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Self-reported versus expert-assessed work-relatedness of pain in the neck, shoulder, and arm

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Objectives The aim of this study was to compare self-reported work-relatedness of neck–shoulder and arm pain with experts' assessments based on specific criteria.

Methods A sample of 217 employed participants in the Oslo Health Study 2000–2001, aged 30, 40, and 45 years, who reported neck–shoulder or arm pain in the past month, underwent a health examination. A criteria document for evaluating the work-relatedness of upper-extremity musculoskeletal disorders was used to establish clinical diagnoses and assess the work-relatedness of pain with respect to the subject's present job. We measured agreement between the participants and experts on whether pain was related to work as observed agreement, positive and negative specific agreement, and kappa.

Results A major proportion of the cases were assessed as work-related, somewhat more frequently by self-report than when assessed by experts (80% versus 65% for neck–shoulder pain, and 78% versus 72% for arm pain, respectively). However, there was considerable disagreement as to which cases were work-related. The experts disagreed more frequently in cases that were reported as non-work-related (particularly for neck–shoulder pain and cases reported by men). Positive specific agreement was fairly high (76–85% in the total population), while negative specific agreement was lower (37–51%). Kappa values were also low (0.16–0.34).

Conclusions Compared with expert assessment, self-reporting did not seem to particularly exaggerate work-relatedness. Nevertheless, there was considerable disagreement, especially on cases assessed as non-work-related. However, agreement will depend on the case definitions and the criteria for work-relatedness used both by the participants and the experts.

Key terms agreement; clinical diagnosis; expert-assessment; exposure; health examination; musculoskeletal disorder; occupational health; questionnaire; risk evaluation; self-assessment; upper extremity.

Self-administered questionnaires on work-related health problems are widely used, especially in population surveys (1–4), but also in more specific epidemiological studies (5–7). The validation of symptom reporting is often done when validating questionnaires (8, 9). However, self-assessment of work-relatedness has hardly been validated. Thus, although self-reported data may be easy to collect, they may be difficult to interpret as a measure of work-related illness in the population.

The definition of work-relatedness may differ according to purpose. If the aim is to prevent work-related illness, a wide definition may be preferable in order to prevent as much illness as possible (10, 11). The World Health Organization defines work-related diseases as multifactorial diseases, in which "the work environment and the performance of work contribute significantly, but as one of a number of factors to the causation" of the disease (page 9, 12). For compensation purposes, a narrower definition is commonly used (11, 13). In order to be included in the British scheduled list of prescribed occupational diseases, a disease must "more likely than not" be caused by work, defined as a (more than) doubling of risk for a person in a particular job compared to someone not in that occupation (page 9, 13).

The concept of work-relatedness may also differ among groups of people, for example, the general population versus physicians (14, 15). To our knowledge, only two studies comparing self-assessment and physician-assessment of work-relatedness have been published. Plomp (14) found hardly any relationship

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between Dutch occupational physicians' and employees' judgment on the work-relatedness of health problems presented during a consultation hour. The British Health and Safety Executive (15) found that the treating doctor (usually the general practitioner) largely supported his patients' assessment of work-relatedness in a survey on self-reported work-related illness. Only cases reported as work-related were studied and, in 80% of the cases in which the doctor gave an opinion, work was considered "possibly", "probably", or "definitely" a cause of the illness. The results of the two studies are thus highly divergent, and the issue needs further exploration. The Oslo Health Study provided an opportunity to compare self-reported and expert-assessed work-relatedness based on a large population sample.

Musculoskeletal disorders are the most common health problem in the general population, and the health problem most often perceived as work-related (5–7, 15). These disorders are often chronic or recurrent, and are commonly associated with hazards both at and away from work. Clinical assessment of work-relatedness may, therefore, be particularly difficult (11). However, a group of European experts (10) has developed evidence- or consensus-based criteria for evaluating the work-relatedness of upper extremity musculoskeletal disorders (MSD); these criteria have been used in epidemiological studies (16, 17) and by occupational physicians in the Netherlands (18).

In a recent study, we demonstrated high prevalences of self-reported work-related health problems in the Oslo population (5). Among 8594 subjects, 38% reported neck–shoulder pain while 20% noted pain in the elbow, forearm, or hand in the preceding month; nearly three in four reported their pain to be work-related (74% and 72%, respectively). Elsewhere, we have shown that occupational factors are important determinants of socio-economic inequalities in musculoskeletal pain in the working population of Oslo (19).

The aim of this study was to compare self-reported work-relatedness of neck–shoulder pain and arm pain with the assessments made by specialists in occupational medicine on the basis of criteria for evaluating the work-relatedness of upper extremity MSD (10).

