Physicians’ beliefs in the assessment of work attribution when reporting musculoskeletal disorders

Y. Chen¹, R. Agius¹, R. McNamee², S. Turner¹, S. Taylor¹, L. Fulluck¹, S. Lines¹, C. Roberts¹ and L. Hussey¹

Background
There is considerable uncertainty about work-relatedness and musculoskeletal disorders in general, and it is also not clear how physicians decide whether work has caused a disorder in an individual patient.

Aims
To investigate physicians’ beliefs about assessment of occupational attribution for work-related musculoskeletal disorders.

Methods
A questionnaire survey was sent to 526 occupational physicians and 248 rheumatologists on: characteristics of cases seen, assessment of work attribution, definition of work-relatedness and threshold for case reporting. Continuous variables were analysed by mean, standard deviation, an independent two-sample t-test and the Mann–Whitney test. Mean and median values were calculated and Spearman’s rank test was applied to ranked data.

Results
Questionnaires were completed by 68% occupational physicians and 64% rheumatologists. Both groups of physicians believed that ‘history of onset in relation to workplace changes’ and ‘symptoms consistent with work exposure’ were the most important factors suggesting work attribution. They considered that the most important objective of a reporting scheme was detection of trends in disease incidence and that the most suitable criteria for defining work-relatedness was the probability that exposure at work ‘more likely than not’ caused the condition (mean 0.73; SD = 0.17), in a perceived likelihood scale (0–1).

Conclusion
There was a strong agreement between occupational physicians and rheumatologists on questions about work-relatedness and musculoskeletal disorders. The level of probability for concluding work-relatedness has been quantified.

Key words
Attribution; musculoskeletal; occupational; physician; subjective probability; surveillance and disease reporting; work-relatedness.

Introduction
Musculoskeletal disorders are common [1,2] and may involve nerves, tendons, muscles and supporting structures of the body [3]. They may be vague (e.g. diffuse forearm pain) or well defined (e.g. carpal tunnel syndrome). Although not often caused by work, musculoskeletal disorders comprise a major proportion of reported work-related ill health and accounted for half of the prevalent cases and for 40% of working days lost in a survey of self-reported illness [4].

A number of epidemiological studies have shown associations between musculoskeletal disorders and work-related physical risk factors [3,5,6]. Although their aetiological roles remain inconclusive, psychosocial risks may also contribute [7,8]. Musculoskeletal disorders are multifactorial in nature and often chronic or recurrent. This creates difficulties in the clinical assessment of work-relatedness, especially as exposure to hazards may occur both at work and away from work [9].

An increasing number of epidemiologic studies have been published on the work-related aetiology of musculoskeletal disorders, but limited attention has been paid to studies of causation in individual patients. The assessment of causality in an individual patient follows a decision making process [10] which, deals with actual causes (e.g. frequent heavy lifting producing back pain in this patient) rather than general causes (e.g. frequent heavy lifting.
causing back pain) [11]. It is not clear how clinicians decide whether, work has caused a disorder in an individual patient, or the level of certainty of this decision.

Surveillance systems such as The Health and Occupation Reporting network (THOR) have been set up to collect information on incident cases to allow targeted prevention and better control of work-related disorders. THOR involves the voluntary reporting of work-related musculoskeletal disorders by two groups of clinical specialists (occupational physicians and consultant rheumatologists). Participating rheumatologists report work-related musculoskeletal disorders to Musculoskeletal Occupational Surveillance Scheme (MOSS). Occupational physicians report all kinds of work-related ill health to Occupational Physicians Reporting Activity (OPRA), with nearly half of OPRA cases being musculoskeletal disorders. MOSS and OPRA are the two of the seven component schemes within THOR and methods of reporting have been described in detail previously [22,23].

An important quality indicator for a surveillance scheme is having a clear definition on what is reportable. When a case is reported, the physician has made a clinical diagnosis, and also an aetiological link attributing the cause of the disorder to work. A judgment on attribution may be contentious and perhaps more difficult for musculoskeletal disorders than occupational asthma or occupational contact dermatitis. To date, there is no clear or generally agreed case definition on work-relatedness for musculoskeletal disorders. Guidelines have been developed based on consensus methods for clinical diagnosis [6,12–15] and for assessment of work-relatedness for upper extremity musculoskeletal disorders [6, 16–17]. However, limited information is available on how physicians use guidelines (if at all) to assess work attribution in clinical settings, and also how to effectively disseminate and implement such guidelines [18–19].

