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# Do workers with self-reported symptoms have an elevated risk of developing upper extremity musculoskeletal disorders three years later?

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## ABSTRACT

**Objectives:** Few prospective studies have evaluated outcomes of workers with self-reported symptoms of upper extremity musculoskeletal disorders (UEMSD). The objective was to study the three-year outcomes of workers with self-reported symptoms, with or without a positive physical examination.

**Methods:** In 1993–4, 598 subjects highly exposed to repetitive work filled out a Nordic-style questionnaire. They underwent a standardised physical examination at that time and again in 1996–7 by the same occupational physician. The three-year outcomes (based on physical examination) of workers with a self-administered questionnaire positive at baseline for UEMSD, with or without a positive physical examination, were studied.

**Results:** The three-year incidence rate was 44.1%; one third of these incident cases had self-reported symptoms in 1993–4. Workers with a positive questionnaire had a significantly higher risk of UEMSD at physical examination three years later (80.1% UEMSD cases with positive questionnaires  $n = 354$ , vs 44.2% cases without positive questionnaires  $n = 69$ ,  $p < 0.001$ ). Moreover, workers with positive questionnaires but without UEMSD diagnosed in 1993–4 ( $n = 177$ ) also had a significantly higher risk of UEMSD at physical examination three years later (60.5% cases with positive questionnaires  $n = 26$ , vs 38.8% cases without positive questionnaires  $n = 52$ ,  $p = 0.01$ ). Results were similar when gender and age were taken into account.

**Conclusion:** Workers highly exposed to repetitive movements have a high risk of developing UEMSD and should be followed closely in surveillance programmes. Workers with self-reported symptoms without UEMSD diagnosed in physical examination represented only one third of new cases three years later. However, their risk of developing UEMSD was significantly increased, compared with those without symptoms.

One important aspect in the prevention of upper extremity musculoskeletal disorders (UEMSD) is the implementation of surveillance systems, even though there is no universally accepted way of defining UEMSD (complaints or specific positive testing).<sup>1</sup> Some authors propose a multilevel model for surveillance of UEMSD, with questionnaires and checklists used initially for a quick assessment.<sup>2–4</sup> Nordic-style questionnaires exploring symptoms experienced over the past year are considered useful tools for this purpose.<sup>5</sup> However, although studies have evaluated questionnaire validity, very few have longitudinally followed subjects with symptoms, especially those without any positive physical findings. Symptoms are sometimes considered an initial stage of

UEMSD.<sup>6</sup> The European consensus definition of UEMSD proposes that the first step in assessing UEMSD should take symptoms into account but not physical signs.<sup>7</sup> A study in one company suggested that workers with self-reported symptoms evaluated by questionnaire had a significantly higher risk of developing UEMSD a year later.<sup>8</sup>

Our objective was to study the outcomes three years later of workers with self-reported symptoms and with or without positive physical examinations in a larger survey of repetitive work.

## METHODS

The study design, population and medical criteria were described earlier.<sup>5,9</sup> In 1993–4, the study aimed to include 700 subjects highly exposed to repetitive work. Subjects worked in one of five activity sectors: (1) assembly-line manufacture of small electrical appliances, motor vehicle accessories, or ski accessories, packaging excluded; (2) clothing or shoe industry, packaging excluded; (3) food industry, packaging excluded (mainly the meat industry); (4) packaging (primarily in the food industry); and (5) supermarkets (cashiers).

In 1993–4, subjects filled out a Nordic-style questionnaire about UEMSD symptoms during the previous six months. The questionnaire was considered positive if the worker reported at least one symptom in the upper extremities for the recall period.

The same occupational physician examined workers at baseline and again in 1996–7 ( $n = 18$ ). The examination followed a standardised protocol and used a list of criteria for the diagnoses of UEMSD in the medical questionnaire. These guidelines covered 33 diagnoses in 1993–4 and 35 in 1996–7 (the slight changes between the two lists were limited to shoulder tendonitis). Participating occupational physicians came to one or two regional meetings before the baseline survey, at which the guidelines were presented and training took place for the standardised physical examination. The guidelines were again presented at regional meetings organised before the second survey.

Clinical examination could classify UEMSD into one of three categories: (1) diagnosis from clinical examination; (2) diagnosis before the clinical examination (for example, previous diagnosis by a specialist for a problem present in the last six months); and (3) suspected diagnosis (clinical examination did not identify all diagnostic criteria or the diagnosis was based on the description of

## Short report

**Table 1** Association between positive questionnaire in 1993–4 and upper extremity musculoskeletal disorders (UEMSD) diagnosed by physical examination in 1996–7 (cases), stratified on gender

	Workers without any UEMSD diagnosed in 1993–4											
	All workers						Men			Women		
	n*	Cases, n (1996–7)	%	p Value†	n*	Cases, n (1996–7)	%	p Value†	n*	Cases, n (1996–7)	%	p Value†
Negative questionnaire in 1993–4	61	31	50.8	<0.001	95	38	40.0	<0.001	53	24	45.3	NS
Positive questionnaire in 1993–4	117	83	70.9		325	271	83.4		10	4	40.0	
Total	178	114	64.0		420	309	73.6		63	28	44.4	

\*Number of subjects.

