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HOW COMMON IS RSI?

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Abstract

Objective—Statistics from Labour Force Surveys are widely quoted as evidence for the scale of occupational illness in Europe. However, occupational attribution depends on whether participants believe their health problem is caused or aggravated by work, and personal beliefs may be unreliable. We assessed the potential for error for work-associated arm pain.

Methods—We mailed a questionnaire to working-aged adults, randomly chosen from five British general practices. We asked about: occupational activities; mental health; self-rated health; arm pain; and beliefs about its causation. Those in work ($n = 1769$) were asked about activities likely to cause arm pain, from which we derived a variable for exposure to any ‘arm-straining’ occupational activity. We estimated the relative risk (RR) from arm-straining activity, using a modified Cox model, and derived the population attributable fraction (PAF). We compared the proportion of arm pain cases reporting their symptom as caused or made worse by work with the calculated PAF, overall and for subsets defined by demographic and other characteristics.

Results—Arm pain in the past year was more common in the 1,143 subjects who reported exposure to arm-straining occupational activity (RR 1.2, 95% confidence interval 1.1 to 1.5). In the study sample as a whole, 53.9% of 817 cases reported their arm pain as work-associated, whereas the PAF for arm-straining occupational activity was only 13.9%. The ratio of cases reported as work-related to the calculated attributable number was substantially higher below 50 years (5.4) than at older ages (3.0) and higher in those with worse self-rated and mental health.

Conclusions—Counting people with arm pain which they believe to be work-related can overestimate the number of cases attributable to work substantially. This casts doubt on the validity of a major source of information used by European Governments to evaluate their occupational health strategies.

Introduction

The UK government’s long-term strategy for occupational health aims to achieve a 20% reduction in the incidence of work-related illness between 2000 and 2010,¹ while the European Commission is seeking a 25% reduction for Europe as a whole between 2007 and 2012.²

One major source of information on which health and safety planning authorities rely in assessing progress towards such targets is Labour Force Surveys. Findings from Labour Force Surveys in Great Britain indicate that each year, more than two million people suffer

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from ill-health which they think is work-related – principally, musculoskeletal disorders of the back and upper limb, and stress.^{3,4} Across 11 member states of the European Union, in 1998/9, an ad hoc extension to the 1999 Eurostat Labour Force Survey estimated that there were some eight million cases of work-related illness, including four million adults with work-associated musculoskeletal problems.⁵

Statistics from Labour Force Surveys are widely quoted as evidence for the scale of occupational illness. However, their validity as a measure of the burden of disease caused by work is questionable. Attribution to occupation in Labour Force Surveys is determined by whether or not participants believe that their health problem has been caused or aggravated by work, but in this context, individual beliefs may not always be reliable.⁷

With proposals to conduct a further Eurostat Labour Force Survey of work-related illness in 2007,⁶ it seems timely to assess the potential for error in Labour Force Survey statistics. In this report we used data from a community-based epidemiological survey to estimate the proportion of arm pain attributable to occupational physical activities. We then compared the calculated attributable fraction with the proportion of cases in which subjects reported that their pain was caused or made worse by work.

Methods

A postal questionnaire was sent to 4,998 adults aged 24–64 years, who were selected at random from the registers of five general practices in the West of England.⁸ The practices included a mix of large and small partnerships, and covered urban and rural, and affluent and deprived areas. A reminder was mailed as necessary after three weeks, and again at six weeks. The study was presented to participants as a general inquiry about aches and pains in the community. Among other things, the questionnaire asked about: age; sex; employment status and occupation; physical activities in a typical working day; mental health; self-rated health (SRH); pain in the arm during the past 12 months; and in those who had suffered from arm pain, interference with activities of daily living and beliefs about its causation.

Arm pain was defined as pain lasting a day or longer during the past 12 months, in an area (covering the whole of the upper limb) depicted in a line drawing.^{8,9} It was classed as ‘frequent’ if had been present for more than six months in aggregate over this period and ‘disabling’ if it had made all of three activities (sleeping, dressing and doing household chores) difficult or impossible.

Subjects who reported arm pain were asked about various possible causal factors. In particular, we asked how strongly the respondent agreed with the following statements:

- a. My problem was caused by work
- b. Work probably didn’t cause my arm problem, but it made it worse.