Diagnoses made by clinical specialists are likely to be more accurate than self reports or employer reporting, but physicians’ subjective judgments are related to the strength of their beliefs [10,20], as well as the strength of available evidence [21]. Having a better understanding of physicians’ beliefs on work attribution for musculoskeletal disorders is important for interpreting surveillance results.

A questionnaire survey was designed for rheumatologists and occupational physicians on assessment of work attribution when reporting musculoskeletal disorders. The survey aimed to investigate physicians’ beliefs and to compare results between occupational physicians and rheumatologists.

Methods

A self-administered questionnaire was conducted among 526 occupational physicians and 248 consultant rheumatologists in 2004. Physicians in this study were UK-wide clinical specialists who reported to THOR.

The questionnaire was developed following appraisal and review of existing research on the work-relatedness of musculoskeletal disorders, and elements in the clinical

<table>
<thead>
<tr>
<th>Table 1. Clinical characteristics of the physicians</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics</td>
</tr>
<tr>
<td>n^a</td>
</tr>
<tr>
<td>Number of years as a consultant rheumatologists or practicing occupational medicine (years)</td>
</tr>
<tr>
<td>Number of new cases of musculoskeletal disorders seen per week (cases)</td>
</tr>
<tr>
<td>Estimated proportion of new cases seen that are work-related (%)</td>
</tr>
<tr>
<td>Time spent in each new clinical consultation (minutes)</td>
</tr>
<tr>
<td>Distribution of new cases by body region (%)</td>
</tr>
<tr>
<td>Upper limb disorders</td>
</tr>
<tr>
<td>Neck problems</td>
</tr>
<tr>
<td>Back problems</td>
</tr>
<tr>
<td>Disorders of other regions</td>
</tr>
<tr>
<td>Total number of physicians:</td>
</tr>
</tbody>
</table>

^a Number of physicians providing information.

^b Differences between two groups of physicians, P values were derived from independent t-test or nonparametric two sample test (Mann–Whitney) for continuous variables.

^c P values were derived from independent t-test for continuous variables.

^d P values were derived from nonparametric two sample test (Mann–Whitney) for continuous variables.
decision-making process. It consisted of three sections; section (II) is the main focus of this study.

In section (I) we asked about clinical practice including numbers and types of new cases, and the proportion of work-related cases seen (Table 1).

In section (II), we asked physicians what prompted them to consider a condition to be work-related, offering possible options for consideration, and asking them to select those they agreed with and to rank them (Table 2). Physicians were also asked about defining work-relatedness and to agree or disagree with 6 potential defining criteria (Table 3). Finally, we asked physicians to specify their threshold for reporting of work-relatedness from 4 categories; 'definitely work-related', 'more likely than not work-related', 'probably work-related' and 'possibly work-related', and to assign a range of values of probability to categories on a likelihood scales of 0–1 (with intervals of 0.1). Mid-point values of these given ranges were used in the analysis.

In section (III), we asked for the physician's understanding of the objectives of the surveillance scheme, and for views on improving the assessment of work-relatedness. Once again, physicians were asked to select and rank objectives (Table 4) and improvements (Table 5), which matched their thoughts.

Options were listed alphabetically to assist objectivity, and the same questionnaire was used for occupational physicians and rheumatologists. Physicians’ opinions were anonymized, but a number linking a questionnaire to an individual reporter was included to allow collection of response rate data.

Before the questionnaires were distributed to the 800 participating physicians, a pilot study was conducted among members of the advisory committees for MOSS and OPRA and research staff. The final version resulted from their feedback.

Two months after the initial mailing, a second mailing of the original questionnaire was sent to non-responders. A further two months after the second mailing, a one page short questionnaire was faxed to half the non-responders. This short questionnaire comprised 3 questions: whether they considered that work attribution could be assessed for the purpose of reporting, the reasons for not responding to the original questionnaire, and the average number of cases they would see in practice. We also investigated physicians’ past history of routine reporting in MOSS and OPRA.