Study population and methods

Study population

The study was part of the Oslo Health Study, a cross-sectional population study conducted from May 2000 to September 2001 under the joint collaboration of the Norwegian Institute of Public Health, the University of Oslo, and the Municipality of Oslo. All individuals in Oslo county born in 1970, 1960, 1955, 1940–41, and 1924–25 were invited by letter to attend a health screening (20). Of the three youngest cohorts (N=26 074, aged 30, 40, and 45 years), 10 712 attended the screening, and 8594 (33%) returned an age-specific supplementary questionnaire, which included questions on work-related health problems (5), similar to the questions used by Statistics Norway in regular national surveys (21).

The introductory question was: "Have you experienced any of the following common health problems in the last month, and are they totally or partially caused by working conditions in your present or previous job?" This was followed by a list of 11 commonly work-related health problems, among them *pain in neck or shoulder* and *pain in elbow, forearm, or hand* (5). The response categories were: "No, I have not experienced this"; "Yes, but not caused by work"; and "Yes, totally or partially caused by work".

To evaluate the self-reported attribution of health problems to work, 668 subjects were invited to further health examinations at the Norwegian Institute of Occupational Health (NIOH). All subjects reporting work-related eczema or respiratory symptoms were invited (N=508), 68% of whom reported pain in the neck–shoulder or arm. In addition, 160 subjects were invited on the basis of their reported neck–shoulder pain or arm pain (pain in the elbow, forearm, or hand), and were selected consecutively after attending the Oslo Health Study, at two different points in time (100 subjects reporting work-related pain and 60 subjects reporting non-work-related pain). In order to protect personal health information, the Norwegian Institute of Public Health sent the invitations to the selected subjects, informing them of our study, and asking them for consent to give their name and contact information to the NIOH. Of the 668 invited subjects, 302 gave their consent and were subsequently contacted; 268 of these were examined between September 2000 and September 2002 by one of three participating physicians in the Department of Occupational Medicine at our institute. This study was restricted to the 217 employed subjects reporting neck–shoulder or arm pain in the past month, 142 women (65%) and 75 men.

Evaluation of work-relatedness of pain

Prior to the health examination, the subjects completed a questionnaire on symptoms, occupational history, and working conditions. They answered once again the question on work-related health problems from the age-specific questionnaire of the Oslo Health Study, but with the work-related category subdivided into *present* and *previous* work. The physician checked the answers with the subject and relevant information was added. The health examination and evaluation process took

approximately one hour. The procedure for assessing the work-relatedness of pain was based on the "Criteria Document for Evaluating the Work-Relatedness of Upper-Extremity Musculoskeletal Disorders" (hereafter referred to as *the criteria document*), published by a group of European experts (10). The document's main goal is prevention; it was designed to help the physician with the process of recognizing and diagnosing work-related upper extremity MSD in the clinical setting, but certain criteria may also be used at the workplace or community level. We used the criteria document to operationalize the concept of work-relatedness and ensure a consistent assessment throughout the study.

The criteria document consists of two parts: (i) establishing the clinical diagnosis, based on case definitions and diagnostic criteria for specific disorders, and (ii) assessing the work-relatedness of the diagnosis.

Subjects reporting pain in the neck–shoulder or arm in the past month were classified as having a clinical diagnosis if the following criteria were met: (i) *temporal criteria:* symptoms present at the examination or on at least 4 days during the past 7 days, (ii) *symptom criteria* for the relevant clinical diagnoses according to the region of pain, and (iii) *sign criteria* on relevant provocative tests, thoroughly described, with photos, in the criteria document.

One of the authors of this study trained the three physicians in performing the diagnostic provocative tests. The five most common clinical diagnoses were selected for the examination: (i) radiating neck complaints, (ii) rotator cuff syndrome, (iii) epicondylitis (lateral and medial), (iv) peritendinitis–tenosynovitis in the forearm–wrist, and (v) carpal tunnel syndrome.

In accordance with the criteria document, the physicians assessed the work-relatedness of pain in all the subjects, whether or not they had a clinical diagnosis, in the following four steps, which are outlined in table 1:

Step 1*: temporal relationship*: "Did the symptoms begin, recur or worsen after the current job started?" (Yes or No);

Step 2: *occupational risk factors*: exposure to work factors known to be specifically associated with MSD in the relevant body region (neck, shoulder–upper arm, elbow–forearm, or wrist–hand), based on scientific literature or the consensus of expert groups. *Physical factors* (posture, force, movement, and vibration), and *non-physical factors* (work organizational and psychosocial factors, such as work–rest ratio, psychological demands, and social support) were categorized into three risk zones: "unacceptable" (red), "not suitable" (yellow; situations for which no green or red delineation was possible, according to the criteria document), and "acceptable" (green).