The answers to these questions were given on a five-point Likert scale, but were subsequently recoded as binary variables taking any measure of agreement (‘agree’ or ‘strongly agree’) as positive. Those for ‘caused’ and ‘made worse’ by work were then combined to create a further variable, ‘caused or made worse by work’ (positive if either component was positive).

Respondents who were in work when the questionnaire was completed were asked whether a typical working day involved any of four physical activities that we judged likely to give rise to arm pain: – a) repeated movements of the wrists/fingers; b) repeated bending and straightening of the elbow for >1 hour; c) work for >1 hour with the hands above shoulder height; and d) lifting weights of 5 kg in one hand. From the responses we derived a single

variable for exposure to any 'arm-straining' occupational activity (i.e. to at least one of a) to d)). We also asked about use of a keyboard for >4 hours per day, but did not include it as an index of strain on the arm since within our data, it showed no association either with the occurrence of arm pain or with reported attribution of arm pain to work.

Questions on mental health related to low mood and tendency to somatise. Low mood was assessed using the mental health section of the SF-36 questionnaire,¹⁰ while somatising tendency was graded from the somatic subscale of the Brief Symptom Inventory.¹¹ The latter is a validated measure of self-reported distress comprising items (each scored 0 to 4) about bothersome nausea, faintness, dizziness, weakness, numbness in the body, chest pain and breathing difficulties during the past seven days. Scores for low mood and somatising tendency were each categorised into approximate thirds of their distribution in the whole study sample. We then derived a composite variable ('combined mental health score'), based on their joint distribution ('worst' = top third of both scales; 'best' = bottom third of both scales; 'intermediate' = other combinations), which we have shown previously to have predictive validity for both the incidence and persistence of musculoskeletal symptoms in longitudinal follow-up.^{9,12}

SRH was assessed by the question: "In general would you say your health is excellent/very good/good/fair/poor?".¹³ Response categories for 'good' and 'very good' were combined, as were those for 'fair' and 'poor', giving a scale with three levels.

Analysis was conducted with STATA (version 9.2), and was restricted to subjects who were in work when the questionnaire was answered, and who provided complete information on relevant variables. We first focused on respondents with arm pain, and compared those who did and did not consider their pain to be caused or made worse by work. Associations with reported occupational attribution were examined by modified Cox regression (with outcomes all treated as occurring at a single time-point),¹⁴ and the findings were summarised as relative risks (RR) with associated 95% confidence intervals (95% CI).

The second part of the analysis included all respondents, whether or not they reported arm pain. With arm pain in the past 12 months as the outcome, we used Cox regression to assess univariate and multivariate associations with occupational activities and other, potentially confounding, risk factors. In this way, we estimated an adjusted RR for the effect of arm-straining occupational activity on risk of arm pain, and derived the population attributable fraction (PAF) according to the formula: $PAF = P'(RR-1)/RR$, where P' was the proportion of cases (subjects with arm pain) exposed to any arm-straining physical activity.¹⁵ This was compared with the prevalence of reported attribution to work among the case group. The comparison was then repeated separately for subsets of the study sample defined according to demographic and other characteristics. A bootstrap method was used to calculate confidence intervals for PAFs and for ratios of the prevalence of reported occupational attribution in the case group to the corresponding PAF.¹⁶

Ethical approval for the study was provided by the NHS South West Local Research Ethics Committee.

Results

Usable responses were received from 2,632 (53%) of those mailed. As reported elsewhere,⁸ the response rate was broadly similar across practices, but women and older subjects were somewhat over-represented in comparison with the age-sex distributions of the general practices as a whole. A total of 669 respondents were not in work when the questionnaire was completed, and a further 194 omitted to answer questions on one or more of: arm pain, age, sex, social class, SRH, mental health, or somatising tendency. The analysis presented

here was based on the remaining 1,769 participants who provided complete information on all relevant variables.

Among these were 817 (46%) who reported arm pain in the past 12 months, including 200 (24% of cases) who believed their pain to have been caused by their work, and a further 240 (29%) who considered that although not caused by occupation, their pain was made worse by work.