For continuous variables, arithmetic mean and standard deviation were calculated. Independent 2 sample t-tests and Mann–Whitney tests were used to assess the significant level of differences.

For ranking measures, both mean rankings and median rankings were calculated, with a small proportion of physicians choosing not to rank some of the listed items. A preliminary review of the ranked data showed that the lower the mean ranking the less likely the item would be chosen, therefore the lowest rank was assigned to non-chosen items (for example, if the lowest rank was 9, the non-chosen items would be ranked 10). At an individual item level, the Mann–Whitney test was used to assess differences in rank between two groups of physicians. Subsequently, for all items, the Spearman’s rank correlation test was used to examine the two distributions of rank from the two groups of physicians.

In the case of a dichotomous measure, such as ‘Yes’ (agree) and ‘No’ (disagree), a Yes/No ratio was calculated; the higher the ratio the more suitable the criterion when assessed by groups of physicians.

The statistical package SPSS version 11.5 was used to carry out the analysis.

Ethical approval was obtained from the North West Multi-centre Research Ethics Committee (MREC) for the THOR surveillance scheme.

Results
In total, 406/526 (77%) occupational physicians responded to the survey and 354 (67%) completed the questionnaire; 186/248 (75%) rheumatologists responded to the survey and 168 (68%) completed the questionnaire. Among the physicians who responded but did not complete the questionnaire, some had retired or withdrawn from the scheme since the mailing of questionnaire and others had completed a short questionnaire, with most considering that work attribution could be assessed for the purpose of reporting.

A review of physicians’ reporting to OPRA and MOSS in the previous 5 years showed that physicians who responded to this survey were more likely to report to the main schemes. For occupational physicians, the average annual reporting rate was 94% (SD = 17%) among responders and 75% (SD = 32%) among non-responders; for rheumatologists, the corresponding rates were 92% (SD = 17%) and 56% (SD = 36%) respectively (Mann–Whitney test, 2-tailed P < 0.000).

Although occupational physicians see fewer new cases of musculoskeletal disorders than rheumatologists, a larger proportion (44%) of occupational physicians’ cases were thought to be work-related, compared to 7% for rheumatologists (Table 1). Furthermore, the highest proportion of occupational physicians’ cases was back problems (41%), compared to 18% for rheumatologists.

There were strong similarities between the two groups of physicians as to what prompts them to consider, whether a condition may be work-related (Table 2), with a high correlation coefficient between rankings by the two groups of physicians (0.950 for mean rankings and 0.961 for median rankings). The ‘history of onset of symptoms in relation to workplace changes’ is the most important
Table 2. Factors suggesting work attribution

<table>
<thead>
<tr>
<th>Question asked: Which items prompt you to consider whether a condition may be work-related?</th>
<th>Occupational physicians</th>
<th>Rheumatologists</th>
<th>Differences (P value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n(^a)</td>
<td>%</td>
<td>Mean rank(^b) of 1–10</td>
</tr>
<tr>
<td>History of onset, recurrence or worsening of symptoms in relation to workplace changes</td>
<td>346</td>
<td>99</td>
<td>2.2</td>
</tr>
<tr>
<td>Symptoms are consistent with occupational exposure (hazards)</td>
<td>339</td>
<td>97</td>
<td>3.0</td>
</tr>
<tr>
<td>Similar symptoms exist in co-workers performing similar job tasks to the patient</td>
<td>332</td>
<td>95</td>
<td>3.4</td>
</tr>
<tr>
<td>Another medical professional had concern that the condition may be work-related</td>
<td>308</td>
<td>88</td>
<td>4.6</td>
</tr>
<tr>
<td>Patient specifically attributed the symptoms to his/her occupation</td>
<td>295</td>
<td>84</td>
<td>5.2</td>
</tr>
<tr>
<td>Employer had concerns that the condition may be work-related</td>
<td>291</td>
<td>83</td>
<td>5.3</td>
</tr>
<tr>
<td>Onset of musculoskeletal disorder in any working adult</td>
<td>137</td>
<td>39</td>
<td>8.4</td>
</tr>
<tr>
<td>Patient was not able to work after the onset of the condition</td>
<td>66</td>
<td>19</td>
<td>9.2</td>
</tr>
<tr>
<td>Others</td>
<td>41</td>
<td>12</td>
<td>9.2</td>
</tr>
<tr>
<td>Total number of physicians answered</td>
<td>351</td>
<td>100</td>
<td>10</td>
</tr>
</tbody>
</table>