Step 3*: non-occupational risk factors*: possible non-occupational origins for the symptom, for example, rheumatic diseases, leisure injuries, exposures (physical or psychosocial) outside of work, or hobbies (Yes or No).

Step 4*: level of work-relatedness*: final decision categorized into "probably work-related" (red = take action), "possibly work-related" (yellow = plan action), and "most likely not work-related" (green = no action).

The "traffic light model" (22) focuses primarily on preventive action, and has been used in regulations and guidelines (23). This model is suitable when the evidence for some risk factors are still lacking and no single work factor or combination of work factors can be said to be the sole cause of upper extremity MSD (10).

The subjects were interviewed about the temporal relationship and the risk factors. However, their answers were carefully considered by the physician, who made the final assessment. The evaluation of occupational risk factors in step 2 was based on specific criteria for each of the four upper extremity body regions, for example: (i) movement of the hands above shoulder height during a substantial part of the day – defined as >2 hours per workday – was, according to the criteria document, a physical risk factor for the shoulder–upper

Table 1. Procedure for evaluation of work-relatedness modified from the criteria document (10). Added or modified elements in *italics*.

Step 1 (time relation)	Step 2 (occupational risk factors)	Step 3 (non-occupational risk factors)	Step 4 (level of work-relatedness)
Yes	Unacceptable (red)	Yes / no	Probably work-related (red)
Yes	Not suitable (yellow) [a]	No	Probably work-related (red)
Yes	Not suitable (yellow) [a]	Yes	Possibly work-related (yellow)
Yes	Acceptable (green)	Yes / no	*Most likely not work-related (green)*
No	Unacceptable (red)	Yes / no	Possibly work-related (yellow)
No	*Not suitable (yellow)* [a]	*No*	*Possibly work-related (yellow)*
No	*Not suitable (yellow)* [a]	*Yes*	*Most likely not work-related (green)*
No	Acceptable (green)	Yes / no	Most likely not work-related (green)

[a] "Not suitable" is, according to the criteria document, used for situations for which no green or red delineation is possible.

arm region; and (ii) having insufficient recovery time per hour when highly repetitive movements are performed was a non-physical risk factor for all four body regions. This was defined as having <10 minute break within every 60 minutes of actions performed >2–4 times/minute, or in cycles of <30 seconds (10).

In evaluating the psychosocial working conditions, we used selected scales from the General Questionnaire for Psychological and Social factors at Work (QPSNordic) (24) instead of Karasek's Job Content Questionnaire (25), which was recommended in the criteria document. QPSNordic was developed to improve the scientific quality and usefulness of questionnaires on psychosocial factors at work; it is psychometrically tested and validated in the Nordic countries (24), and extensively used in Norway. Job control was not included in the criteria document, but we found this psychosocial dimension relevant for upper extremity MSD (26, 27). We thus used scales for the three occupational factors: (i) psychological job demands (10 items), (ii) job control (9 items), and (iii) social support at work (5 items). Each item was responded to on a five-point Likert scale. Scale scores in the upper quartile for psychological job demands, and in the lower quartile for social support were considered a risk, in accordance with the criteria document, as were scores in the lower quartile of the job control scale.

The procedure of the criteria document was somewhat modified (table 1: added or modified elements in italics). Firstly, the original procedure had no category for "not suitable" (yellow) in occupational risk factors (step 2) for the alterative of "no temporal relationship" (step 1). As we soon experienced the need for this, the category was added, using the same logic as for a positive temporal relationship. Secondly, in the original procedure a positive temporal relationship (step 1), without relevant occupational risk factors (step 2), with or without non-occupational risk factors (step 3), led to the final decision of "possibly work-related" (yellow) in step 4. For example, a person with no known occupational risk factors, who had suffered a leisure injury in the upper extremity after starting his current job, and still experienced pain, would end up with a positive temporal relationship and thus be assessed as "possibly work-related". We found this unreasonable to our purpose, both in cases with and without non-occupational risk factors. We therefore modified the procedure to conclude with "most likely not work-related" in such cases.

In accordance with the criteria document, the occupational exposure (step 2) was rated "unacceptable" (red) in the presence of one or more physical risk factors for the relevant body region. If no physical risk factor was present, the occupational exposure was rated "acceptable" (green) in the absence of non-physical risk factors, and "not suitable" (yellow) when non-physical risk factors were present.

