to the cases by job type, 166 being matched by shift type, and a further 166 random controls. Choobineh *et al* (2007)(127) investigated workers from an Iranian rubber factory where 91 (20%) of the 454 workers recruited reported neck pain in the 12 months prior to the study. Madan *et al* (2008)(129) conducted a cross sectional study investigating factory and office workers in India, and workers from the Royal Mail in the UK who were either white British or of Indian subcontinental origin; participants were categorised as either manual or office workers. Within the manual workers there were 12 (7%) individuals from India, 21 (29%) of Indian origin in the UK and 37 (23%) from the United Kingdom who reported neck pain in the previous month. From the office workers there were 26 (28%) from India, 13 (19%) of Indian origin in the UK and finally 44 (26%) white British individuals who reported neck pain in the previous month. Merlino *et al* (2003)(130) recruited 996 apprentice construction workers from four trade unions in the United States, and found that 33 females (49.2%) and 284 males (30.6%) reported prevalent neck pain. d'Almeida *et al* (2008)(128) conducted a record review of electric and gas company records in France, sickness absence records from 2000 to 2004 (5543 episodes) were studied using data from the company's epidemiology registry, and the authors reported that 11% of employees had neck MSD. Gillen *et al* (2007)(131) studied a diverse sample (cases and their matched referents) of hospital workers. There were 160 cases that were defined by a new acute or cumulative work-related musculoskeletal injury. Lastly, Buitenhuis *et al* (2009)(132) followed 733 people with neck complaints after traffic accidents, who had made compensation claims with a Dutch insurance company.

7.2 Results and measures of absence

Results of the studies reporting on the impact of neck pain on work absence are summarised in Table 23.

Five studies, two included in the Task Force on Neck Pain systematic review and the studies by Scuderi *et al* (2005)(123), d'Almeida *et al* (2008) (128), and Gillen *et al* (2007) (131), reported the mean number of work days lost. One of the studies reported in the review by the Task Force on Neck Pain (122) reported a mean of 14.6 lost workdays over 2 years follow-up, this was a study of welders and metal workers in

two construction companies and absence was identified from medical records. The second study identified from the Task Force on Neck Pain review presented the mean number of workdays lost in Canadian workers receiving compensation with absence identified from a computerised insurance database as 74.5 days (SD=12.6). Scuderi *et al*. (2005)(123) also studied people making workers' compensation claims and compared them with private injury claimants; mean number of lost works days were 37.1 and 4.7 respectively at 3 months follow-up, and 131.6 days and 28.7 days after 2 years follow-up. This was based on self-reported days lost from work from a single question in the questionnaire. Gillen *et al* (2007)(131) reported the mean number of lost workdays in the four weeks prior to the interview being completed. This was found to be a mean of 4 days with a standard deviation of 6.4 days in the 4-week period. This was based on self-report from adapted sections of the Chronic Pain Grade by Von Korff where disability resulting from neck pain was investigated (133). Finally, d'Almeida *et al* (2008)(128) reported a mean of 16.4 days sickness absence for those with neck pain.

Tsauo *et al* (2007)(124) asked participants, in a single question, whether their neck pain led to lost time from work. Of those with prevalent neck pain ten (11.2%) of the 89 people at the start of the study reported work absence due to their neck pain. One study by Viikari-Juntura *et al* (2000) (134) included in the Task Force review reported that 72% of the 429 people with neck pain included in their study had no sick leave and that 18% had taken more than 3 days sick leave (135).

Predictors of sick leave were evaluated in two studies in the systematic review from the Task Force on Neck Pain. One study reported that, in construction companies, metal workers were more likely than welders to have sick leave of more than three days. The other study by Viikari-Juntura *et al* (2000)(136) stated that blue-collar workers are more likely than white collar workers to have taken sick leave of longer than three days as a result of their neck pain.

Six of the studies looked into the percentage of workers taking sick leave in the year prior to the study (125-130). In the study by Vos *et al* (2008)(125), 52 (35%) of the 148 employed participants reported being on sick leave due to neck pain at baseline. The authors stated that almost half of the patients on sick leave returned to work

within 7 days. At 6 months seven (11%) of the participants that were still employed remained on sick leave. Of the participants employed at the 1 year follow-up 95% were at work and not on sick leave. Alexopoulos *et al* (2006)(126) measured absence with the Standardised Nordic Questionnaire (28) and reported that only 23 (6%) of the 393 Dutch nursing staff and 18 (5%) of the Greek nursing staff took sickness absence due to neck complaints in the year prior to the study. Choobineh *et al* (2007)(127), reported that 26 (5.7%) of the 454 employees from a rubber factory took sick leave due to neck pain in the last 12 months. Madan *et al* (2008)(129) also reported small percentages of sickness absence in their population of Indian and UK manual and office workers. Sickness absence in the past year resulting from neck pain was reported in 6 (3%) of the Indian manual workers, and also 7 (3%) of the office workers from India and the Indian workers residing in the UK. There were 3 (4%) of the manual workers from the Indian sub sample in the UK, 9 (5%) of the UK office workers and 11 (7%) of the UK manual workers who reported sickness absence due to neck pain in the previous year. Finally, Merlino *et al* (2003)(130) reported that 16 (1.6%) of their sample of apprentice construction workers in the United States had missed work due to a neck disorder in the past 12 months.

In the study by Buitenhuis *et al* (2009)(132), 247 (34%) reported having work disability (including absence from work and working fewer hours) at the baseline questionnaire, which was a median of 21 days after the traffic accident causing the injury. At 6 months those reporting work disability had gone down to 138 (19%) and 92 (13%) at the one-year follow up questionnaire. Only a small proportion of those on work disability were self-employed (5.3% at baseline, 6.5% at 6 months and 7.6% at 12 months). Of the employees on work disability at 6 and 12 months most were blue collar workers (60.5% and 60%, respectively).

7.3 Performance

Two papers reported on neck pain and its impact on work performance the quality appraisal of which are reported in Table 24 and the results of which are reported Table 25. One was a cross sectional survey by Forcier *et al* (2008)(111) and the other a case control study by Gillen *et al* (2007)(131). Gillen reported a follow up period of 24 months.

7.3.1 Settings and participants

Forcier *et al* (2007)(111) included 202 employees (89% response rate, N=226) from 4 supermarkets in Canada. Problems with the neck were reported by 44 (22%) of the supermarket employees. Gillen *et al* (2007)(131) recruited 166 individuals with a musculoskeletal disorder and 498 controls from workers in a hospital in the USA.

7.3.2 Results and measures of performance

The study by Forcier *et al* (2008)(111) administered a French version of the Standardised Nordic Questionnaire. Of those employees reporting neck pain 5 (11%) also reported that their problem prevented them from carrying out their regular work. Gillen *et al* (2007)(131) reported that work effectiveness was significantly lower among cases i.e. those with neck pain compared to controls i.e. those without neck pain. However, Gillen *et al* (2007) (131) did not clearly report the measure that they used and therefore the magnitude of this difference cannot be reported.

Table 24: Quality appraisal of studies reporting the impact of neck pain on work performance

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Forcier *et al* (2008)(111)	Partly	N/A	Partly	Partly	No	Unclear	**Moderate**
Gillen *et al* (2007)(131)	Unclear	Unclear	No	Unclear	Partly	Partly	**High**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

Table 25: Studies reporting the impact of neck pain on work performance

Study	Number of participants	Outcome	Time period	Reported results
Forcier *et al* (2008)(111)	202	Nordic Questionnaire: problems carrying out regular work	2 years	5 (11%)
Gillen *et al* (2007)(131)	6000	Work effectiveness (self-reported)	2 years	Mean score 84 (SD 25) work-related neck injuries vs. 92 (SD 16) job-matched controls

7.4 Evidence statements

- Neck pain and discomfort is common with a twelve-month period prevalence of between 5% and 20% ***Limited evidence**
- Across a range of settings about 1 in 20 people take sick leave for neck pain per year *****Strong evidence**
- Most sick leave attributed to neck pain lasts less than 7 days **Moderate evidence
- 20% of those taking sickness absence for neck pain will be off sick at 3 months ***Limited evidence**
- The presence of workers compensation and attribution has a strong effect upon sickness absence duration ***Limited evidence**
- There is **very** limited evidence for an adverse effect of neck pain upon work performance ***Limited evidence**

8. RESULTS – THE IMPACT OF UPPER LIMB PAIN ON WORK ABSENCE AND PERFORMANCE

Thirteen studies reported on work absence in people with upper limb pain (58;126;127;129-131;137-143), the quality of which is reported in Table 26 and the results of which are reported in Table 27. Work performance in people with upper limb pain was reported in three studies (111;131;143) the quality appraisal of which is reported in Table 28 and the results of which are reported in Table 29.

8.1 Absence

8.1.1 Study Designs

Three studies employed a cohort approach (58;139;142). Bültmann *et al* (2007)(58) recruited their Canadian sample of 632 individuals with musculoskeletal injuries to the upper extremity from the Workplace Safety and Insurance Board files. The second cohort was a dissertation paper by Miller *et al* (1998)(142) who carried out a study of 52 people with upper extremity disorders in the United States. Kuijpers *et al* (2006) (139) also employed a cohort approach to identify predictors for sick leave in shoulder pain in a cohort study of 350 Dutch people followed-up over 6 months.

Eight studies reported cross sectional data about the impact of upper limb pain on absence (126;127;129;130;138;140;141;143). Skov *et al* (1999)(138) assessed the amount of time taken off work by 802 people in Denmark with an occupational hand injury. Alexopoulos *et al* (2006)(126;141) conducted two cross sectional surveys, one of these investigated 393 Dutch and 351 Greek nursing personnel with shoulder complaints, and the other study investigated 853 shipyard employees with hand/wrist pain. Wijnhoven *et al* (2007)(143) conducted a cross sectional study recruiting 2517 workers from a population based study in The Netherlands. Choobineh *et al* (2007)(127) recruited 454 male production line workers from an Iranian rubber factory who reported a number of musculoskeletal problems including the area of the wrists and hands, elbows, and shoulders. Madan *et al* (2008)(129) recruited 814 participants from India and the United Kingdom who either worked in an office regularly using keyboards, or workers that carried out repetitive manual tasks. These workers were selected if they reported shoulder pain, elbow pain, arm pain, and hand and wrist pain. The final cross sectional study was carried out by Merlino *et al*

(2003)(130) who recruited 996 apprentice construction workers from the United States who reported having pain in the shoulders, elbows, wrists and hands. The final cross sectional study was included in the Task Force on Neck Pain systematic review (122). Viikari-Juntura *et al* (2000)(140) conducted a survey to evaluate the extent to which symptoms and signs in the neck and shoulders of 474 workers attending company occupational health services were associated with sick leave. Data was collected from the occupational health service medical records after a standardised examination protocol had been used to assess the participant.

There was one case control study examining upper limb pain by Gillen *et al* (2007)(131), which included hospital workers from the United States, 160 of whom reported an upper extremity musculoskeletal disorder and were recruited as cases, and 498 of whom who did not report an upper extremity musculoskeletal disorder and were recruited as controls.

Lastly, Hashemi *et al* (1998)(137) conducted a retrospective review of 21,338 workers' compensation insurance claims for work-related musculoskeletal upper extremity disorders in the United States.