Spearman’s rho test for correlation between two groups of physicians’ ranking on the nine items was carried out. The correlation coefficient was 0.950 (2-tailed sig. 0.000) for the mean rankings and 0.961 (2-tailed sig. 0.000) for the median rankings.

\(^a\) Number of physicians have considered this item.

\(^b\) The lowest rank was 9 originally, 10 was given to missing rank.

\(^c\) Differences between two groups of physicians in each item, \(P\) values were derived from Mann–Whitney test of the distributions of ranks.
factor for suggesting work-attribution, while ‘symptoms consistent with occupational exposure’, ‘similar symptoms exist in co-workers’ and ‘a medical professional’s concerns of work-relatedness’ are also important indicators.

All six of the proposed criteria of work-relatedness were evaluated by over 80% of the physicians in both groups of specialties (Table 3). ‘More likely than not that exposure at work caused the condition’ was considered to be the most suitable criterion, with a Yes/No ratio of 6.14 to 1 for occupational physicians and 7.33 to 1 for rheumatologists. On average, more physicians agreed to include ‘aggravated by work’ into their criteria of work-relatedness than those who did not (Yes/No ratio of 1.94 to 1 for occupational physicians and 1.53 to 1 for rheumatologists).

Over half of the occupational physicians (59%) and rheumatologists (53%) selected the category ‘more likely than not work-related’ as the threshold for reporting, a third (33% occupational physicians and 28% rheumatologists) chose ‘probably work-related’, and the remaining few selected ‘definitely work-related’ or ‘possibly work-related’. The distributions of probabilities of the 2 groups of physicians are remarkably similar. The threshold of work-relatedness for reporting was quantified by a mean subjective probability of 0.73 (SD = 0.17) with most of the physicians using the threshold value between 0.55 and 0.80 in the perceived likelihood scale between 0 and 1.

Both groups of physicians considered that the most important objective for reporting was ‘to detect trends of the disease incidence’ (Table 4), but also rated highly other objectives, such as ‘to prevent disease’, ‘to estimate the burden of disease’ and ‘to identify new risk factors’. In response to questions about the possible ways ahead to improve the assessment of work attribution, ‘providing up-to-date reviews of evidence of the association between workplace risk factors and musculoskeletal disorders’ was considered to be the priority (Table 5).

Discussion

There was strong agreement between two groups of physicians on questions about work-relatedness and musculoskeletal disorders and most physicians in this survey were clear about assessment of work attribution and reporting of cases to OPRA and MOSS, with relatively high certainty of work-relatedness.

This study surveyed a large number of physicians and achieved good response rates, however, our results may be affected by selection bias arising from incomplete...
Table 4. Objectives of a surveillance scheme

<table>
<thead>
<tr>
<th>Question asked: According to your understanding, what is/are the appropriate objectives for a surveillance scheme for work-related musculoskeletal disorders?</th>
<th>Occupational physicians</th>
<th>Rheumatologists</th>
<th>Differences (P value)(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n(^a)</td>
<td>%</td>
<td>Mean rank(^b) of 1–7</td>
</tr>
<tr>
<td>To detect trends of the frequency of disease</td>
<td>327</td>
<td>93</td>
<td>3.1</td>
</tr>
<tr>
<td>To help to prevent future occurrence of disease</td>
<td>311</td>
<td>89</td>
<td>3.1</td>
</tr>
<tr>
<td>To identify new risk factors</td>
<td>312</td>
<td>89</td>
<td>3.4</td>
</tr>
<tr>
<td>To estimate the burden of the disease</td>
<td>297</td>
<td>85</td>
<td>3.7</td>
</tr>
<tr>
<td>To investigate the aetiology of disease</td>
<td>268</td>
<td>77</td>
<td>4.2</td>
</tr>
<tr>
<td>To improve patient management</td>
<td>197</td>
<td>56</td>
<td>5.0</td>
</tr>
<tr>
<td>Total number of physicians answered:</td>
<td>350</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>

Spearman’s rho test for correlation between two groups of physicians’ ranking on the six items was carried out. The correlation coefficient was 0.829 (2-tailed sig. 0.042) for the mean rankings and 0.898 (2-tailed sig. 0.015) for the median rankings.