Table 1 shows the frequency with which arm pain was reported as being work-related, according to various individual characteristics. No clear differences were observed in relation to age, sex or SRH. However, reported occupational attribution was more common in manual as compared with non-manual workers, and in subjects who reported that their work entailed arm-straining physical activities (RR 2.3, 95%CI 1.6-3.4 for belief that the pain was caused by work, and 1.6, 95% CI 1.2-2.0 for belief that it was caused or made worse by work). Subjects were also more likely to report that their pain was caused or made worse by work if it was frequent, or if they were in the worst category for combined mental health score.

In univariate analyses based on the full sample of 1,769 subjects, each of the four arm-straining occupational activities was significantly associated with report of arm pain, with RRs of 1.5 (95%CI 1.2-1.8) for work involving repeated movements of the wrist or fingers, 1.5 (95%CI 1.2-1.8) for repeated bending of the elbow, 1.4 (95%CI 1.1-1.9) for prolonged work with the hands above shoulder height, and 1.1 (95%CI 0.9-1.4) for lifting or carrying in one hand. After adjustment for age, sex, social class, SRH and combined mental health score, the RR for subjects reporting at least one arm-straining occupational activity was 1.2 (95%CI 1.1-1.5) (Table 2).

The prevalence (P') of this exposure among the 817 subjects with arm pain from the whole sample was 70.9%. Thus, from the formula $P'(RR-1)/RR$, the estimated PAF for occupational exposure to arm-straining physical activities was 13.9% (95%CI 6.6% to 21.3%). This was substantially less than the proportion of cases who believed that their pain was caused by work (24.5%) or who reported that their arm pain was caused or made worse by work (53.9%).

To explore factors that might be associated with under- or over-attribution of arm pain to work, the same methods were used to calculate stratum-specific estimates of RR, P' and PAF for various subsets of the study sample. The PAFs were then compared with the prevalence of reported attribution among the cases from each subset (Table 3). Overall, the ratio of reported attribution to calculated PAF was 3.9 (95%CI 2.5 to 8.2). Over-attribution was proportionately higher below age 50 years (ratio = 5.4, 95%CI 2.4 to 31.0) than at older ages (ratio = 3.0, 95%CI 1.9 to 6.7), and also higher in the worst vs. best bands by SRH (ratios 7.4 and 2.4 respectively) and combined mental health score (ratios 6.3 and 2.2).

We repeated analyses for the subset of 124 patients with disabling arm pain and found similar levels of over-attribution (ratio = 1.7 for arm pain caused by work; 3.7 for arm pain caused or made worse by work).

Discussion

Our findings indicate that counting people with arm pain which they believe to be work-related can overestimate the number of cases attributable to work substantially. Furthermore, the degree of overestimation varied importantly by age and mental health status, raising doubts as to whether it would be constant over time. This calls into some question the use of

the LFS to quantify trends in occupational illness nationally and internationally. It also has implications for the validity of reporting schemes for occupational disease more widely.

Our study was designed primarily to assess risk factors for musculoskeletal pain in the community, and as a test of the Labour Force Survey methodology it had several limitations. It focused principally on arm pain, and did not address other major work-related illnesses that are ascertained by Labour Force Surveys such as stress. Also, the questions by which we ascertained arm pain that participants considered to be work-related were not identical to those used by Labour Force Surveys in Great Britain or Europe. The Labour Force Survey is administered at interview, and the module on ill-health begins with a screening question to identify subjects with any illness, disability or other physical or mental problem in the past 12 months that they (or a proxy respondent) think was caused or made worse by work. If they respond positively, they are then asked for the number of such illnesses, and to describe the most serious. There seems no obvious reason, however, why individual attribution of occupational illness should be much more reliable when the questions about work-relatedness are posed in a slightly different format.

Another possible source of error was that we based our calculation of attributable fraction on only four occupational activities, and thus may have failed to count some arm pain that resulted from other aspects of work. It is notable, however, that after adjustment for the four activities that we included in our calculation, there was no residual elevation of risk in manual as compared with non-manual workers (Table 2). This suggests that any underestimation of the attributable fraction was relatively minor.