Statistical analyses

Before performing the analyses, the physicians' evaluations of risk factors were checked for inconsistencies with the criteria, without looking at the subjects' own assessments. According to the criteria document, the assessment of work-relatedness was based on the evaluation of ongoing exposure in the present job. Therefore, only pain reported caused by the present work was classified as "work-related", whereas pain reported to be caused by previous work (N=22) was classified as "non-work-related". The fact that the latter group was comparable to the strict "non-work-related" group (N=18), particularly on occupational risk factors for upper extremity MSD according to the criteria document, supported this classification. The study participants thus had two response categories: "work-related" and "not work-related", while the physicians had three: "probably work-related", "possibly work-related", and "most likely not work-related". Comparisons were made, with the physicians' "probably work-related" and "possibly work-related" categories combined as "work-related", as well as with the "possibly work-related" category omitted. We measured the agreement between subjects and physicians as observed agreement (ie, simple or raw agreement: the proportion of cases for which the raters agree), and positive and negative specific agreement (ie, the proportion of cases in a category, positive or negative, for which the raters agree), and calculated kappa (ie, chance-corrected agreement) (28). See the appendix for details. Analyses were performed using the statistical software SPSS 15.0 for Windows (SPSS Inc, Chicago, IL, USA).

The study protocol was approved by the Norwegian Data Inspectorate and recommended by the Regional Committee for Medical Research Ethics.

Results

Self-reported work-relatedness of pain

The presence of self-reported neck–shoulder pain and arm pain overlapped considerably among the 217 subjects (table 2). Nearly all reported neck–shoulder pain (N=208), while arm pain was somewhat less frequent (N=150), and almost two in three reported both (N=141). Work-related pain in at least one region was reported by 177 subjects (hereafter called the work-related group), while 40 subjects did not report any work-related pain (the non-work-related group). Subjects in the latter group were somewhat older and more frequently had a part-time job than subjects in the work-related group (table 3). Part-time work was more common among women than among men (18% versus 5%), but the proportion of women was similar in both groups.

The prevalence of region-specific physical risk factors for upper extremity MSD, according to the criteria document, was substantially higher in the work-related than in the non-work-related group, in particular risk factors for arm pain (table 3). Undertaking computer or mouse work most of the workday, and repetitive work with insufficient recovery time were somewhat more frequent in the work-related group. Differences in psychosocial working conditions were generally small. However, although the prevalence of high psychological demands was similar, the average level was higher in the work-related than in the non-work-related group (3.1 versus 2.8; range 1–5).

In both groups, approximately one in three had one or more clinical musculoskeletal diagnoses (table 3). Long duration of pain was more frequent in the non-work-related group; 38% had pain lasting at least 15 years, compared to 18% among subjects reporting work-related pain. However, the latter group more often had co-workers with similar pain, and their pain improved much during vacations. There were minor differences with regard to the consequences of pain (table 3), except that subjects in the non-work-related group more frequently had changed their work. However, 10 of the 12 subjects with non-work-related pain who had changed their work, reported that their pain was caused by a previous job.

Within the work-related group, subjects who reported work-related pain in both the neck–shoulder and arm regions (N=107) differed somewhat from subjects who reported work-related neck–shoulder, but no arm, pain (N=52). The former group more frequently had physical risk factors in their work; 64% versus 45% had physical risk factors for neck pain, and 47% versus 24% had risk factors for shoulder pain. Computer or mouse work and repetitive work with insufficient recovery time were also more frequent (38% versus 21%, and 25% versus 10%, respectively). However, high psychological job demands seemed to be more frequent among subjects who reported work-related pain only in the neck–shoulder region (12% versus 4%).

Of the 217 subjects, 120 reported eczema (80 work-related) and 96 reported respiratory symptoms (30 work-related). Perceived work-relatedness of these symptoms was more frequent in the work-related than in the non-work-related group: 41% versus 18% for eczema, and 15% versus 8% for respiratory symptoms.

Table 2. Distribution of subjects according to self-reported region and work-relatedness of pain, attributed to the present job.

	Arm			
Neck–shoulder	Work-related pain	Non-work-related pain	No pain	Total
Work-related pain	107	8	52	167
Non-work-related pain	4	22	15	41
No pain	6	3	0	9
Total	117	33	67	217

Table 3. Background, exposure, and outcome-related variables among subjects with neck–shoulder or arm pain, according to self-reported work-relatedness in the present job. (% is valid percent)