Table 26: Quality appraisal of studies reporting the impact of upper limb pain on absence

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Alexopoulos *et al* (2006) (141)	Yes	N/A	Yes	Yes	Yes	Yes	**Low**
Alexopoulos *et al* (2006)(126)	Yes	N/A	Yes	Unclear	Yes	Yes	**Low**
Bültmann *et al* (2007)(58)	Partly	Yes	Yes	Yes	Yes	Yes	**Low**
Choobineh *et al* (2007)(127)	Partly	N/A	Yes	Partly	Yes	Yes	**Low**
Gillen *et al* (2007)(131)	Unclear	Unclear	No	Unclear	Partly	Partly	**High**
Hashemi *et al* (1998)(40)	Partly	N/A	Partly	Partly	No	Partly	**Moderate**
Kuijpers *et al* (2006)(139)	Unclear	Unclear	Unclear	No	No	Unclear	**High**
Madan *et al* (2008)(129)	Partly	N/A	Yes	Yes	Yes	Yes	**Low**
Merlino *et al* (2003)(130)	Partly	Partly	Yes	Unclear	Partly	Yes	**Moderate**
Miller *et al* (1998)(142)	Yes	Partly	Unclear	Yes	Yes	Yes	**Low**
Skov *et al* (1999)(138)	Partly	N/A	Partly	No	Unclear	Partly	**Moderate**
Viikari-Juntura *et al* (2000)(140)	Unclear	Unclear	Partly	Unclear	Unclear	Unclear	**Moderate**
Wijnhoven *et al* (2007)(143)	Partly	N/A	No	No	Yes	Partly	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study;

Low = low risk of bias in the study

8.1.2 Settings and participants

In the study by Hashemi *et al* (1998)(137) the sample was taken from an existing claims database, which represented approximately 10% of the United States private workers compensation market. This included 21338 claims relating to musculoskeletal diseases of the upper extremity. Bültmann *et al* (2007)(58) also used an existing compensation database (Workers Safety and Insurance Board Database) to identify participants for their study. The sample consisted of 632 individuals who had filed a claim for a musculoskeletal injury; all individuals were sent a baseline questionnaire and a follow-up questionnaire at six months after their injury. Wijnhoven *et al* (2007)(143) used data from a Dutch population based study the "Musculoskeletal Complaints and Consequences Cohort Study" which is a questionnaire based study of non-institutionalised Dutch inhabitants aged 25 years and older, however the types of occupation are not reported in this study.

Kuijpers *et al* (2006)(139), Skov *et al* (1999)(138) and Miller *et al* (1998)(142) recruited participants from a health setting. The sample in the study by Kuijpers *et al* (2006)(139) consisted of 350 Dutch people who were recruited at their first consultation for shoulder pain with a General Practitioner. At 6 months follow up 85% (298/350) returned a completed postal questionnaire. Skov *et al* (1999)(138) recruited participants from a hospital casualty department, with 1022 people with acute hand injuries invited to complete a survey questionnaire. The types of injuries are not reported and the majority may not have been relevant to this review. The survey had a response rate of 78.5% (802/1022). Miller *et al* (1998)(142) recruited participants via advertisements placed in various clinics and hospitals, with 52 individuals taking part. The participants in this study had work related upper extremity disorders, however it is not clear where the exact area of the upper extremity was causing the pain and so the results cannot be generalised to the other studies within this review.

Seven studies recruited participants from the workplace (126;127;129-131;140;141). The study by Viikari-Juntura *et al* (2000)(140) included a cohort of 474 workers (blue and white collar) from the forestry industry in Finland consulting the company occupational health service with a new episode of neck or shoulder pain. Data for all

474 was not available in the medical records, 426 (90%) had data from the physical examination, 460 (97%) symptom histories were recorded and 412 (87%) had both symptom history and physical examination data. Shoulder pain was recorded for 203 (43%) of the participants and 159 (34%) and 100 (21%) had reported upper arm and forearm pain, respectively.

Alexopoulos *et al* (2006)(126;141) completed two studies. The first investigated shipyard workers and recruited these from their workplace in The Netherlands. Here there were 853 workers, 73.2% of these being blue collar and the remaining 26.8% being white-collar workers. The second study by Alexopoulos *et al* (2006) included 744 nursing personnel who were recruited from nursing homes, large general hospitals and homes for the elderly. Choobineh *et al* (2007)(127) conducted their study among factory workers in a rubber factory in Iran. The study population consisted of 454 male production workers, working in 3 shifts and in 4 groups at 16 different units. At least half of those with at least one year of job tenure were randomly selected and included in the study, the mean job tenure being 6.8 years (SD 6.1). In this population 32.2% of the workers reported shoulder pain, 15.4% reported pain in the elbows, and 35% reported pain in the hands and wrists. Madan *et al* (2008)(129) recruited 814 individuals from the United Kingdom and India who were either classed as manual workers or office workers. In India the office workers were employed at a call centre, software house or other offices, and the manual group consisted of those working on production lines, whilst all of the UK workers were employed by the Royal Mail either in offices or sorting mail by hand. Apprentice construction workers (N=996) made up the population in the study by Merlino *et al* (2003)(130) who were recruited from four trade unions located in four states of the United States. Finally, Gillen *et al* (2007)(131) used data from an ongoing longitudinal case control investigation, where participants included 166 cases with upper limb pain and 498 pain free controls. Participants included hospital workers at two institutional sites, including nurses and other health care professionals, technical workers, administrators, clerical, and skilled and unskilled craft workers.

8.2 Results and measures of absence

The results for the impact of upper limb pain on work absence are summarised in Table 27.

The study by Hashemi *et al* (1998)(137) used insurance claims data to calculate the length of disability due to upper extremity disorders. For the claims that included at least one day of disability the median length of disability was 99 days (mean was 294 days). For all claims, including those without any compensated lost workdays the median was zero (mean was 87 days). Assessing all the compensation claims, 81% had a length of disability of 8 weeks or less, the length of disability for 71.6% of the claims was 1 week or less. Only 14% of the claims were for more than 16 weeks.

Kuijpers *et al* (2006)(139) also asked participants about duration of sick leave. Only 30% (89/298) had taken at least one day of sick leave for their shoulder pain, with 25% taking less than 6 weeks sick leave. Of the participants in this study 16% (47/298) reported taking more than 10 days of sick leave for their shoulder pain. Skov *et al* (1999)(138) also asked a single question relating to the duration of time off work due to acute occupational hand injuries. In this study 57% (457/802) took some time off work for their injury, with an average of 6.1 days per person being taken off work. However, only 14% took more than 10 days and just 7% reported more than 20 days off work. Hashemi *et al* (1998)(137) reported the cost of insurance compensation claims, from a US database. The total cost of all the disability claims for work-related upper extremity disorders was $130 million. However, only 20.8% of the claims cost more than $5000. About half the claims cost $500 or less and 15.4% were zero-cost claims.

Four studies looked for predictors of sick leave in people with upper limb pain (138-140;142). Kuijpers *et al* (2006)(139) found previous sick leave, more shoulder pain, perceived cause of strain or overuse & co-existing psychological complaints to be predictors of sick leave for shoulder pain. Skov *et al* (1999)(138) also found that those who had taken more sick leave in the past were more likely to take sick leave for hand injuries. In this study manual workers had a higher risk of taking time off work than blue-collar and privately employed workers. Clinical variables were also predictors

for taking time off work and the duration of leave taken. Similar predictors of sick leave for neck and shoulder pain were shown in the study by Viikari-Juntura *et al* (2000) (140). The authors found that having a blue-collar occupation and previous sick leave were predictors of taking more than three days sick leave for a combined group of people with neck and shoulder pain.

Miller (1998)(142) reported that the number of lost work days in one month follow-up were predicted by attorney consultation, previous lost work days, symptom severity, and support at work. Bültmann *et al* (2007)(58) reported the number of individuals that had returned to work at the baseline assessment after being absent from work due to a musculoskeletal problem and found that 110 (45.1%) of those who had not returned to work had reported an upper extremity disorder. Furthermore, 24 (27.3%) of those that had returned to work but had experienced recurrences of sick leave reported upper limb disorders, and a further 79 (27%) had returned to work and maintained work despite reporting upper limb pain. Gillen *et al* (2007)(131) reported the mean number of days lost from work during a four-week period prior to the baseline interview, the mean number of lost workdays due to upper extremity injury was 2.3 (SD 4.2). However, Gillen *et al* (2007)(131) do not specify which regions of the upper limb these concerns.

Six papers reported the number of people who took sick leave in a 12-month period due to an upper extremity disorder (126;127;129;130;141;143). The study that Alexopoulos *et al* (2006)(141) conducted into shipyard employees obtained absenteeism data from the company register. Here it was reported that for hand and wrist pain 2.6% of white-collar workers, 4.1% of metal workers, 2.2% of welders, and 2.9% of other blue-collar workers took sick leave over the 12-month period. In the second study by Alexopoulos *et al* (2006)(126) the authors asked nursing personnel if they had taken sickness absence due to shoulder complaints in the past year, it was found that 7% of the Dutch and 5% of the Greek personnel had taken sick leave. Choobineh *et al* (2007)(127) administered a self-report questionnaire asking about work absences relating to shoulder pain, elbow pain, and hand and wrist pain; the authors found that 9.9% of the sample took sick leave due to shoulder pain, 10.5% due to elbow pain, and 11.8% due to pain in the wrists and hands. Madan *et al* (2008)(129) asked their samples from the UK and India if they had experienced sick

leave in the past year due to shoulder, wrist/hand, arm and elbow pain. Elbow pain led to the least sickness absences with none of the office workers from India or those if Indian sub continental origin residing in the UK, and none of the Indian manual workers reported any absences due to elbow pain. Arm pain led to the highest proportion of sickness absences in these groups with 49% (N=33) of office workers from the UK with Indian continental origin and 47% (N=81) of office workers from the UK, and also 38% (N=29) of manual workers from the UK with Indian origin reporting sickness absence in the past 12 months. Merlino *et al* (2003)(130) asked a single question relating to work absence, this being 'during the past 12 months have you been prevented from doing work due to your condition?'. From the 996 construction workers in this sample, 1.8% reported absence due to shoulder pain, 1.1% due to elbow pain, and 3.4% due to hand/wrist pain. The final study reporting sickness absence in the previous 12 months was conducted by Wijnhoven (2007)(143) which was a population based study of 2517 individuals, participants were asked to answer yes or no as to whether they had taken work leave. Pain in the elbow, wrist and hand led to a mean number of 16 days sickness absence in males and 12.3 sickness absence days in females.

Table 27: Studies reporting the relationship between upper limb pain and work absence and the measures used

Study	Number of participants	Outcome	Time period	Reported results
Alexopoulos *et al* (2006) (141)	853	Work absence for hand/wrist pain (employer records)	1 year	2.6% for white collar 4.1% for metal workers 2.2% for welders 2.9% for other blue collar
Bültmann *et al* (2007)(58)	632 (214 with UL pain)	Work absence (WSIB database)	6 months	110/214 (39%)
Alexopoulos *et al* (2006)(126)	744	The Nordic questionnaire: sickness absence in the past 12 months	1 year	7% for Dutch nurses 5% for Greek nurses
Choobineh *et al* (2007)(127)	454	Work absence	1 year	9.9% for shoulder problems 10.5% for elbow problems 11.8% for wrists/hand problems
Skov *et al* (1999)(138)	802	Time off work after occupational hand injury		457/802 (57%)
Viikari-Juntura *et al* (2000)(140)	474	Days of sick leave	1-3 days >3 days	12% Shoulder 12% Upper arm 9% Forearm 23% Shoulder 24% Upper arm 28% Forearm pain
Hashemi *et al* (1998)(40)	21338	Work disability claims	<=1 week <=8 weeks >16 weeks	81% 71.6% 14%
Skov *et al* (1999)(138)	802	Time off work after	>10 days	14% (25% of those taking sick leave; 62%