The response rate in our survey was incomplete (53%), but it was not a lot lower than in recent Labour Force Survey rounds in Britain (58% to 73% for the 2004/05 winter quarter),¹⁷ and it seems implausible that the large discrepancy between reported attribution and the calculated attributable fraction could be explained by response bias.

Not surprisingly, subjects were more likely to attribute their arm pain to work if they were in a manual job and if they carried out arm-straining physical activities (Table 1). In addition, attribution was more common in subjects with a poor combined mental health score. Here, the association appeared to be driven more by perceived aggravation of the arm problem than by belief that work caused the symptom, and it may reflect a tendency for people with low mood or somatising tendency to focus more on their symptoms, and to be more aware of exacerbating factors.

Given that people differed in their propensity to attribute arm pain to work, it was important to check whether the degree of over-attribution varied according to the same characteristics. When subjects were stratified, the extent of over-attribution varied across strata according to indices of mental health, and there was substantial variation by age, mainly because the calculated attributable fraction was lower at younger ages. Differences by sex and social class were smaller (Table 3).

When attention was restricted to arm pain that subjects believed to be caused, and not just aggravated, by work, the burden of illness attributed to work was closer to the calculated attributable fraction (Table 3). However, the differentials by age, and gradients by mental and self-rated health were still apparent.

While reasonable judgements on occupational aggravation of arm symptoms may be possible from their temporal relationship to work, there are generally no distinctive features that allow cases caused by work (i.e. that would not have occurred in the absence of occupational exposures) to be distinguished from those that are not. Attribution might still be made with reasonable confidence if the relative risk of arm pain from an occupational

activity were sufficiently high. For example, if an activity increased risk fourfold, then three out of four cases in exposed persons would be a consequence of the activity. However, this does not apply to arm pain, where the relative risks associated with occupational activities are mostly less than two.

This difficulty in attribution applies not only to Labour Force Surveys, but also to reporting schemes in which the judgement on whether cases are occupational in origin is made by clinicians.^{18,19} Confident attribution to work can only be made where there are distinctive clinical features (e.g. demonstration that new-onset asthma is associated with sensitisation to an allergen in the workplace) or the relative risk from the occupational exposure is high. In other situations, controlled epidemiological investigations are needed to estimate attributable numbers reliably.

For the purpose of monitoring trends, it would not matter so much if a method overestimated attributable numbers, provided the degree of over-estimation was constant over time. However, our finding that over-estimation varied substantially by age and in relation to other characteristics is a warning that this may not apply, at least in the case of upper limb disorders.

The Labour Force Survey is likely to contain other biases in addition to the one we have highlighted, some operating in the opposite direction. In particular, as enquiries depend on an open question in which respondents recall and volunteer only their worst work-related problem, some work-related complaints may be underestimated relative to inquiries based on closed questioning. Our findings, however, add a further tier of uncertainty in relation to interpretation of the data.

At this stage, it would be helpful to extend our observations to other types of illness, mimicking more closely the Labour Force Survey methodology for assessment of work-related cases. Meanwhile, however, our findings cast doubt on the validity of one of the major sources of information that governments are using to evaluate the success of European occupational health strategy.

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Main messages

- Statistics from Labour Force Surveys are widely quoted as evidence for the scale of occupational illness in Britain and Europe.
- Occupational attribution depends on whether participants believe their health problem to be caused or aggravated by work, and personal beliefs may be unreliable for some outcomes. We assessed the potential error for work-associated arm pain.
- Our findings indicate that counting cases of arm pain perceived to be work-related can substantially overestimate the burden of illness attributable to arm-straining occupational activity.
- The degree of overestimation may not be constant by subgroup or over time.

Policy implications

- These findings call into question the validity of the Labour Force Survey method for monitoring the incidence of some types of work-related illness. For these disorders, controlled epidemiological investigations may estimate attributable numbers more reliably.