	Work-related pain (N_1=177)		Non-work-related pain (N_2=40)	
	N	%	N	%
Gender				
Women	118	67	24	60
Men	59	33	16	40
Age				
30 years	55	31	8	20
40 years	65	37	12	30
45 years	57	32	20	50
Work				
Full-time	159	90	29	72
Part-time	18	10	11	28
Presence of physical risk factors (≥1) based on criteria document	126	71	13	33
Physical risk factors for:				
Neck pain (N_1=165, N_2=35) [a]	93	56	11	31
Shoulder/upper arm pain (N_1=158, N_2=31) [a]	61	39	6	19
Elbow/forearm pain (N_1=90, N_2=20) [a]	61	68	5	25
Wrist/hand pain (N_1=113, N_2=22) [a]	81	72	7	32
Computer or mouse work >4 hours per workday	55	31	8	20
Repetitive work with insufficient recovery time	35	20	3	8
Poor psychosocial working conditions (≥1 factors)	43	24	10	25
High psychological demands	10	6	2	5
Low decision latitude	32	18	6	15
Low social support	5	3	3	8
Clinical diagnoses (≥1)	69	39	12	30
Radiating neck complaints	19	11	6	15
Rotator cuff syndrome	41	23	5	13
Epicondylitis	17	10	2	5
Peritendinitis/tenosynovitis in forearm/wrist	12	7	2	5
Carpal tunnel syndrome	21	12	6	15
Much better on days off	32	18	3	8
Much better during vacations	96	55	10	26
Co-workers with similar pain	95	54	13	33
Consequences of pain				
Reduced workability (very much/quite a lot)	55	31	13	33
Reduced leisure time activity (very much/quite a lot)	53	30	16	40
Medical consultation (past year)	78	44	14	35
Sickness certification (past year)	42	24	11	28
Change of job because of pain	19	11	12	31

[a] Subjects with pain in the specific region.

Self-reported versus expert-assessment

Among the 208 subjects with neck–shoulder pain, 167 (80%) reported their pain to be work-related, while the experts assessed 136 cases (65%) to be probably or possibly work-related (table 4). However, there was considerable disagreement as to which cases were work-related. Of the 167 cases reported by participants as work-related, the experts assessed 51 (31%) to be not work-related. Of the 41 cases self-reported as not work-related, the experts assessed 20 (49%) to be probably or possibly work-related; this was higher in men (79%) than in women (33%). However, the numbers are small, particularly in men.

Among the 150 subjects with arm pain, 117 (78%) reported work-related pain, while the experts assessed 108 cases (72%) to be probably or possibly work-related (table 5). There was somewhat less disagreement as to which cases were work-related than for neck–shoulder pain. Of the 117 cases reported as work-related, the experts assessed 24 (21%) to be non-work-related. Of the 33 cases reported as non-work-related, the experts assessed 15 (45%) to be probably or possibly work-related – 58% in men and 39% in women.

The agreement between self-reported and expert-assessed work-relatedness was generally higher for arm pain than for neck–shoulder pain (table 6). The positive specific agreement was 74–88%, while the negative was much lower, generally 37–52%, but particularly low for neck–shoulder pain in men, which was approximately 20%. Kappa values were fairly low, ranging between -0.02–0.37, and lowest for neck–shoulder pain in men, for whom the agreement was no better than chance. When we included the "possibly work-related" category, compared with excluding it, the observed agreement and the positive specific agreement increased, while the negative specific agreement and the kappa value decreased. Among subjects with clinical diagnoses, all agreement measures were higher, with kappa values of 0.33 and

Table 4. Self-reported and expert-assessed work-relatedness of *neck–shoulder pain* among women and men and in the total population.

		Expert-assessed					
		Probably work-related		Possibly work-related		Not work-related	
Self-reported	N	N	%	N	%	N	%
Women							
Work-related	112	62	55	12	11	38	34
Not work-related	27	6	22	3	11	18	67
Total	139	68	49	15	11	56	40
Men							
Work-related	55	37	67	5	9	13	24
Not work-related	14	7	50	4	29	3	21
Total	69	44	64	9	13	16	23
Total population							
Work-related	167	99	59	17	10	51	31
Not work-related	41	13	32	7	17	21	51
Total	**208**	**112**	**54**	**24**	**12**	**72**	**35**

Table 5. Self-reported and expert-assessed work-relatedness of *arm pain* among women and men and in the total population.

		Expert-assessed					
		Probably work-related		Possibly work-related		Not work-related	
Self-reported	N	N	%	N	%	N	%
Women							
Work-related	74	44	59	12	16	18	24
Not work-related	21	6	29	2	10	13	62
Total	95	50	53	14	15	31	33
Men							
Work-related	43	33	77	4	9	6	14
Not work-related	12	4	33	3	25	5	42
Total	55	37	67	7	13	11	20
Total population							
Work-related	117	77	66	16	14	24	21
Not work-related	33	10	30	5	15	18	55
Total	150	87	58	21	14	42	28

Table 6. Agreement measures comparing self-reported and expert-assessed work-relatedness of neck–shoulder pain and arm pain among women (N=142) and men (N=75), and in the total population (N=217).