Study	Number of participants	Outcome	Time period	Reported results
		occupational hand injury	>20 days	of days taken) 7%
Kuijpers *et al* (2006)(139)	350	Sick leave due to shoulder pain	> 10 days < 6 weeks 6 months	47/298 (16%) 25% 89/298 (30%)
Gillen *et al* (2007)(131)	166 cases 498 controls	Length of lost work time due to any cause	4 weeks	Mean 2.3 days (SD 4.2)
Hashemi *et al* (1998)(40)	21338	Compensated length of disability		Mean 294 days (of claims >1 day) Median 99 days (of claims >1 day) Mean 87 days (incl. 0 days off claims) Median=0 days (incl. 0 days off claims)
Wijnhoven *et al* (2007)(143)	2517	Length of work leave	1 year	Mean 16 days in men with elbow, wrist and hand pain Mean 12.3 days in women with elbow, wrist and hand pain
Skov *et al* (1999)(138)	802	Length of time off work after occupational hand injury		Average 6.1 days (range 0-180 days)
Hashemi *et al* (1998)(40)	21338	Cost of disability		Total cost £130 million 20.8% cost >$5000 61.2% cost <=$1000 50.4% cost <=$500 15.4% zero-cost claims
Madan *et al* (2008)(129)	165 178	Sick leave in previous year	1 year	Indian office workers: 2 (1%) Shoulder, 0 (0%) Elbow, 36 (22%) Wrist/Hand, 38 (23%) Arm Indian manual workers: 5 (3%) Shoulder, 0 (0%) Elbow, 11 (6%)

Study	Number of participants	Outcome	Time period	Reported results
	67 73 172 159			Wrist/Hand, 15 (8%) Arm Office workers in UK of Indian origin: 2 (3%) Shoulder, 0 (0%) Elbow, 32 (48%) Wrist/Hand, 33 (49%) Arm Manual workers in UK of Indian origin: 4 (5%) Shoulder, 3 (4%) Elbow, 25 (34%) Wrist/Hand, 29 (38%) Arm UK office workers: 9 (5%) Shoulder, 3 (2%) Elbow, 76 (44%) Wrist/Hand, 81 (47%) Arm UK manual workers: 13 (8%) Shoulder, 3 (2%) Elbow, 49 (31%) Wrist/Hand, 58 (36%) Arm
Merlino *et al* (2003)(130)	996	Prevented from doing work due to condition		1.8% due to shoulder pain, 1.1% elbow pain, 3.4% wrist/hand pain
Miller *et al* (1998)(142)	52	Predictors of lost workdays	1 month	Predicted by attorney consultation, previous days missed, symptom severity, and support at work.
Viikari-Juntura *et al* (2000)(140)	474	No work absence		65% Shoulder 64% upper arm 63% forearm

8.3 Performance

Three studies were identified that investigated the relationship between work performance and upper limb pain(111;131;143), the quality appraisal of these studies is reported in Table 28. Gillen *et al* (2007)(131) conducted a case control study of hospital workers with (N=166) and without (N=498) a musculoskeletal disorder in one hospital in the United States. Both Wijnhoven *et al* (2007)(143) and Forcier *et al* (2008)(111) conducted cross sectional surveys. Wijnhoven *et al* (2007) (143) recruited 2517 Dutch inhabitants with various occupations, whereas Forcier *et al* (2008)(111) employed a more specific sample investigating 202 supermarket employees from four supermarkets in Canada.

Table 28: Quality appraisal of studies reporting the impact of upper limb pain on work performance

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Forcier *et al* (2008)(111)	Partly	N/A	Partly	Partly	No	Unclear	**Moderate**
Gillen *et al* (2007)(131)	Unclear	Unclear	No	Unclear	Partly	Partly	**High**
Wijnhoven *et al* (2007)(143)	Partly	N/A	No	No	Yes	Partly	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

8.3.1 Settings and participants

Wijnhoven *et al* (2007)(143) used data from 2517 individuals from the Dutch population based Musculoskeletal Complaints and Consequences Cohort Study. From these individuals it was reported that the period prevalence of pain in the elbow, wrist or hand was 20.1% in men and 26.2% in women. Gillen *et al* (2007)(131) recruited 166 cases and 498 controls from workers in a hospital in the United States. Cases were those individuals with a new presentation of an acute or cumulative musculoskeletal injury. Forcier *et al* (2008)(111) recruited 226 employees from four supermarkets in Canada, with 89% (202) completing the study. From this sample 202 (22%) reported shoulder pain, 32 (16%) reported pain in the wrists and hands, and 19 (9%) reported elbow pain.

8.4 Results and measures of performance

The findings of the impact of upper limb pain on work performance are presented in Table 29.

Forcier *et al* (2008)(111) asked their sample to report whether the musculoskeletal disorder prevented them from carrying out their regular work. For those with shoulder pain 9 (21%) reported problems with their regular work, in addition to 6 (19%) with wrist or hand pain, and 5 (28%) with elbow pain.

Wijnhoven *et al* (2007)(143) report upper extremity pain that included the elbow, wrist and hand combined. For this combined group there were 27.4% of males and 32.6% of females reporting limited functioning due to their pain, in addition to 11.5% of males and 13.5% of females who reported ever being work disabled due to musculoskeletal problems in the elbow, wrist and hand.

Gillen *et al* (2007)(131) discovered that work effectiveness was 85% (+/- 23%) on the cases in this study compared to 92% (+/- 15%) in the controls, which indicates that controls reported being more work effective. Although the authors do not report how they calculated these figures.

Table 29: The impact of upper limb pain on work performance

Study	Number of participants	Outcome	Time period	Reported results
Forcier *et al* (2008)(111)	202	Nordic Questionnaire: problems carrying out regular work	2 years	9 (21%) with Shoulder pain 6 (19%) with wrist or hand pain 5 (28%) with elbow pain.
Wijnhoven *et al* (2007)(143)	N = 2517 F	Limited functioning (self-reported, yes/no) Work disabled due to problems in the elbow, wrist and hand		27.4% males 32.6% females 11.5% males 13.5% females
Gillen *et al* (2007)(131)	166 cases 498 controls	Work effectiveness		85 +/- 23% for cases vs. 92 +/- 15% for controls

8.5 Evidence statements

- Individuals with upper limb pain take very little sickness absence. ****Moderate evidence**
- The costs of sickness absence for upper limb pain are high. ***Limited evidence**
- Reports on the separate conditions are not common. ***Limited evidence**
- No indication of the impact of upper limb pain on performance. **–No scientific evidence**

9. MULTIPLE SITES

There were many papers that reported on multiple pain sites although they had measured individual areas when results were reported these areas were not split. The areas that are reported in this way are back pain with upper limb pain, back pain with neck pain, neck pain with upper limb pain, and back pain with neck pain and with upper limb pain.

9.1 Back pain with upper limb pain

Two studies reported on back pain with upper limb pain, and work absence (144;145) and one reported on work performance (146). Two of the studies were conducted in a workplace setting (145;146), and the third recruited participants from a database of registered insurance claims (144).

9.1.1 Absence

9.1.1.v Study types

Both of the papers reporting on absence were cohort studies, and their quality appraisal is reported in Table 30. The follow-up times varied between the studies with Crook *et al* (1998)(144) following up their sample 3, 9, 15 and 21 months after injury, and Franche *et al* (2007)(145) following-up their participants at 6 months post injury.

9.1.1.vi Settings and participants

In the study by Crook *et al* (1998)(144) the sample consisted of randomly selected compensated injured workers who had musculoskeletal injuries and who were considered to be at a high risk of developing chronic pain syndrome. These participants included a total of 148 patients amongst whom 71 (48%) reported low back pain, 13 (9%) reported upper limb pain, and 22 (15%) reported shoulder pain.

Franche *et al* (2007)(145) recruited participants from the "Workplace Safety and Insurance Board" claims database of Ontario Canada. The sample consisted of 632 individuals, 66.1% of these reporting back pain and 33.1% reporting upper extremity pain.

Table 30: Quality appraisal of studies reporting back pain with upper limb pain

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Crook *et al* (1998)(144)	Partly	No	No	Partly	No	Unclear	**High**
Franche *et al* (2007)(145)	Partly	Unclear	Unclear	Unclear	Partly	Partly	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study;

Low = low risk of bias in the study

9.1.1.vii Results and measures of absence

Table 31 reports the findings of the two studies that assessed the impact of back pain with upper limb pain and work absence.

Crook *et al* (1998)(144) administered the McGill Pain Questionnaire and the Functional Disability Subscale to all of their participants. The authors found that after 270 days 59 participants (40%) had not made at least one attempt to return to work. Functional disability was found to be significantly and negatively associated with returning to work, and modified work being available was significantly and positively associated with return to work in this population.

Franche *et al* (2007)(145) asked a single question relating to the number of workdays missed over the 6 month follow-up period. The mean number of self-reported days of work absence was 14.5 days (standard deviation 7.1 days).

Table 31: The impact of back pain with neck pain on absence

Study	Number of participants	Outcome	Time period	Reported results
Crook *et al* (1998)(144)	148	Work absence	21 months	40%
Franche *et al* (2007)(145)	632	Work days lost due to injury	1 month	Mean 14.5 days

9.1.2 Performance

9.1.2.viii Study types

One study reported on work performance in those reporting back pain with upper limb pain. Beaton *et al* (2005)(146) conducted a cohort study with follow up at 4 weeks and 12 weeks. The quality appraisal of this study is reported in Table 32.

9.1.2.ix Settings and participants

Beaton *et al* (2005)(146) recruited 45 individuals who worked for a newspaper and who were visiting a health professional with a new episode of pain.

Table 32: Quality appraisal of studies reporting the impact of back pain with upper limb pain on performance

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Beaton *et al* (2005)(146)	Partly	Partly	Unclear	No	No	Unclear	**High**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

9.1.2.x Results and measures of performance

Beaton *et al* (2005)(146) used the Roland Morris Questionnaire(147) and the Disability of the Arm, Shoulder and Hand (DASH) Questionnaire. Over the course of the study the authors found that their participants improved in relation to their overall problem and level of pain, but the paper was unclear in the reporting of results and the magnitude of this improvement was not reported.

9.1.3 Evidence statements

- The mean number of workdays missed due to back pain with upper limb pain was moderate. ***Limited evidence**
- Return to work after an episode of back pain with upper limb pain was achieved by a small majority of individuals. ***Limited evidence**

9.2 Back pain with neck pain

Five of the studies were identified that reported on the impact of back pain with neck pain on work absence(148-152). The impact of back pain with neck pain on work performance was reported by two studies (153;154).

9.2.1 Absence

9.2.1.xi Study types

Of the five papers that reported on the impact of back pain with neck pain on work absence, one reported a systematic review (149), two conducted cohort studies (151;155), one reported a cross sectional survey (152) and one employed a qualitative approach (148). Follow up in these studies ranged from 1 year (151) to 12 years(150). Table 33 reports the quality appraisal of these studies.

9.2.1.xii Settings and participants

One study recruited participants from an insurance office (148), and one study recruited participants from their workplace, these were Swedish rural farmers and rural non-farmers (150). Linton *et al* (1998)(151) and Linton *et al* (2000)(152) recruited potential participants from a community sample for two separate cross sectional studies, and the final study by Hansson *et al* (2004)(149) was a systematic review. Sample sizes ranged from 1914 (152) to 2305 (151). The quality appraisal of these studies are reported in Table 33.

Table 33: Quality assessment of studies reporting the impact of back pain with neck pain on absence

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Berglind *et al* (2002) (148)	Partly	No	Unclear	Yes	No	Unclear	**Moderate**
Hansson *et al* (2004) (149)	Yes	N/A	Unclear	Unclear	Unclear	Unclear	**Moderate**
Holmberg *et al* (2006) (150)	Partly	No	No	No	Partly	Yes	**Moderate**
Linton *et al* (1998) (151)	Partly	N/A	Yes	Yes	Partly	Yes	**Low**
Linton *et al* (2000) (152)	Partly	Partly	No	No	No	Partly	**High**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

9.2.1.xiii Results and measures of absence

The findings of the studies reporting on back pain with neck pain and the impact on work absence is reported in Table 34.