\(^a\) Number of physicians have considered this item.

\(^b\) The lowest rank was six originally, seven was given to missing rank.

\(^c\) Differences between two groups of physicians in each item, P values were derived from Mann–Whitney test of the distributions of ranks.
Table 5. Ways ahead in the improving the assessment of work-relatedness

<table>
<thead>
<tr>
<th>Question asked: For improving the assessment of work-relatedness in the diagnosis of musculoskeletal disorders, which items that you would recommend?</th>
<th>Occupational physicians</th>
<th>Rheumatologists</th>
<th>Differences (P value)(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>na</td>
<td>%</td>
<td>Mean rank(^b) of 1–6</td>
</tr>
<tr>
<td>Providing up-to-date reviews of evidence of the association between work place risk factors and musculoskeletal disorders</td>
<td>334</td>
<td>96</td>
<td>2.0</td>
</tr>
<tr>
<td>Developing criteria for the reporting of cases based on a consensus of participating physicians</td>
<td>292</td>
<td>84</td>
<td>2.9</td>
</tr>
<tr>
<td>Developing criteria for the reporting of cases based on peer-reviewed published evidence</td>
<td>281</td>
<td>81</td>
<td>3.0</td>
</tr>
<tr>
<td>Generating communication and discussion between rheumatologists and occupational physicians on the issue of work-relatedness</td>
<td>271</td>
<td>78</td>
<td>3.6</td>
</tr>
<tr>
<td>Others</td>
<td>20</td>
<td>6</td>
<td>5.8</td>
</tr>
<tr>
<td>Total number of physicians answered:</td>
<td>349</td>
<td>100</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Spearman’s rho test for correlation between two groups of physicians’ ranking on the 5 items was carried out. The correlation coefficient was 0.700 (2-tailed sig. 0.188) for the mean rankings and 0.649 (2-tailed sig. 0.236) for the median rankings.

\(^a\) Number of physicians considered this item.

\(^b\) The lowest rank was five originally, six was given to missing rank.

\(^c\) Differences between two groups of physicians in each item, P values were derived from Mann–Whitney test of the distributions of ranks.
participation. Additional investigation found no evidence that the level of response to this survey was related to physicians’ beliefs about work-relatedness for musculoskeletal disorders, but a lack of response to the survey might be related to a physician’s reporting in general.

In aetiological studies on work attribution, precise measurements on the duration, intensity and frequency of the work exposure are required. In contrast, in the clinical environment, subjective evaluations of exposure and history become important. The aim of this study was to investigate physicians’ beliefs on the work-related causation of musculoskeletal disorders rather than to prove causality, with specific focus on subjective probability in decision making.

A range of terms are used to communicate the level of probabilities. For example, in a survey of physicians’ opinions on the level of work-relatedness of self-reported ill health the terms ‘definitely’, ‘probably’, ‘possibly’, ‘unlikely to be’ and ‘definitely not’ have been used [24]. However, their meaning is not clear and there is wide variability in interpreting these qualitative descriptions [25,26]. In our study, different levels of subjective probability of work-relatedness were investigated both qualitatively and quantitatively, and this method facilitated better interpretation of the results.

Investigating physicians’ general beliefs instead of studying their assessment of specific cases might have found less variability in physicians’ opinions. Summaries of specific cases were used to investigate variability in physicians’ decision but, as they are related to specific cases, the results may not represent physicians’ decision in general [27]. On the other hand, this study of physicians’ general views has found some common ground. It has shed light on the rationale of physicians’ decisions on work attribution. Nevertheless, physicians’ beliefs may be influenced by the bias and errors based on heuristic principles that are common in subjective probability estimates: availability, representivity, anchoring and adjustment [28].