	Neck–shoulder pain		Arm pain	
	Possibly/ probably work-related [a] (%)	Probably work-related [b] (%)	Possibly/ probably work-related [c] (%)	Probably work-related [d] (%)
Women				
Observed agreement	66	58	73	60
Positive specific agreement	77	74	82	79
Negative specific agreement	43	45	50	52
Men				
Observed agreement	65	58	76	69
Positive specific agreement	81	79	88	87
Negative specific agreement	20	23	43	50
Total population				
Observed agreement	66	58	74	63
Positive specific agreement	78	76	85	82
Negative specific agreement	37	40	48	51

[a] Kappa = 0.23 for women, -0.02 for men and 0.16 for total population.
[b] Kappa = 0.25 for women, 0.03 for men and 0.19 for total population.
[c] Kappa = 0.32 for women, 0.29 for men and 0.31 for total population.
[d] Kappa = 0.32 for women, 0.37 for men and 0.34 for total population.

Table 7. Differences in expert-assessed work-relatedness of neck–shoulder pain and arm pain between using the modified and the original procedure of the criteria document.

	Expert-assessed			
	Possibly work-related		Not work-related	
Self-reported	Modified procedure	Original procedure	Modified procedure	Original procedure
Neck–shoulder pain				
Work-related	17	54	51	14
Not work-related	7	14	21	14
Total	24	68	72	28
Arm pain				
Work-related	16	32	24	8
Not work-related	5	12	18	11
Total	21	44	42	19

0.42 for neck–shoulder pain (N=60) and arm pain (N=27) respectively, excluding the "possibly work-related" category.

Table 7 shows the differences in the experts' assessment of work-relatedness when using the modified versus the original procedure of the criteria document. As the modification did not influence the "probably work-related" category, this was omitted from the table. If we had used the original procedure, 44 additional cases of neck–shoulder pain would have been assessed as possibly work-related (68 versus 24) instead of non-work-related. The corresponding additional cases of arm pain would have been 23 (44 versus 21). This would have given somewhat higher agreement measures, with kappa values of 0.29 versus 0.16 for neck–shoulder pain including the "possibly work-related" category, and 0.39 versus 0.19 when excluding the category (data not shown). For arm pain, the corresponding kappa values would have been 0.31 (same value) and 0.45 versus 0.34, respectively.

Discussion

Our comparative study included 217 Oslo citizens (aged 30, 40 and 45 years) who reported neck–shoulder pain or arm pain in the past month. A major proportion of these cases were assessed as work-related, although somewhat more frequently by the subjects than by the experts. However, there was considerable disagreement as to which cases were work-related. There was more agreement on arm pain than neck–shoulder pain and generally more on cases assessed as work-related, as opposed to non-work-related ones, particularly in men.

Methodological considerations

The low participation in the Oslo Health Study may have led to self-selection of healthy individuals into the study. This would primarily have influenced the descriptive results, and has been thoroughly discussed elsewhere (5, 29). There were twice as many women as men among the subjects in our study, which may partly be explained by the facts that neck–shoulder pain and arm pain are more prevalent among women, and that women to a larger extent participated in the Oslo Health Study (5).

Thirty-four subjects consented to be contacted but were not examined, mainly because their symptoms were better or because they did not want an examination. The proportion of self-reported work-related cases was somewhat higher in our study than in the Oslo Health Study; 91% versus 74% for neck–shoulder pain and 90% versus 72% for arm pain, including cases caused by a previous job. However, we will not assume that self-selection of individuals with work-related pain significantly influenced comparisons between work-related and non-work-related pain, or between self-reported versus expert-assessed work-relatedness. The low attendance, particularly of subjects reporting non-work-related pain, led to small numbers in the stratified analyses, and thus uncertain results. The physicians were not blind to the subjects' assessments, which is a precondition for the measures of agreement employed. Employing formalized criteria for work-relatedness and checking for inconsistencies with the criteria without looking at the subjects' own assessments, may have reduced the interdependence of the two assessments. Subjects provided information on exposure which was evaluated by experienced physicians in occupational medicine. Objective exposure data are recommended by some, especially in cases of claims for financial compensation or legal issues (30). We share the view held by others that self-reported ergonomic exposures, in general, are adequate for epidemiologic purposes (31), and sufficiently accurate for our purpose.

Several factors may influence the attribution of illness to work, for example beliefs about disease etiology, a need to find an external explanation for symptoms, or a potential for economic compensation (14, 32). The subjects in our study had nothing to gain or to lose by attending the health examination, or reporting their pain as work-related or non-work-related. With the exception of hand-arm vibration syndrome, MSD are not eligible for compensation in Norway. The participating experts were independent of all stakeholders such as employers, employees/patients or insurance bodies (32), and met the subjects only once in relation to the research project.