In the systematic review by Hansson *et al* (2004)(149) the 26 studies reviewed resulted in very limited evidence in the majority of the areas reviewed. All of the factors investigated were found to have no effect on influencing sick leave relating to back pain with neck pain, for example there was limited evidence between the studies that gender, previous sickness absence, higher age and workload had an impact on sick leave related to back and neck pain.

The cohort study conducted by Berglind *et al* (2002)(148) used single questions to ask about return to work, and the authors reported that 20% of workers had not returned to work at follow-up 2 years later. The second cohort study reported by Holmberg *et al* (2006)(150) asked questions about neck and low back pain and any sick leave that participants had ever had. From the 836 (47%) who reported current neck and back pain at survey one, 61 (7.3%) had ever been on sick leave.

The first cross sectional study reported by Linton *et al* (1998)(151) asked a single question on how many days the participant had been on sick leave for their neck or back pain. There were 438 (19%) participants with spinal pain reporting at least one day of official sick leave; 35 (8%) of these reported their sick leave being longer than 15 days. The second cross sectional study reported by Linton *et al* (2000)(152) partly replicated and extended the 1998 study, asking 1914 participants again about how many days they had been on sick leave due to their back or neck pain. In this sample it was found that 325 (17%) of those reporting spinal pain had taken sick leave during the previous year, with 45 (14%) reporting being off work without actually being sick listed.

Table 34: Studies reporting the impact of back pain with neck pain on absence

Study	Number of participants	Outcome	Time period	Reported results
Berglind *et al* (2002) (148)	289	Work absence		20% were not working at follow up
Hansson *et al* (2004) (149)	28 papers	Causes of sick leave attributed to back and neck disorders		Limited evidence on the confounding variables that influence back and neck pain related to work absence and performance
Holmberg *et al* (2006) (150)	1782	Sick leave (yes or no)	1 year	7.3% had been on sick leave
Linton *et al* (1998) (151)	2305	Sick leave for neck pain or back pain in the past 12 months?	1 year	19% had at least one day of official sick leave
Linton *et al* (2000) (152)	1914	Sick leave for neck pain or back pain in the past 12 months?	1 year	17% reported sick leave during the previous year

9.2.2 Performance

9.2.2.xiv Study types

There were two studies that reported on work performance related to back pain and neck pain (153;154), the quality appraisal of these studies is reported in Table 35. Both of these were cohort studies with Gillen *et al* (2004)(153) following participants up at 1 and 2 weeks and 1 and 3 months, and Hansson *et al* (2006)(154) following participants up at 28 days, 90 days, one year and two years.

9.2.2.xv Settings and participants

Gillen *et al* (2004)(153) recruited 90 participants through an occupational health clinic where their medical records were reviewed and then questionnaires were distributed to potential individuals. The population in Hansson *et al* (2006)(154) study were 1822 participants from Sweden who were recruited from 5 general insurance offices after being sick listed for at least 28 days due to their back or neck pain.

Table 35: Quality assessment of studies reporting the impact of back pain with neck pain on work performance

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Gillen *et al* (2004)(153)	No	Partly	Unclear	Partly	Unclear	Yes	**Moderate**
Hansson *et al* (2006)(154)	Partly	No	No	No	No	Unclear	**High**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

9.2.2.xvi Results and measures of performance

Table 36 reports the findings from the papers assessing the impact of back pain with neck pain on work performance.

Between the two studies reporting back pain with neck pain there were a number of varied validated measures used. Gillen *et al* (2004)(153) administered the Health Assessment Questionnaire and the Acute Version Medical Outcomes SF-36. It was

reported that although 82 participants (91%) returned to work, functional limitations as measured with the SF36 persisted over time. The participants in Hansson *et al* (2006)(154) completed the Von Korff Pain and Disability Score(133) and the Hannover Activities of Daily Living which assessed disability related to back pain. The results indicate that men had a higher quality of life and less functional impairment than the women in the study at the end of follow up. Although both of these studies use validated measures, neither one reports any clear statistical figures that can support whether back or neck pain impacts on work performance.

Table 36: Studies reporting the relationship between back pain and neck pain and work performance and the measures used.

Study	Number of participants	Outcome	Time period	Reported results
Gillen *et al* (2004)(153)	90	Work Effectiveness	4 weeks	Functional limitation persisted over time
Hansson *et al* (2006)(154)	1822	Von Korff's pain and disability scale		Men had less functional impairment than women

9.3 Evidence statements

- Sickness absence as a result of back pain with neck pain in the previous 12-months was common. ***Limited evidence**
- Functional limitation persists over time affecting work performance. ***Limited evidence**
- Functional impairment affects women to a greater degree than men. ***Limited evidence**

9.4 Neck pain with upper limb pain

Five studies reported on work absence alone(78;141;156-158), with a further three reporting on both work absence and work performance(78;159;160).

9.4.1 *Absence*

9.4.1.xvii Study types

All seven of the studies reported on the relationship between neck pain with upper limb pain and work absence. There is one cohort studies(156), two case series studies (157;160) and four cross sectional survey studies(78;141;158;159). The quality appraisal of these studies is reported in Table 37.

9.4.1.xviii Settings and participants

Three of the studies were conducted in a medical setting(156;157;160). The number of participants recruited varied greatly between the studies, from 10 in the study by Friedman *et al* (1997)(160) to 727 in the study by Bot *et al* (2007)(156). The remaining four studies recruited their participants from the workplace(78;141;158;159), with workplaces varying from Swedish Ambulance personnel (159), Greek Shipyard employees(141), laundry and dry cleaning establishments throughout The Netherlands (158), and computer workers from The Netherlands (78).

Table 37: Quality appraisal of studies reporting the impact of neck pain with upper limb pain on absence

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Aasa *et al* (2005) (159)	Yes	N/A	Yes	Yes	Yes	Yes	**Low**
Alexopoulos *et al* (2006) (141)	Yes	N/A	Yes	Yes	Yes	Yes	**Low**
Bot *et al* (2007) (156)	Partly	No	No	Partly	Partly	Yes	**Moderate**
Friedman *et al* (1997) (160)	Partly	Yes	Partly	Partly	Partly	Partly	**Moderate**
Himmelstein *et al* (1995) (157)	Partly	Partly	Partly	Unclear	Partly	Unclear	**Moderate**
Ijzelenberg *et al* (2004) (158)	Yes	N/A	Yes	Yes	Yes	Yes	**Low**
Kuijpers *et al* (2006)(139)	Yes	Partly	No	No	Unclear	Yes	**Moderate**
Nyman *et al* (2007)(103)	Unclear	No	Partly	Yes	Yes	Yes	**Moderate**
Viikari-Juntura *et al* (2000)(140)	Unclear	Unclear	Partly	Unclear	Unclear	Unclear	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

9.4.1.xix Results and measures of absence

Table 38 reports the results of the relationship between neck pain with shoulder pain and absence from work.

Bot *et al* (2007)(156) completed a 3 month follow-up on their sample of 383 patients recruited from general practices and asked a single question regarding the length of time the individual was absent from work because of their complaint since the baseline questionnaire was completed. From this sample 342 (89%) completed the follow-up questionnaire and it was reported that 40 (12%) had been on sick leave in the three months from baseline to follow-up. Van den Heuval *et al* (2007)(78) recruited 1738 computer workers from five different companies in The Netherlands and asked them if their musculoskeletal symptoms had caused disability from work for one day or more. Van den Heuval *et al* (2007)(78) reported that 32% of productivity loss in those with neck and shoulder symptoms was said to be caused by sickness absence.

Friedman *et al* (1997)(160) administered the Stanford Health Assessment Questionnaire where it was discovered that from those who were working at baseline, the average number of weeks absent was 3.1 (standard deviation of 9.7 weeks) in those with a work related upper extremity disorder. However it is not clear when the time frame was that the average weeks of absences were reported within.

The participants recruited by Himmelstein *et al* (1995)(157) were examined by an occupational physician and completed a number of questionnaires including a visual analogue scale to rate pain severity, and others that measured perceived control over pain from the Coping strategies questionnaire, fear of pain, and time away from work were measured with single questions. However, some of these were not validated measures and so it is unclear whether or not these measures could have introduced bias to the results. The results indicate that the length of time each patient was out of work or working with modified duties was between 6 days and 68 months (median 10 months). Furthermore 56 (44%) participants at baseline were totally work disabled due to their upper extremity disorder.

The Nordic Questionnaire(28) was administered in three of the studies (141;158;159). The reports of sickness absence relate to neck pain with upper limb disorders and therefore the findings are comparable among these studies. Aasa *et al* (2005)(159) reported that 15% of the female and 12% of the male Swedish ambulance personnel with a neck-shoulder disorder took sick leave in the previous 12 months. Alexopoulos *et al* (2006)(141) looked into varying occupational roles in a shipyard company, and discovered that 4.4% of white collar workers, 4.4% of metal workers, 7.5% of welders, and 5% of other blue collar workers took sick leave in the past year. Finally Ijzelenberg *et al* (2004)(158) reported that within a sample of laundry and dry cleaning employees, 54 (14%) took sick leave in the past 12 months due to neck and shoulder complaints.

Table 38: Studies reporting the relationship between neck pain with upper limb pain and absence from work

Study	Number of participants	Outcome	Time period	Reported results
Nyman *et al* (2007)(103)	817	Prevalence of sickness absence for back and neck pain (National Social Insurance Board)		49%
Aasa *et al* (2005) (159)	234	Standard Nordic Questionnaire: sick leave		13.5% with neck shoulder pain 12.5% with low back pain
Alexopoulos *et al* (2006) (141)	853			37.8% of white collar 43.3% of blue collar workers
Bot *et al* (2007) (156)	727	Work absence	3 months	12%
Ijzelenberg *et al* (2004) (158)	373	Work absence in last 12 months due to neck/shoulder/ elbow/wrist/hand pain?		54 (14%) of total sample – 25% (54/216) of those with upper limb or neck complaints
Nyman *et al* (2007)(103)	817	Sick leave	>14 days >180 days in a year	59% for concurrent LBP & neck pain 43% for concurrent LBP & neck pain (21% for solely LBP or solely neck pain)
Kuijpers *et al* (2006)(139)	350	Sick leave	>=1 day >10 days	30% 16%
Viikari-Juntura *et al* (2000)(140)	474	Work absence	1-3 days >3 days	9.6% 16.6%
Friedman *et al* (1997) (160)	106	Stanford Health Assessment Questionnaire: Duration of sick leave		Average 3.1 weeks
Himmelstein *et al* (1995) (157)	124	Length of work absence		Range 6 days to 68 months

9.4.2 *Performance*

9.4.2.xx Study types

Three studies reported on work performance in relation to neck pain with upper limb pain (78;159;160). Friedman *et al* (1997)(160) conducted a case series study, whilst Van den Heuvel *et al* (2007)(78) and Aasa *et al* (2005)(159) carried out cross sectional survey.

9.4.2.xxi Settings and participants

The study by Friedman *et al* (1997)(160) invited 106 individuals from 2 occupational rehabilitation clinics in New Zealand, where they completed a medical examination and a series of self-report questionnaires. Van den Heuvel *et al* (2007)(78) recruited participants from the baseline of another study the "Prospective Research on Musculoskeletal Disorders in Office Workers" (PROMO Study). All of the workers were invited to participate in the survey, with the final sample consisting of 1951 workers. Aasa *et al* (2005)(159) invited a random sample of 1,500 Swedish Ambulance personnel to complete a self-report questionnaire relating to disorders of the neck and shoulder regions. After two written reminders there were a total of 234 (78%) females and 953 (79%) males that responded and completed the questionnaire.