† $\chi^2$  or Fisher exact tests.**Table 2** Association between positive questionnaire in 1993–4 and upper extremity musculoskeletal disorders (UEMSD) diagnosed by physical examination in 1996–7 (cases), stratified on age

	Workers without any UEMSD diagnosed in 1993–4											
	All workers						Age <40 years old			Age $\geq$ 40 years old		
	n*	Cases, n (1996–7)	%	p Value†	n*	Cases, n (1996–7)	%	p Value†	n*	Cases, n (1996–7)	%	p Value†
Negative questionnaire in 1993–4	140	61	43.6	<0.001	16	8	50.0	<0.01	120	46	38.3	<0.05
Positive questionnaire in 1993–4	338	265	78.4		104	89	85.6		34	20	58.8	
Total	478	326	68.2		120	97	80.8		154	66	42.9	

\*Number of subjects.

† $\chi^2$  or Fisher exact tests.

symptoms during the last six months but not present at the examination). Our definition of UEMSD determined by the clinical examination included “proved”, suspected and prior diagnoses.

Outcomes three years later were based on physical examination. Bivariate analyses using  $\chi^2$  or Fisher exact tests (SAS v8.2, SAS Institute Inc, Cary, NC, USA) considered first all workers, and then only those whose physical examination in 1993–4 was not positive. The potential effects of sex and age were studied both by stratification and using logistic models adjusted on these variables.

## RESULTS

In all, 598 workers (85% of the initial target group) completed the self-administered questionnaire again in 1996–7 and were each re-examined by the same physician. Their mean age was 41 years, and 70% were women. Most had the same (or similar) occupational constraints as three years earlier, in the same company; only 134 (22.4%) said that their job or work station had changed during the period in question. Four no longer worked at the same firm.<sup>9</sup> At baseline, 70.7% of the 598 workers had at least one UEMSD in 1993–4.

Among all workers (n = 598), those with a positive questionnaire at baseline had a significantly higher risk of UEMSD at physical examination in 1996–7 than those without (80.1% UEMSD cases with positive questionnaires n = 354, vs 44.2% cases without positive questionnaires n = 69, p < 0.001), with a crude OR at 5.1 (95% CI 3.4 to 7.5). The OR adjusted on sex and age was 4.6 (95% CI 3.1 to 6.8). Results after stratification on these parameters were similar (table 1 and 2, first row).

The three-year incidence rate, defined as the cases of UEMSD diagnosed by physical examination in 1996–7 among workers without any UEMSD diagnosed in 1993–4 (n = 177), was 44.1%. Only one third of these incident cases had self-reported symptoms in 1993–4. However, workers with a positive questionnaire (but no UEMSD diagnosed in the 1993–4 physical examination), had a significantly higher risk of UEMSD at physical examination three years later than those without any (60.5% cases with positive questionnaires n = 26, vs 38.8% cases without positive questionnaires n = 52, p = 0.01). The crude OR was 2.4 (95% CI 1.2 to 4.9), and the age and sex adjusted OR was 2.3 (95% CI 1.1 to 4.8). Results after stratification were not all significant, but the number of subjects was small in some cells (tables 1 and 2, second row).

## DISCUSSION

Workers highly exposed to repetitive movements had a high rate of developing UEMSD. Positive answers to a questionnaire on symptoms at baseline were associated with a higher incidence of UEMSD in a population exposed to highly repetitive work. For surveillance purposes, using a Nordic-style questionnaire to investigate UEMSD symptoms may identify subjects at higher risk of developing UEMSD. These results are consistent with the conclusion of a small preliminary study on the same topic.<sup>8</sup> Few studies with a similar objective have been published. Walhström *et al* showed that perceived muscular tension in the neck was associated with an increased risk of developing neck pain among visual display unit users.<sup>10</sup> Nordlund *et al* found a similar health status after eight years in a group of UEMSD patients diagnosed after physical examination and a group of controls who reported severe musculoskeletal symptoms at baseline (without a positive clinical examination).<sup>11</sup> In a one-year prospective study of 436 workers, Silverstein *et al* found that the presence of shoulder symptoms alone appears to predict rotator cuff tendonitis.<sup>12</sup>

## Main messages

- ▶ Workers highly exposed to repetitive movements were found to have an increased risk of developing UEMSD.
- ▶ Positive answers to a self-administered questionnaire were associated with a higher prevalence and incidence of UEMSD three years later in a population exposed to highly repetitive work.

## Policy implication

Surveillance programmes should follow workers highly exposed to repetitive movements and pay special attention to those who report symptoms.

The design of this study provided no information on events during the three years between examinations. That may be a limitation, given the rapid and cyclic evolution of these disorders. Furthermore, analyses considered only the presence or absence of UEMSD, without distinguishing the sites, sides or regions involved. Investigations of the 26 workers with self-reported symptoms but no physical signs in 1993–4 showed that 10 of them (38%) had disorders involving a different region or side in 1996–7. Symptoms reported in a questionnaire may thus be interpreted as an indicator of susceptibility. They could also point to an early stage of a disease, or a lack of sensitivity of the physical examination. However, these limitations do not affect our results, because our goal was to develop first-stage UEMSD surveillance.

In conclusion, in this working population highly exposed to repetitive work, workers had a high risk of developing UEMSD and should be followed closely in surveillance programmes. This already happens in some countries, such as in France, where these workers are checked regularly by occupational physicians in routine surveillance. This study also indicated that workers with self-reported symptoms without UEMSD diagnosed in physical

examination represented only one third of new cases three years later. However, their risk of developing UEMSD was significantly increased, compared with those without symptoms.

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