Results

Negative specific agreement and kappa values were generally low, with the latter below 0.40, often defined as poor/slight (<0.21) to fair (0.21–0.40) agreement (33, 34). However, our sample was unbalanced, with low prevalences of non-work-related pain assessed by both subjects and experts. A severely unbalanced sample may lead to low kappa and low specific agreement in the rare category (28, 35, 36).

If our sample (208 with neck–shoulder pain, 150 with arm pain) had been perfectly balanced, with an equal number of self-reported work-related and non-work-related cases, and with the same percentage distribution of the experts' assessments as in the real sample, the kappa values would have been somewhat higher; 0.28 versus 0.19 for neck–shoulder pain and 0.42 versus 0.34 for arm pain, excluding the "possibly work-related" category. The corresponding values for negative specific agreement would have been substantially higher, 63% versus 40% and 68% versus 51%, respectively. Thus, our unbalanced sample may have contributed to the fairly low agreement between the subjects and the experts.

The experts assessed as non-work-related quite a few conditions reported by the subjects as work-related. However, the experts assessed, as probably or possibly work-related, a larger proportion of conditions reported to be not work-related, especially in men. The positive specific agreement was thus higher than the negative, reflecting higher agreement on work-related than non-work-related cases. This result is noteworthy, as one might anticipate self-report of work-relatedness to lead to overestimation rather than underestimation, compared with the experts' assessments. Both may, however, reflect differences between the experts' perspective and the lay perspective of the causes of illness (14). It is also worth keeping in mind that there is no "gold standard" in these cases.

We found higher agreement for arm pain than for neck–shoulder pain. The former may be more closely related to physical risk factors, and the latter to psychosocial factors, as indicated by our results, while the criteria document emphasizes physical risk factors more than psychosocial ones.

In our study, the experts disagreed more with men than women who reported their neck–shoulder pain as non-work-related. Men may be unaware of a possible connection between their work and pain, they may hesitate to report their pain as work-related, or they may see their pain as an inevitable part of their job, and consequently not worth reporting (37). On the other hand, reporting of work-related pain, with which the experts disagreed, was somewhat more frequent in women than in men. Force-demanding tasks have been found to be considerably more strenuous for females than males, which may explain excess musculoskeletal morbidity among females (38). Workplace design factors may be an important reason for gender differences in working technique (39). In our study, physical risk factors for upper extremity MSD, according to the criteria document, were somewhat more frequent in men (73% had one or more) than in women (59%). However, the criteria do not differentiate according to gender, and may thus underestimate the risk in women. In addition, a higher total workload in paid and unpaid work among women (39) may make them more vulnerable to lower levels of physical work exposure.

Subjects reporting work-related pain were somewhat younger than those reporting non-work-related pain, but age did not seem to be a consistent predictor of agreement between responder and expert (data not shown). Among subjects with clinical diagnoses, all agreement measures were higher. These subjects had positive provocative tests, in addition to their symptoms, and may represent a group with more serious pain conditions, for whom the association between work and pain was more evident to both the individual and the expert. Subjects reporting work-related eczema or respiratory symptoms more frequently reported work-related pain also, but did not seem to exaggerate the work-relatedness of their pain (higher positive specific agreement; data not shown).

Eight individuals had encountered occupational injuries which still caused pain in the upper extremity region; seven of them reported their pain as work-related in the present job. Such cases are not captured by the criteria document, but may reasonably be considered as work-related. For these subjects, changing the final decision to the "probably work-related" category only marginally changed the agreement values.

Work-relatedness

Subjects who reported work-related pain had substantially higher prevalences of physical risk factors for upper extremity MSD in their work than those reporting non-work-related pain (table 3). Physical risk factors form a major part of the criteria for evaluation of work-relatedness, and the differences in these between the self-reported work-related and non-work-related groups may be considered a separate measure of agreement.

A temporal relationship, with exposure before response, is essential in causal inference (40) and is considered a sine qua non for assuming causality (36). It was also considered important by the subjects, but not without exception; approximately 20% of the women and 15% of the men who reported work-related pain, did not report a positive time relationship (data not

shown). On the other hand, approximately 85% of the subjects who did report such a relationship, assessed their pain to be work-related.

The concept of work-relatedness may differ according to context or purpose. Plomp (14) found somewhat higher agreement between occupational physicians and employees when the consultation was initiated by the physician (eg, because of absenteeism or a periodical medical examination) rather than the employee. He suggested that the potential socio-economic implications of the label of "work-relatedness of health problems" might be important, such as loss of job, reduction in income, or dispensation from specific types of work. An occupational physician, being salaried by the employer, may have a different position in relation to the employee/patient than a general practitioner. This may in part explain the different results found by Plomp (hardly any agreement) and by the British Health and Safety Executive (largely supportive of their patients' assessment) (15). Besides, differences in experience between occupational physicians and general practitioners, with respect to evaluation of work-relatedness, may lead to differences in assessments (42).