Table 39: Quality appraisal of studies reporting the impact of neck pain with upper limb pain on performance

	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall Risk of Bias
Aasa *et al* (2005)(159)	Yes	N/A	Yes	Yes	Yes	Yes	**Low**
Friedman *et al* (1997) (160)	Partly	Yes	Partly	Partly	Partly	Partly	**Moderate**
Van den Heuvel *et al* (2007)(78)	No	N/A	Partly	Partly	Partly	Partly	**Moderate**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

9.5.1.xxii **Results and measures of performance**

Table 40 reports the findings of the studies reporting the impact of neck pain with upper limb pain on work performance.

Friedman *et al* (1997)(160) administered the Stanford Health Assessment Questionnaire and it was found that self-rated disability scores best predicted work disability in this population. However, the reporting on the outcomes for work disability are not clear and so it cannot be concluded which aspects of work are affected.

Van den Heuvel *et al* (2007)(78) asked their sample a number of questions relating to performance including, have your symptoms slowed down your work pace? However this was not a validated measure. The authors reported that 507 (26%) participants reported productivity loss, and if the individual reported neck pain with shoulder pain 702 (36%) reported a loss in productivity. Of those reporting productivity loss 162 (32%) referred specifically to sick leave, but it is not clear how productivity was

affected in the other 68%. No details are given as to what is meant by a loss in productivity in this population.

Aasa *et al* (2005)(159) administered the Nordic Questionnaire(28) which asked the participants about activity limitations the authors reported that 10% of the female ambulance personnel and 7% of the male ambulance personnel had experienced some activity limitation during the previous year.

Table 40: Studies reporting the relationship between neck pain with upper limb pain and work performance

Study	Number of participants	Outcome	Time period	Reported results
Aasa *et al* (2005)(159)	234 females 953 males	Activity limitation in the previous year due to neck shoulder pain.	1 year	10% females 7% males
Van den Heuvel *et al* (2007) (78)	1951	Productivity loss: slowed down work pace or decreased working hours?		26%
Friedman *et al* (1997) (160)	106	Stanford Health Assessment Questionnaire		Self rated disability scores best predicted work disability in this population

9.6 Evidence statements

- Sickness absence in the previous 12-months was reported by the minority of individuals suffering neck pain with upper limb pain. ****Moderate evidence**
- Activity limitation and productivity loss was frequent in individuals reporting neck pain with upper limb pain. ****Moderate evidence**

9.7 Back pain with neck pain and with upper limb pain

Four papers reported on the combined impact of back pain with neck pain and with upper limb pain on absence(103;155;161;162). There were no papers that reported on the combined impact of back pain with neck pain and with upper limb pain work performance.

9.7.1 *Absence*

9.7.1.xxiii Study types

There was found to be 3 papers that employed a cohort study method (103;155;161), with the follow up periods being 1 year (155), 5 years (103), and 15 years(161). The final paper used a cross sectional survey to obtain their results(162). The quality appraisal of these studies is reported in Table 41.

9.7.1.xxiv Settings and participants

Pole *et al* (2006)(162) used the Workplace Safety and Insurance Board to identify their participants, and then they were contacted by telephone for further information. Lötters *et al* (2006)(155) enrolled their participants from their workplace, who were covered by the Workplace Safety and Insurance Board. Kjellman *et al* (2001)(161) used an existing database to identify potential participants and record their baseline data. The sample sizes from these studies varied from 166 (162) to 2329 (103).

Table 41: Quality appraisal of studies reporting the impact of back pain with neck pain and with upper limb pain on absence

Study	Study Participation	Study Attrition	Prognostic Factor	Outcome	Confounders	Analysis and Results	Overall risk of Bias
Kjellman 2001	Unclear	Partly	Unclear	Unclear	Unclear	Partly	**Moderate**
Lötters 2006(a)	Partly	No	No	Yes	Unclear	Partly	**Moderate**
Nyman 2007	Unclear	No	Partly	Yes	Yes	Yes	**Moderate**
Pole 2006	Partly	N/A	Yes	Yes	Yes	Yes	**Low**

Overall Risk of Bias – High = high risk of bias in the study that could have affected the results; Moderate = moderate risk of bias in the study; Low = low risk of bias in the study

9.7.1.xxv Results and measures of absence

The results from the studies reporting the impact of back pain with neck pain and with upper limb pain on work absence is reported in Table 42. Lötters *et al* (2006)(155) used the Roland Morris Disability Questionnaire and reported that the mean duration of sickness absence was 34 days with a standard deviation of 15 days. 51% of this was due to low back pain and 28% was caused by neck pain.

In Kjellman *et al* (2001)(161), a single question was asked relating to sick leave and it was reported that 26% were on sick leave for more than 28 days. Nyman *et al* (2007)(103) located the data on absenteeism from the National Social Insurance Board, reporting that the prevalence of sick leave in their sample was 49%. Pole *et al* (2006)(162) calculated the number of days absent for each individual from the Workers Social Insurance Database.

Table 42: Studies reporting the relationship between back, neck and upper limb pain and work absence and the measures used.

Study	Number of participants	Outcome	Time period	Reported results
Nyman *et al* (2007)(103)	817	Prevalence of sickness absence from the National Social Insurance Board	5 years	49%
Kjellman *et al* (2001)(161)	148	Sick leave for more than 28 days or granted disability pension	12 years	26%
Lötters *et al* (2006)(155)	187	No RTW Unsustainable RTW Sustainable RTW	1 year	49% (N=92) 12% (N=22) 39% (N=71)
Pole *et al* (2006)(162)	166	No RTW Unsustainable RTW Sustainable RTW	28 weeks	14.5% 19.9% 65.7%

9.7.2 Evidence statements

- Absence as a result of back pain with both neck and upper limb pain was longer-term. ***Limited evidence**
- High proportions of non-return to work were reported in individuals who had back pain with both neck and upper limb pain. ***Limited evidence**

10. DISCUSSION

10.1 Summary

The aim of this systematic review was to critically appraise and summarise the available evidence on the impact of back, neck and upper limb pain in adults, aged 18 years or over, on their performance or absence in the workplace. Systematic searches were carried out in two stages. Firstly a search of the systematic bibliography developed in phase one of this project (reference: BOHRF 227E05) was initially carried out to identify papers meeting the inclusion criteria (see section 3.1). Secondly, nine electronic bibliographic databases were searched to identify papers published after the completion of the systematic bibliography in phase one. In addition to the systematic searches of published research papers twenty-six organisations were contacted to request copies of any internal reports that they may have carried out in their organisations looking into the impact of back, neck or upper limb pain on absence and performance in their workplaces. A total of 153 papers including one organisational report were identified from the searches that met the inclusion criteria for the review.

The majority of papers included in the review assessed the impact of back pain on work (*n*=113 papers). Absence was researched more frequently than performance with almost three quarters of papers reporting on absence alone and approximately one in ten papers reporting both absence and performance. Cohort studies were the most frequently utilised study type (*n*=89 papers); this is appropriate for the research question that this review aimed to answer as cohort studies enable the direction of the association between musculoskeletal pain and work absence and performance to be established.

The results showed a wide range in estimates of the proportion of work absence and the length of absence, depending on setting, occupation, and definition of absence. In most studies work absence was of limited duration, only a small proportion of individuals had long-term absence. The large impact of pain on absence and performance was mainly the result of the high prevalence of these conditions in the working population, and the large proportion of workers taking (some) time off work. The review also provided information on factors that may predict absence or return to

work, including the number of pain problems and other comorbidities, but also social and cultural factors, and communication barriers. A summary of the results presented as evidence statements is given below.

10.1.1 Summary of the impact of back pain on work absence and performance

- The incidence of sickness absence attributable to back pain in workforces is 2.3 – 5.6% per year (higher figure for shorter absence definition) **** Moderate evidence**
- Job type influences whether individuals with back pain take absence from work. ***Limited evidence**
- From studies in the workplace the majority of people with back pain don't take sick leave ***Limited evidence**
- Absence from work over the past 12-months as a result of back pain was reported by 11% to 26% of study participants ****Strong evidence**
- 2/3 – 4/5 of those who do go off sick will RTW in one month. This appears to be similar regardless of whether recruited from workplace or healthcare setting ****Moderate evidence.**
- Modifiable predictors of shorter periods absence with at least moderate (****) evidence are
    - Earlier treatment
    - Less disability
    - Psychological factors – more so cognitive / illness perceptions than depression / anxiety (the latter possibly having a greater effect upon presenteeism than RTW)
    - job modification
    - perceived work stressors
- If compensation / insurance claims are made then the median time off is around one month (22-43 days) **Moderate evidence**
- 10-20% will still be off at 3 months (higher figure for those identified by longer absence initially) ****Moderate evidence**
- Recurrence of sickness absence secondary to back pain within 3 years 15-35% (higher figure for shorter absence) ****Strong evidence**

- Up to one in five individuals with back pain report that pain has had an adverse effect on work performance, either through modified or reduced duties *****Strong evidence**

10.1.2 Summary of the impact of neck pain on work absence and performance

- Neck pain and discomfort is common with a twelve-month period prevalence of between 5% and 20% ***Limited evidence**
- Across a range of settings about 1 in 20 people take sick leave for neck pain per year *****Strong evidence**
- Most sick leave attributed to neck pain lasts less than 7 days **Moderate evidence
- 20% of those taking sickness absence for neck pain will be off sick at 3 months ***Limited evidence**
- The presence of workers compensation and attribution has a strong effect upon sickness absence duration ***Limited evidence**
- There is **very** limited evidence for an adverse effect of neck pain upon work performance ***Limited evidence**

10.1.3 Summary of the impact of upper limb pain on work absence and performance

- Individuals with upper limb pain take very little sickness absence. ****Moderate evidence**
- The costs of sickness absence for upper limb pain are high. ***Limited evidence**
- Reports on the separate conditions are not common. ***Limited evidence**

10.2 Limitations and strengths of the review

This review has encompassed a wide range of literature ensuring the reviews scope is as broad as possible, however, there remain limitations to the review in addition to its strengths, both of which will be discussed in the following paragraphs.

10.2.1 Limitations of the review

All systematic reviews rely on evidence generated and published by others; this may be limited to some extent by the methodology of the studies or the clarity of the reporting. Therefore, a systematic appraisal of the risk of bias in each study was carried out. The most common shortcomings were poor reporting of the studies this is discussed further in section 10.3.

A further limitation is the broad scope of the review; this is a practical limitation. By including a range of musculoskeletal conditions and having a very broad remit i.e. the impact of those conditions on absence and performance with no limits on study type, occupation, country, or the measures used to assess absence and performance, lead to a large number of papers being identified. The difficulty with large systematic reviews arises in data management and the conclusions that may be drawn from the variety of papers identified, in that the heterogeneity of the papers can make the findings difficult to interpret, meaning results cannot be reported in detail. The large number of papers included in the review also leads to difficulties in summarising evidence in a systematic and structured way, this is addressed through the use of evidence statements, however the choice of which evidence to highlight is guided by the authors which may lead to bias in the interpretation of the findings.

There is the potential for publication bias in all systematic reviews, where papers that may have assessed the impact of pain on work are not published for a variety of reasons. The risk of publication bias is likely to be higher in observational studies, and could have affected the results of this review, if studies reporting higher rates of absence, or stronger associations between predictors of work absence and performance, had a higher probability of being published. Determining the extent of any potential bias may be assessed through contacting authors and asking if they have any papers or research that they have not published, however this was not possible in the current review due to the large numbers of authors identified. It is unlikely that publication bias has had a strong impact on the findings of the current review, given the extensive searches undertaken for this review, and the broad perspective taken when including research on the impact of pain on work. A further strength of the review was the systematic assessment of the quality of all studies in the review, which

provided an indication of the risk of bias in the included studies and will help to formulate more specific recommendations for future research in this area.