Causality was defined by Last as the relating of causes to the effect they produce [29], and a given cause may be necessary, sufficient, neither, or both. Work exposure is necessary but seldom sufficient to cause work-related musculoskeletal disorders. In OPRA and MOSS [22,23] reporting guidelines state that ‘such a condition (work-related musculoskeletal disorder) could be considered occupational if it would not have occurred in the absence of the occupational exposure or if the occupational exposure made a substantial difference to severity’. Results from this study showed that, although many more physicians agree than disagree with ‘necessary causation’, they gave highest priority to the criteria based on ‘probability of the cause’. The final decision on the link between causes (work-related risk factors) and effects (disorders) depends on the balance of probability. Among the proposed criteria, ‘the importance of the cause’ was based on the World Health Organization’s definition ‘Work-related diseases are defined as multifactorial when the work environment and the performance of work contribute significantly, but as one of a number of factors, to the causation of disease’ [30]. This definition has been widely used but it was the least agreeable criterion in our survey (probably due to the ambiguity of the term ‘significantly’).

The threshold of work-relatedness for reporting to a surveillance scheme, whose main objective is for prevention, should be lower than that for compensation purposes. However, both for surveillance and for compensation, the assessment of attribution is in individuals rather than investigation of associations in the population. It was suggested that when ascribing a disease to a particular occupational exposure based on specific clinical features of the disease (or on the epidemiological evidence), that the risk of disease should be at least doubled by the relevant occupational exposure [31]. However, it has been argued that some of the prescribed diseases are not uniquely occupational. In addition, epidemiological evidence derived from population studies is important in supporting the assessment of possible causal links but cannot, on its own, establish a link in an individual.

Consensus guidelines on decisions for work-relatedness of upper-extremity musculoskeletal disorders were developed and used in the Dutch registration scheme for suspected occupational diseases [6]. Nevertheless, the final decision is still based on a physician’s own judgement, and the level of work-relatedness for reporting has not been defined. More information is needed on the assessment of work attribution in an individual that is based on the balance of probability.

It has been recommended that clinicians should be alert to the possibility of work-relatedness in any patient with a musculoskeletal disorder whose job exposed him/her to a highly repetitive task, forceful exertions sustained, awkward postures, or vibration [32]. Once a precise diagnosis has been made, work-relatedness can be determined using general principles of occupational medicine such as: relation of symptoms to work, change in symptoms away from work, history of workplace exposure to likely ergonomic factors, similar conditions among co-workers, presence of prior trauma to the affected body parts, and non-work activities that may cause or contribute to injury. The first four of these principles were also identified as important by physicians in this study.

This study suggests that work attribution of musculoskeletal disorders can be assessed in the clinical environment. The focus of future studies will develop logical strategies to detect work-related causation, and may include developing a set of questions used during clinical consultations [33]. Occupational physicians in our study
gave higher priority to the development of criteria using consensus methods, while rheumatologists favoured the use of peer-reviewed published evidence. Perhaps the best way forward is to adopt both approaches, as used for low back pain [34].

In summary, the issue of work-relatedness is complex but our study has shown that it can be assessed by physicians for musculoskeletal disorders. Further work is in progress to assess the impact of physicians’ beliefs on reporting, and how physicians assess work attribution in individual clinical cases.

Acknowledgements

The THOR project is funded by a grant (D5044) from the UK Health & Safety Executive (HSE) awarded to R.A. and co-investigators. This paper expresses the views of the authors and not necessarily of the funding body. We are grateful to all investigators. This paper expresses the views of the authors and not necessarily of the funding body. We are grateful to all investigators.

We gratefully acknowledge contributions of the physicians who have given invaluable comments on the design of the questionnaire during the pilot phase of the study. They are: Dr A Adièshe, Dr T Carter, Dr NST Gendi, Dr R Hull, Dr J Hunter, Dr WR Jenkinson, Dr E Waclawski.

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Appendix 4: Questionnaire for GP or other treating doctor. 

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Hatmaker 1: ‘I thought my son-in-law might take over—but he’s just left to take a labouring job for more money’. 
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