Our study's participants and the experts did not use the same response categories. The "possibly work-related" category gave the experts an extra, less certain alternative, which the subjects did not have. On the other hand, the subjects were asked whether their pain was "totally or partially caused by working conditions", while the criteria document was based on evidence or consensus of a causal relation. Lower levels of work exposure, below the risk levels of the criteria, may not cause pain in healthy individuals or those with low exposure outside their work. They may, however, lead to an exacerbation of a pre-existing condition, the development of pain in an individual with a high total workload in paid and unpaid work (39), or the maintenance or recurrence of pain in subjects with work-related pain caused by a previous high risk job. Such cases would be assessed as work-related by the subject but non-work-related by the experts – correctly according to our criteria. Thus, the somewhat different criteria and response alternatives may have resulted in lower agreement in our study.

According to the procedure of the original criteria document, a positive time relationship, without relevant occupational risk factors, would lead to the final decision of a case being possibly work-related. This procedure would have resulted in considerably more cases being assessed as possibly work-related (table 7) and higher agreement values. The original procedure may capture some cases caused or made worse by exposure levels lower than the risk levels of the criteria, particularly in vulnerable individuals. According to the criteria document, further investigation of the "possibly work-related" cases is warranted (eg, observation of the work situation, or surveillance of the person over time) (10). This was beyond the scope of our study. We chose to modify the procedure of the criteria document to suit our needs. However, the original procedure may be reasonable when the purpose of the evaluation is the prevention of upper extremity MSD and further investigation is possible.

Using criteria in the assessment of work-relatedness may reduce subjectivity in judgments. However, we often found it difficult to evaluate exposures in work against the criteria, in particular repetitiveness in occupations with some degree of repetitive work, but not assembly work. We discussed this matter with the authors of the criteria document and found our judgments needed to be stricter. As a consequence, fewer cases were assessed as work-related. Others may have encountered the same problem. While 54% of neck–shoulder pain conditions and 58% of arm pain conditions were assessed as probably work-related in our study, 95% of upper extremity MSD cases in men and 89% in women (<50 years), were classified as such in a study by Roquelaure et al (16), in which the criteria document was used. This may indicate discrepancies in the application of the criteria document and the need for further improvement and specification of the criteria.

Concluding remarks

Self-reported data is often used to follow population trends in work-related illness. Self-assessed work-relatedness of disease has been found to be an independent predictor of work disability (43), and may thus be of importance as such. However, the use of these data as a measure of work-related illness in the population has often been considered with skepticism, assuming it would result in exaggerated estimates. The British Health and Safety Executive (15) performed a case review to identify and exclude cases which were clearly not work-related, and concluded that their prevalence estimates based on self-reported work-related diseases could be reduced by 24%. However, they did not evaluate cases reported as non-work-related to adjust for potential under-reporting.

Our results indicate that prevalence estimates based on self-report may be more valid than previously assumed with regard to neck–shoulder pain and arm pain. Compared with the assessment of experts, self-reporting did not seem to particularly exaggerate work-relatedness. However, there was considerable disagreement between the subjects and experts in individual cases. Agreement was higher for cases assessed as work-related compared to those categorized as non-work-related, and higher for arm pain than for neck–shoulder pain. Studies of other disease categories (15), or other age or cultural groups may yield different results, and need to be performed.

Several factors, in addition to true disagreement, contributed to low agreement values, including an unbalanced sample and different response categories for subjects and experts.

Agreement will depend on the criteria by which the subjects and the experts evaluate work-relatedness. When we included the cases assessed by the experts to be possibly work-related in our analyses, the agreement values changed (compared to excluding such cases); this was also the case when using the modified procedure of the criteria document as opposed to the original. Both might influence to what extent cases made worse by work are included as work-related. Agreement will also depend on the case definition, illustrated by higher agreement for clinical diagnoses than for all cases of self-reported pain. The fact that a large proportion of reported non-work-related cases were attributed to a previous job, raises the issue that, with a wider definition, most cases of neck–shoulder and arm pain might actually be considered as work-related.

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Appendix : Definition of agreement measures (28,36)

	Rater B		
Rater A	Pos	Neg	Total
Positive	a	b	g_1
Negative	c	d	g_2
Total	f_1	f_2	N

Observed agreement = $\frac{a + d}{N}$

Positive specific agreement = $\frac{a}{\frac{f_1 + g_1}{2}} = \frac{2a}{2a + b + c}$

Negative specific agreement = $\frac{2d}{b + c + 2d}$