10.2.2 Strengths of the review

One of the main strengths of this review is the broad scope of literature that was included; although this was a practical limitation in terms of the amount of evidence appraised it is also a strength. In addition to the electronic databases of published research individual organisations were contacted to elicit internal reports attempts to include grey literature in the form of organisational reports is important, as organisations are less likely to publish reports in the scientific literature and there is the possibility of missing potentially relevant data. The response to the request for information from organisations was disappointing, however; one report has been included in the review from this method. In itself the outcome of the requests for information from organisations raises interesting questions. In the majority of cases it was unclear whether a non-response from the organisations indicated that they did not have an interest in the topic area, whether organisations were unwilling to release potentially sensitive information to outside agencies, or whether the request for information was received by the correct staff member.

10.3 Quality of papers versus the reporting of research

The Quality in Prognostic Studies (QUIPS) tool was made specific to our research question and used to assess the potential risk of bias of all the included observational studies. It was also possible to make some adjustments to use a similar scale for systematic reviews that have been included in the review. However, it was not possible to use this for qualitative studies, as this type of research has a very different purpose and assessing the risk of bias would not be appropriate.

An overall summary of the risk of bias across items is given for each study, which was necessary to provide the strength of the evidence for the summary statements at the end of each section. As for all averages, this overall judgement on its own does not fully describe the aspects of quality in the included studies. Individual items, such as study participation, attrition and outcome measurement, should be looked at to provide insight into the specific areas of poor or good quality in any study.

For the most part, it has been difficult to assess the methodological quality or risk of bias due to the high number of poorly reported studies included in this review. Where the reporting of the study is particularly poor, for example where all sections of the QUIPS scale are 'unclear', it has been assumed that there is also a high risk of bias. The other most common reason for studies being judged as having a high risk of bias was for not using validated measures for the prognostic factor, which in this review was the musculoskeletal pain condition, or for the outcome of interest, work performance and absence from work.

There needs to be an improvement in the standard of reporting of observational studies. The quality of reporting in randomised controlled trials has gradually improved since the wide acceptance of the CONSORT statement with journal editors and authors (163). It is hoped that the publication of the Standards of Reporting of Observational Studies (STROBE) will do the same for epidemiological studies (164).

10.4 Measures of absence and performance

There was a general lack of consistency in the measurement of both absence and performance; some of this inconsistency is due to the differing research questions and study types that each paper reported. However, in the workplace some standard measures would facilitate comparisons between workplaces and between conditions so it is important that measure of absence and performance are addressed.

10.4.1 Absence

The measurement of absence was generally more standardised than measures of performance, however the use of specifically designed and validated measures of absence was less common than the performance measures. This may be a result of absence being a more tangible concept to measure and therefore there is a longer history of researchers and employers measuring it. Additionally employers need to ensure that they maintain absence records to facilitate sick pay. Although sickness absence was generally well reported in this review there remain difficulties in comparing measures between studies as a result of the differing methods. It is interesting to note that only one study reported in two papers included in this review

utilised medical records, specifically sickness certificates, to measure absence from work (42;43). Measuring absence using sickness certificates brings its own difficulties, particularly in the UK where the first seven days of absence can be self-certified, but they are a clear indication that an employee has been absent from the workplace, and should be easily comparable across organisations and conditions.

Different definitions of short and long-term absence, criteria before reporting an absence and information systems (e.g. national vs organisational) complicate this area. Many studies used insurance databases to identify periods of work absence. Although this is not a validated method of measurement it would be expected that the insurance databases would be accurate due to the implications of errors in terms of costs to employers and potenteial compensation costs. Employers databases were used very occasionally to identify work absence in this review but there was no indication from the authors as to the completeness of these databases. There has been some published research assessing the quality of absence recorded in employment records compared to self-reported sickness absence. It was found that self-reported data was good when identifying the exact period of absence i.e. the specificity was high, however self-reported data was not found to be very sensitive (165;166). One reason for the differences in sensitivity could be the differing time periods in the recall of sickness absence (167), asking participants to recall absence over the past year will lead to more error than recall over the past week for example. There is also evidence to demonstrate that there is little discrepancy between self-report absence and absence recorded on employers databases (168), and also that the duration of absence differs considerably between self-report and employers databases (167).

When considering the findings of any research therefore, it is very important to look at the type and quality of the absence records that are being utilised, employers records may be very accurate or they may have a lot of missing information, whilst recall bias is a potential problem when asking individuals to report their absence over a long period. Furthermore, from the studies reported in this review it can be seen that when participants are asked single questions about their absence, as opposed to longer more structured questionnaires where absence is often only a small part, the frequency and duration of absence begins to vary widely suggesting that participants may be struggling to recall their absences. This underlines the importance of implementing

appropriate measurement of absence within the workplace to ensure that organisations are retrieving accurate data on their employees.

A report carried out by the Institute of Occupational Medicine for the Health and Safety Executive (HSE) in 2005 attempted to address some of the issues in identifying accurate figures for work absence (169). The report was commissioned as a result of the HSE's identification of the need for an agreed structure and guidelines for recording sickness absence, particularly in small and medium enterprises, where systems to record absence data were either lacking or non-existent. As this report was commissioned by the HSE there is an emphasis on the work-relatedness of sickness absence and developing systems that allow this absence data to be used by organisations and safety representatives was a core objective. Although the methods and the tool developed as part of this review could be used for all absences, work-related or otherwise. The report developed a tool that could be used within organisations to record absence and produced a classification system for absence with guidelines to enable non-medical personnel to make full use of absence recording systems. These guidelines provided information on the causes of absence and absence management with additional information on how to use the tool to record absence (169). Although this work was carried out in the UK the authors were disappointed by the lack of feedback that organisations provided about the use of the tool or the usefulness of the guidelines. Although the importance of recording and managing absence if clear within all organisations it seems as though there is some degree of reluctance in applying recording and management principles in the workplace. Whether this lack of feedback was because employers did not have an interest in absence, because they felt that the tool and guidelines developed did not apply to their organisation or because they already employed a method of recording and managing absence that they were happy with was not clear. However, the report (169) does go someway to highlighting the importance of organisations utilising appropriate systems for recording absence data, which cannot be underestimated in terms of increasing performance and productivity within organisation but also in developing and managing appropriate systems to enable staff with health conditions to manage their absence in the context of their work, in particular developing timely return to work strategies for those with longer term absence. The advantages of clear return to work strategies have been highlighted by Waddell *et al* (2008)(170), but without an

understanding of employee absence patterns, strategies cannot be developed to appropriately manage return to work.

10.4.2 Performance

Measurement of performance was limited with just 26% of all papers reviewed including an assessment of performance, furthermore the measures used to assess performance were mostly non-validated single items designed specifically for the study in which they were used. There are a range of performance measures available (171-173) although the majority have been developed and validated in the United States, these measures with appropriate validation, should be of some benefit in the UK. There are two methods that may be used in measuring performance in the workplace, self-reported performance and objective performance (such as the number of phone calls taken in an hour in a call centre). It is interesting to note that all the measures of performance identified as part of this review were self-report. Self-reported performance has benefits in that it can be used to gauge moral and job satisfaction whilst enabling employees to make a case for career development. Objective measures of performance have traditionally been used in a disciplinary context, but may also provide useful information for organisations to improve targets. Using standardised measures of performance within UK workforces would not only enable individual organisations to track their own performance but would enable comparison between companies and countries. Understanding an organisations performance would enable the identification of areas of good practice that could be enhanced and may identify areas of poorer performance where measures can be introduced to ensure that staff receive the appropriate support to enable them to increase their performance.

Productivity losses may occur without absence from the workplace and it has been estimated that on an average day 7% of respondents to a Dutch study were working with health problems suggesting that loss of productivity without absence is common (27). The findings of this review would support the suggestion that performance is affected without absence, especially when considering neck and upper limb pain, where absence was minimal for the majority of individuals. Furthermore, the economic costs of reduced performance in the workplace have been calculated as

greater than the combined costs of absence and healthcare in the US (9). It has been suggested that measuring performance itself may be more important than the actual measure used (9). However, there has been little research comparing different measures of performance in terms of their outcome and usefulness within organisations and without this research there is little to help organisations decide on the most appropriate measure for their specific needs. This is a clear area where further research needs to be carried out within organisations.

10.5 Settings of research

This review identified research that was undertaken in a variety of settings, not solely the workplace, in fact research conducted within the workplace contributed the fewest number of studies to the review overall. When comparing data across different settings there are some interesting differences. For example, in the back pain studies, the mean duration of absence is highest in studies using existing datasets (range 32 to 337 days absent) and lowest in studies where data is collected from the workplace (range 6 to 44 days absent). However, the number of individuals reporting absence over the previous twelve-months is lowest in participants recruited from healthcare settings at between 7% and 18% when compared to participants recruited from the workplace at between 15% and 27%. The data on duration of absence would suggest that there is a "healthy worker" effect, identified in routine databases. This may reflect the entry criteria for many of these databases in that they often identify a group who have taken a certain amount of sick leave e.g. 14 days. The findings that participants recruited from the workplace are more likely to report absence in the previous year than those recruited from a healthcare setting may indicate that although they are having fewer days absent they are having periods of absence more frequently. This could be a responding bias due to context, reflect different question construction, or time period. Alternatively, it may be that the workplace studies have some degree of Hawthorn effect where a participant's response is modified as a result of their being studied. A more plausible one is that studies in workplace settings take place in those work settings where back pain is an issue and seen as either a "reasonable" reason for absence e.g. nursing or where absence truly is higher.

These differences in findings between settings are an important consideration when assessing the impact of health in the workplace. There are implications associated with the measurement and management of absence; different measures may be more suitable in the workplace than in the healthcare setting, and the influence of absence management polices may also be seen in the findings, furthermore it is important to include individuals who are currently absent from work to ensure that a broad and clear picture of the health of employees in the workplace is attained.

10.6 Country

There were only six UK studies assessing the impact of back, neck and upper limb pain on work absence and performance. All six papers reported on back pain with one also reporting upper limb pain, absence was also reported by all papers with one also reporting on work performance and one also reporting the cost of back pain in terms of benefit costs. However, each of these studies reported different periods of absence, ranging from an annual prevalence of 6.2% to 44.3% reporting a period of absence in the previous twelve-months. The study that evaluated the impact of back pain on performance at work found that reduced duties as a result of back pain was reported by 11% of patients at baseline with 33% of these remaining on reduced duties at twelve-months. The study that reported on the costs of back pain estimated that the total costs of work-related benefits were £1,287,204 over the period of one year to the Jersey economy.

In summary the findings from the UK studies do not suggest that there is any great difference in the impact of back pain on absence or performance in the workplace than those studies conducted in other countries. It is important to highlight the gaps in the UK research in terms of assessment of absence and particularly performance, there also needs to be further investigation of neck and upper limb pain in a UK population as these conditions were found to have an adverse impact on work performance.

10.7 How do the findings of this review fit with other research?

Performance and absence are intrinsically linked and it has been demonstrated that reduced productivity is prevalent for approximately 60% of employees after return to work from a period of sickness absence (174). The median loss of productivity was estimated to be 1.6 hours per eight hour working day, this loss of productivity was associated with poor relations with supervisors in the workplace in addition to an individuals functional disability, furthermore recurrent sickness absence was the greatest predictor of future productivity loss(174). Other research has found that a third of employees have attended work despite feeling that they should perhaps have taken sickness absence, this was most common in those employees working in the care, welfare and education sectors (particularly nursing, midwifery and teaching professions)(175). Furthermore Hansen *et al* (2008)(176) reported that in a twelve month period 70% of the workforce included in their study went to work at least once will ill. Furthermore Hansen *et al* (2008)(176) found a number of factors that were associated with this presenteeism including, time pressures such as supervisory responsibilities and working long hours in addition to relationships with colleagues The findings from the current study appear to support this finding with those studies recruiting health professionals reporting slightly lower durations of work absence (section 6.1.2), although there was no data from the current review to assess performance by job type. The impact of health problems on work productivity was examined by Meerding *et al* (2005)(177) who found that about half of employees with health problems reported reduced productivity on their last working day, this was calculated to be a mean loss of two-hours per worker per day. The finding of this review that performance measurement is not common and is generally not conducted with validated measures (section 5.5) is concerning when the estimates of the impact of health on performance presented by Meerding *et al* (2005)(177) are considered.

A review by Coté *et al* (2008)(178) showed that risk factors associated with neck pain included a range of workplace cultural issues for example social support in the workplace, and health and safety issues such as suitable workstations i.e. design of workstations and posture of employees. These findings were supported by the current review where the culture of the workplace was important in whether employees were

absent from work and was also associated with employees return to work, but we found these issues in those individuals reporting back pain (section 6.1.1), it would appear that these are factors affecting all employees with poor health.

Appropriately managing return to work after a period of absence is very important and there is one paper that has aimed to understand return to work behaviours in employees with sickness absence. Shaw *et al* (2002)(179) aimed to identify how individuals perceptions of personal and environmental issues influence return to work. The authors found that one of the key aspect of returning to work was the individuals expectations, where opportunities in their current workplace were limited other opportunities were explored such as retraining or other employment opportunities. These findings underscore the findings of this review, where the individuals expectations for return to work had an impact on whether they did return or not, furthermore availability of modified duties was also associated with shorter durations of sickness absence (sections 6.1.1 and 6.1.2). It has been suggested that some of this expectation to return to work and also those remaining at work whilst ill, (presenteeism) which impacts upon performance, can be related to a "duty to work" this duty to work may have a positive impact on an individual in maintaining or returning to work or may be detrimental to an individuals health and performance(180). A systematic review of the qualitative literature on return to work after a musculoskeletal injury identified that goodwill and trust between all stakeholders are central to successful return to work, the authors also reported that there are often social and communication barriers to return to work and intermediaries have a key role in facilitating the return to work process(181).

Not only does the culture of the workplace impact upon return to work but there is also some evidence to suggest that it is associated with recurrence of sickness absence in those employees with musculoskeletal pain. Ijzelenberg *et al* (2005)(182) reported that poor social support and high job strain in the workplace was associated with recurrence of sickness absence. The involvement of all stakeholders in return to work process is paramount in developing a successful return to work plan for employees. But this return to work goal needs to be articulated and operationalised clearly and set within the context of the competing goals and environments in which the stakeholders are located (183).

In summary measuring absence and performance independently of each other may lead to some loss of information in terms of an employees experience of ill-health, we would advocate measuring both. However, both absence and presenteeism / performance are influenced not just by the health conditions and its severity, but also by the culture and communication within the workplace, family, social and other factors.

10.8 How do the findings of this review fit with current occupational health and Government recommendations?

The findings of this review need to be considered in the context of current occupational health guidelines, and Government initiatives, to ensure that the conclusions and recommendations are set within current advice and legislation.

10.8.1 Government initiatives and recommendations

The report "Working for a healthier tomorrow" (184) set out to review the health of the working age population in the UK. The authors recommended that workplaces need to take a greater role not only in preventing ill-health but also in managing and promoting health and well-being of employees. Additionally the report suggested that employers might play a part in promoting positive perceptions of fitness for work and facilitate return-to-work.

The business case for investing in employee health was made very clearly in the "Working for a healthier tomorrow" report, with advantages in reducing employee turnover, and increasing both the engagement and productivity of employees. As part of the report an examination of 55 case studies from organisations was carried out (185). Of the seven organisations who reported a benefit-cost-ratio (BCR) for wellness programmes, it was found that for every £1 spent the most an organisation recovered was £4.17 in programme benefits over a one year period. Of those case studies providing BCR figures immediate performance and financial benefits were seen across different types of organisations, sectors and firm sizes each with differing interventions (185). However the magnitude of these benefits did vary greatly from a

programme targeting medical costs with a BCR of £2.3 for every £1 spent to programmes targeting musculoskeletal issues with a BCRs of £15.4, £24.6 and £84.9 for every £1 spent (185).

The Government responded to the "Working for a healthier tomorrow" report with a range of provisions for individuals, healthcare professionals and employers (186). Employers will be provided with tools to help them understand the costs of absence, support to address individual employee health issues and funding to deliver more innovative health and wellbeing measures in the workplace. Given the difficulties reported in section 10.4.1 in implementing measures to record and manage absence in the work place, any initiative from the Government will need to be carefully tailored to ensure that it can be taken on by organisations. However the incentive of a funding stream, to be known as the "challenge fund" starting in 2009, aimed at promoting health and wellbeing in the workplace should go someway to enabling employers to meet some of the costs associated with interventions to manage health in the workplace.

10.8.2 Occupational health guidelines

There are some occupational health guidelines available for employers, which advise on the management of health problems in the workplace. These guidelines are freely available and can be easily incorporated into organisations to ensure employees and employers are aware of current recommendations. They are all published in leaflet form and freely available online, meaning that they can easily be accessed by both employers and employees. The publication "Work and health: Changing how we think about common health problems" (187) was designed to challenge how those who deal with health issues in the workplace think about these issues. The leaflet makes recommendations as to how employers could manage health issues as well as highlighting what not to do. A complementary publication "Health at work" (188) is aimed at employees and provides the same advice as that for employers, but the advice is tailored to address some of the myths surrounding working with health problems. The consistent observations of workplace factors affecting sickness absence duration and return to work in this review supports this approach. The final publication providing advice about working with health problems focuses on back pain "Back pain at work; a guide for people at work and their employers" (189). The

leaflet also provides advice and suggestions about how to manage back pain in the workplace and provides comparable advice to those of the previous two leaflets with an emphasis specifically on back pain. A recent publication is designed to address musculoskeletal issues in particular and provides a guide aimed at employers for the management of musculoskeletal pain in the workplace (190).

10.8.3 Additional research reports

The report entitled “Improved early pain management for musculoskeletal disorders” (191) reviewed the evidence for pain management interventions in individuals with a new onset of musculoskeletal pain, the interventions assessed were those designed to enable individuals to maintain or return to work. The authors found that job culture had more to do with avoiding withdrawal and inactivity than the individual’s gender or ethnicity. These findings are broadly in line with those reported in section 6.1.1 of this review, where having a positive culture in the workplace was found to improve return to work in individuals with back pain. Furthermore the authors reported that along with continued activity positive expectations of recovery were associated with reduced absence, again this is in line with the findings of this review as reported in section 6.1.1. Our review identified that individuals with pain in multiple sites reported longer durations of absence from the workplace (section 9), this was again supported by the review of improved early pain management for musculoskeletal disorders, where the authors reported that co-morbidities (in particular musculoskeletal co-morbidities) were associated with the duration of absence ad future disability from musculoskeletal disorders. In summary, although the focus of the report “Improved early pain management for musculoskeletal disorders” (191) was to assess interventions that were addressing an individuals pain, there were a range of factors identified which were associated with absence from work, and these factors were supportive of the findings of this review.

The report “Avoiding long-term incapacity; developing an early intervention in primary care” from the Peninsula Medical School (192) focussed on sickness absence from the healthcare professionals perspective. The report found that there was general support for early interventions to facilitate return to work, however as this report did not include employers their conclusions were limited to the impact on health services.

Whilst the findings of this report are important in identifying the issues associated with work absence to healthcare professionals the authors have not acknowledged the importance of including other stakeholders in the form of employers, which have been identified in the current review and also in other reports presented in this section of the review. Lastly a survey of the use of occupational health support by the Health and Safety Executive (193) found that there was a recognised lack of knowledge about how to deal with health issues, across all sectors. This was particularly true for micro and small companies which were more willing to consider sharing occupational support services than companies of other sizes. The report found that companies of all sizes and sectors would welcome greater access to advice on occupational health issues.

The issues identified by the Peninsula Medical School report (192) and the Health and Safety Executive (193) are being addressed to some degree by the UK Government with the introduction of recommendations from the report "Working for a healthier tomorrow" (186), where all stakeholders, individuals, employers and health professionals, are being involved in addressing the impact of health on work.

The National Institute for Clinical Excellence (NICE) has produced guidelines for managing long term sickness absence and incapacity for work (194). The report is again focussed on health professionals management of sickness absence and provides a pathway which should be used to facilitate return to work. However this pathway does not involve consultation with employers, and workplace modifications are considered to be intensive interventions to be offered after absence has been continuing for some time.

The findings of the current review would suggest that involving employers and providing workplace modifications at the earliest opportunity would improve return to work therefore reducing sickness absence (section 6.1.1).

11. RECOMMENDATIONS

11.1 Recommendations for employers

- Use of standardised measures of absence and performance
- Introduction of absence and performance measurement into the workplace, coordinating use of measures across organisations
- Standardised measurement of health conditions, as recommended by Health and Safety Executive report "Managing health at work"(169)
- Proactive management of employees with health conditions to facilitate early return to work or maintenance of work for example through the provision of modified duties
- Target a wider population of workers with brief low cost interventions rather than focussing on those with chronic pain conditions
- Consider the importance of social factors, culture and communication barriers in improving return to work
- Development of partnerships with researchers to facilitate useful measurement of employees health, absence and performance and to ensure that interventions can be evaluated appropriately

11.2 Recommendations for research

There are two priorities in our recommendations for researchers

- A strong requirement for adequately powered incipient cohort studies identifying people with new onset musculoskeletal pain (of whatever cause) and following the natural course of this to evaluate individual, organisational and contextual factors predicting and associated with performance whilst at work, decisions about absence, return to work and/or disability pensioning.
- Studies evaluating the absence and performance effects of primary prevention, indicated/targeted prevention and treatments in organisational / occupational health settings using the targets identified in this review.

Additional recommendations are as follows;

- Further development and validation of standardised measures of absence and performance

- Incorporation of measures of performance in addition to absence in assessment protocols in both observational and interventional studies
- Design studies comparing different types of performance measures to assess their utility within organisations and to assess their transferability to UK populations
- Develop and evaluate brief, early interventions targeting a wider population of workers with musculoskeletal pain that focus on maintaining work activities, or facilitating early return to work
- More consistency in reporting to enable comparisons to be made between studies (163;164)
- Stronger focus on other musculoskeletal conditions than back pain, such as neck or upper limb problems
- More focus on multiple pain sites; many workers have more than one pain problem, and this appears to have a negative impact on absence, performance and return to work
- Development of partnerships with employers to ensure measures of employees health, absence and performance are useful in the employment setting

12. CONCLUSIONS

In conclusion this review has highlighted the large impact of back, neck and upper limb pain, on absence and performance in the workplace. Although estimates vary widely, the evidence seems to indicate that a considerable proportion of the working population takes time off work for musculoskeletal pain, but that only a minority have long-term absence. Musculoskeletal pain not only leads to work absence but is also associated with reduced performance whilst staying in work. Social factors, culture and communication influence both absence and performance. The review has identified a number of issues that need to be considered by both employers and researchers. The first is measurement of absence and performance; very few standard measures were used, particularly when measuring performance meaning that comparison between studies was difficult. There was also a clear lack of research on neck and upper limb pain both of which were demonstrated to have an adverse effect on work performance. The proportion of studies that recruited participants from the workplace was surprisingly low given that the impact poor health has on work has been reported to be high. Back, neck and upper limb pain are very common in the workforce so it could be expected that a larger proportion of the papers would have recruited from the workplace. There is a strong need for good quality research on absence and performance that is carried out in the workplace.

The findings of this review can be considered in the context of governmental and occupational health recommendations. Firstly, the fit for work initiative advocates employers taking on some of the responsibility for managing health care making, very clearly, the business case for introducing wellness programmes. This initiative is supported by funding to enable employers to address some of the issues associated with working with ill health. There are already a range of occupational health guidelines available providing guidance and advice on the management of ill-health in the workplace, these guidelines are targeted not just at employers but also employees and health professionals. However, whether all parties are taking up this information is unclear. Organisations, researchers and public bodies need to address this uptake to ensure that good quality occupational health advice and support is provided to all people of working age, by all stakeholders.

Appendix 1: Search terms included in the systematic bibliography of employee health and occupational performance

Population	**Work (setting)**	**Health/illness**	**Performance**	**Interventions**	**Study type**	**Other**
Adults 16-65 years old At work inc. working at home Employed inc. self-employed and voluntary On sick leave Off sick Exclude: Unemployed Younger people (<16 years) Retired Retirement	Work Employment Occupation Workplace Office Business Factory Industry	Health Good health Wellness Wellbeing Resilience Hardiness Quality of life Illness Disease Sickness Disability Symptoms Pain Mood Fatigue Stress Work stress Job stress Musculoskeletal Back Neck Shoulder Knee Hip Minor mental health conditions Anxiety Depression Cardio-vascular disease **Exclude** Other health conditions/diseases Lifestyle factors (smoking, diet etc)	Work performance Performance Productivity Attendance Presenteeism Sub-optimal Performance Work capacity Work disability Absence Absenteeism Sick leave Sick certification Return on investment Output per head Profit per employee Job security Risk of unemployment	Attendance management Restricted working Light duties Reduced duties Absence management Absence policy Protective effects Buffers Mediators Moderators Stress management Health promotion Vocational rehabilitation	Scientific research Cross-sectional Case control Cohort RCT Case study Report Before-after study Pre-post Time series Case series Systematic review Qualitative research Interviews Correlation Regression Associations Predictors Prognostic factors Risk factors Exclude: Unsupported opinion/reviews Editorials Commentaries Letters	Person-environment fit WLB Social support Caring responsibilities Blue Flags Work perceptions Role conflict Ambiguity Management style Job satisfaction Job enrichment Symptom impact Yellow flags **Work retention & rehabilitation** Optimism Discretionary effort Black flags System obstacles Barriers/obstacles to recovery/ optimal function

Appendix 2: Full search strategy

1. WORK.SH.
2. (OCCUPATIONAL ADJ HEALTH).TI,AB,SH.
3. (OCCUPATIONAL ADJ (MEDICINE OR NURSING)).TI,AB,SH.
4. (WORKPLACE OR WORKER$).TI,AB,SH.
5. (OCCUPATION$ OR VOCATION$ OR JOB OR JOBS).TI,AB.
6. (OFFICE OR OFFICES).TI,AB.
7. (BUSINESS OR BUSINESSES).TI,AB.
8. (FACTORY OR FACTORIES).TI,AB.
9. (SELF ADJ EMPLOY$).TI,AB.
10. (VOLUNTARY ADJ WORK OR WORKING OR WORKER$).TI,AB.
11. (EMPLOYEE OR EMPLOYMENT).TI,AB,SH.
12. 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8 OR 9 OR 10 OR 11

13. (WORK PERFORMANCE).TI,AB,SH.
14. PRODUCTIVITY.TI,AB,SH.
15. (ATTENDANCE NEAR WORK).TI,AB,SH.
16. PRESENTEEISM.TI,AB,SH.
17. (SUB ADJ OPTIMAL OR SUBOPTIMAL).TI,AB,SH.
18. ((WORK OR WORKING) NEAR CAPACITY).TI,AB,SH.
19. (WORK NEAR DISABILITY).TI,AB,SH.
20. ((WORK NEAR ABSENCE) OR ABSENTEEISM).TI,AB,SH.
21. ((SICK OR SICKNESS) ADJ (LEAVE OR CERTIFICAT$)).TI,AB,SH.
22. (RETURN ADJ ON ADJ INVESTMENT).TI,AB,SH.
23. (OUTPUT ADJ PER ADJ HEAD).TI,AB,SH.
24. (PROFIT ADJ PER ADJ EMPLOYEE).TI,AB,SH.
25. 13 OR 14 OR 15 OR 16 OR 17 OR 18 OR 19 OR 20 OR 21 OR 22 OR 23 OR 24
26. (JOB ADJ SECURITY).TI,AB,SH.
27. (RISK NEAR UNEMPLOYMENT).TI,AB,SH.
28. TURNOVER.TI,AB,SH.
29. RETENTION.TI,AB,SH.
30. (HEALTH ADJ COSTS).TI,AB,SH.
31. (WORKERS ADJ COMPENSATION ADJ (COST OR COSTS)).TI,AB,SH.
32. (JOB ADJ SATISFACTION).TI,AB,SH.
33. COMMITMENT.TI,AB,SH.
34. LOYALTY.TI,AB,SH.
35. (COST ADJ (BENEFIT OR EFFECTIVENESS)).TI,AB,SH.
36. (PRODUCTIVITY ADJ MANAGEMENT).TI,AB,SH.
37. 26 OR 27 OR 28 OR 29 OR 30 OR 31 OR 32 OR 33 OR 34 OR 35 OR 36

38. 25 OR 37

39. MUSCULOSKELETAL.TI,AB,SH.
40. (BACK NEAR (ACHE$1 OR PAIN)).TI,AB,SH.
41. ((SPINE OR SPINAL OR LUMBAR) NEAR PAIN).TI,AB,SH.
42. ((NECK OR CERVICAL) NEAR PAIN).TI,AB,SH.
43. ((SHOULDER OR SHOULDERS) NEAR PAIN).TI,AB,SH.
44. ((UPPER ADJ (LIMB OR EXTREMIT$)) NEAR PAIN).TI,AB,SH.
45. ((HAND OR HANDS OR WRIST$ OR FINGER$ OR THUMB$) NEAR PAIN).TI,AB,SH.
46. (OSTEOARTHRITI$ OR ARTHRITI$).TI,AB,SH.
47. FIBROMYALGIA.TI,AB,SH.
48. 39 OR 40 OR 41 OR 42 OR 43 OR 44 OR 45 OR 46 OR 47

49. (STUDY OR STUDIES).TI,AB,SH.
50. SURVEY.TI,AB,SH.
51. INTERVIEW$.TI,AB,SH.
52. QUESTIONNAIRE$.TI,AB,SH.
53. PT=CONGRESSES OR PT=CONTROLLED-CLINICAL-TRIAL OR PT=EVALUATION-STUDIES OR PT=GUIDELINE OR PT=META-ANALYSIS OR PT=MULTICENTER-STUDY OR PT=REVIEW OR PT=VALIDATION-STUDIES
54. ((SYSTEMATIC ADJ REVIEW) OR (META ADJ ANALYSIS)).TI,AB,SH.
55. ((CROSS ADJ SECTIONAL) OR OBSERVATIONAL)).TI,AB,SH.
56. (CASE ADJ (CONTROL OR STUDY OR STUDIES OR SERIES)).TI,AB,SH.
57. COHORT.TI,AB,SH.
58. 49 OR 50 OR 51 OR 52 OR 53 OR 54 OR 55 OR 56 OR 57
59. (RCT OR (RANDOMI$ OR RANDOM OR RANDOMLY)).TI,AB,SH.
60. (BEFORE ADJ AFTER).TI,AB,SH.
61. (PRE ADJ POST).TI,AB,SH.
62. (TIME ADJ SERIES).TI,AB,SH.
63. (CORRELATION OR REGRESSION OR ASSOCIATION OR ASSOCIATIONS).TI,AB,SH.
64. PREDICTOR$.TI,AB,SH.
65. (PROGNOSTIC OR PROGNOSIS).TI,AB,SH.
66. (RISK ADJ FACTORS).TI,AB,SH.
67. 59 OR 60 OR 61 OR 62 OR 63 OR 64 OR 65 OR 66
68. 58 OR 67

69. 12 AND 38 AND 48 AND 68
70. PT=COMMENT OR PT=LETTER OR PT=EDITORIAL

69 NOT 70

Appendix 3: Letter to experts and organisations

Arthritis Research Centre National Primary Care Centre
Primary Care Sciences
Keele University
Staffordshire, ST5 5BG
Tel: 01782 583905
Fax: 01782 583911
Email: j.cowen@cphc.keele.ac.uk

June 2008

Enc.

Dear Sir/Madam

My colleagues and I are constructing a systematic review of the impact of back, neck and upper limb pain on work performance and absence from work, funded by the British Occupational Health Research Foundation (BOHRF).

We are aware that many organisations produce reports on occupational health at work, and in order to create a comprehensive a bibliography we need to identify and collate copies of as many of these reports as possible.

We are writing to you to ask if you or your organisation could provide any information, reports, presentations, research papers or other documents to aid our review. I enclose our aims to clarify what information we are looking for.
We would be extremely grateful if you could assist us in our research.

Yours Sincerely

Jemma Cowen

OBO:

Professor Chris .J. Main

Professor Danielle van der Windt

Dr Nicholas Glozier

Dr Gwenllian Wynne-Jones

Mrs Jo Jordan

Project aim

To systematically critically appraise and summarise the best available evidence on the impact of back, neck and upper limb pain on performance in the workplace and absence from work through a search of electronic bibliographic databases, hand searching relevant journals and reference lists, and contacting experts and organisations.

Research questions

We are looking for literature to address the following topics:

1 Identify the best available evidence evaluating the effect of back, neck and upper limb pain on performance or attendance at work.

2 Summarise the evidence of the overall impact of back, neck and upper limb pain and also consider the separate affects of back, neck and upper limb pain.

3 Evaluate the range of outcome measures used to assess work performance and absence from work for people with these conditions.

Outcome measures that we will consider include:

- Employee self assessment
- Task specific measures (for example, number of phone calls answered in a call centre)
- Work absence – both objectively and self-assessed
- Functional disability
- Cost and cost effectiveness

Appendix 4: Timetable for conducting the systematic review

June-08	RA (Jemma Cowen) starts	Background reading (All)	Additional electronic & database searches (JJ, JC)	Contact Organisations & experts (GW-J, JC)
July-08	Sift titles and abstracts (JC, GW-J, JJ)	Develop data extraction forms (GW-J, JC, ZM)	Start putting 1st report together (GW-J)	
August-08	Sift titles and abstracts (JC, GW-J, JJ)	Draft report mid-Aug (All)	Review report (CM, NG, DvdW)	Revise & submit report to BOHRF (GW-J, JJ, JC)
September-08	Critical Appraisal & data extraction (JC, GW-J, JJ)			
October-08	Critical Appraisal & data extraction (JC, GW-J, JJ)			
November-08	Critical Appraisal & data extraction (JC, GW-J, JJ)	Draft report mid-Nov (All)	Review report (CM, NG, DvdW)	Revise & submit report to BOHRF (GW-J, JJ, JC)
December-08	Synthesise work performance measures (JC, GW-J)	Summary tables for main review (JC, JJ)	Meta-analyses for main review - if necessary (JJ, JC)	
January-09	Synthesise work performance measures (JC, GW-J)	Summary tables for main review (JC, JJ)	Meta-analyses for main review - if necessary (JJ, JC)	
February-09	Summary tables for main review (JC,	Draft report mid-Feb (All)	Review report (CM, NG, DvdW)	Revise & submit report to BOHRF

	JJ)			(GW-J, JJ, JC)
March-09	Summarise evidence (JC, GW-J, JJ)			
April-09	Summarise evidence (JC, GW-J, JJ)	Draft final report (JC, GW-J, JJ)	Draft journal papers (JC, GW-J, JJ)	
May-09	Draft final report (JC, GW-J, JJ)	Draft journal papers (JC, GW-J, JJ)	Review final report (CM, NG, DvdW)	Revise & submit final report to BOHRF (GW-J, JJ, JC)
June-09	Review, revise & submit journal papers (All)	Make revisions to final report & re-submit (All)		
July-09	Review, revise & submit journal papers (All)	Make revisions to final report & re-submit (All)		

Appendix 5: Quality assessment and details of each study included in the review

See additional document; Summary tables

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