Table 1
Characteristics associated with attribution of arm pain to work

Characteristic	Subjects with arm pain ^a				Believe pain caused or made worse by work		
	N	N	%	RR (95% CI) ^b	N	%	RR (95% CI) ^b
Age (years):							
34	114	32	28	1	61	54	1
35 - 39	84	20	24	0.9 (0.5 - 1.5)	49	58	1.1 (0.8 - 1.6)
40 - 44	123	28	23	0.8 (0.5 - 1.4)	65	53	1.0 (0.7 - 1.4)
45 - 49	140	28	20	0.7 (0.4 - 1.2)	69	49	1.0 (0.7 - 1.4)
50 - 54	149	35	23	0.9 (0.5 - 1.4)	79	53	1.0 (0.7 - 1.5)
55 - 59	155	46	30	1.1 (0.7 - 1.7)	93	60	1.2 (0.8 - 1.6)
60	52	11	21	0.8 (0.4 - 1.5)	24	46	0.9 (0.5 - 1.4)
Sex:							
Male	367	100	27	1	196	53	1
Female	450	100	22	0.8 (0.6 - 1.1)	244	54	1.0 (0.8 - 1.2)
Social class:							
Non-manual	584	127	22	1	297	51	1
Manual	233	73	31	1.4 (1.0 - 1.9)	143	61	1.2 (0.9 - 1.4)
Self-rated health:							
Excellent	82	21	26	1	44	54	1
Very good/good	634	159	25	0.9 (0.6 - 1.5)	340	54	1.0 (0.7 - 1.3)
Fair/poor	101	20	20	0.7 (0.4 - 1.3)	56	55	1.0 (0.6 - 1.4)
Combined mental health score:							
Best	87	17	20	1	36	42	1
Intermediate	511	121	24	1.2 (0.7 - 2.0)	267	52	1.2 (0.9 - 1.8)
Worst	219	62	28	1.4 (0.8 - 2.4)	137	62	1.4 (1.0 - 2.1)
Frequent pain:							
No	631	152	24	1	325	52	1
Yes	186	48	26	1.1 (0.8 - 1.5)	115	62	1.2 (1.0 - 1.5)
Physical activities in an average working day: ^c							
Tasks involving repeated movements of wrist or fingers	427	140	33	2.1 (1.6 to 2.9)	274	64	1.5 (1.2 to 1.8)
Repeated bending and straightening of elbow for >1 hour in total	358	124	35	2.1 (1.6 to 2.8)	238	66	1.5 (1.2 to 1.8)
Work with hands above shoulder height for >1 hour in total	78	34	44	1.9 (1.3 to 2.8)	59	76	1.4 (1.1 to 1.9)
Lifting or carrying weights of 5 kg in one hand	275	85	31	1.4 (1.1 to 1.9)	162	59	1.1 (0.9 to 1.4)
Any of above four arm-straining activities	579	170	29	2.3 (1.6 to 3.4)	350	60	1.6 (1.2 to 2.0)

Relative risks were derived separately for each characteristic with adjustment for general practice (in five bands).

^aAnalysis was restricted to the 817 subjects who reported arm pain in the past year.

^cRelative risks are for those who reported an activity relative to those who did not.

Table 2
Associations of personal characteristics and occupational physical activities with arm pain in the past 12 months

Risk factor	Number of subjects ^a	Arm pain in the past 12 months		
		N	%	RR (95% CI) ^b
Age (years):				
34	290	114	39	1
35 - 39	212	84	40	1.0 (0.8 to 1.4)
40 - 44	273	123	45	1.2 (0.9 to 1.6)
45 - 49	304	140	46	1.3 (1.0 to 1.6)
50 - 54	292	149	51	1.4 (1.1 to 1.8)
55 - 59	282	155	55	1.5 (1.2 to 1.9)
60	116	52	45	1.3 (0.9 to 1.7)
Sex:				
Male	875	367	42	1
Female	894	450	50	1.2 (1.0 to 1.4)
Social class:				
Non-manual	1311	584	45	1
Manual	458	233	51	1.0 (0.9 to 1.2)
Self-rated health:				
Excellent	250	82	33	1
Very good/good	1373	634	46	1.2 (0.9 to 1.5)
Fair/poor	146	101	69	1.4 (1.0 to 2.0)
Combined mental health score:				
Best	295	87	29	1
Intermediate	1151	511	44	1.4 (1.1 to 1.8)
Worst	323	219	68	2.0 (1.5 to 2.6)
Exposed to one or more of four arm-straining activities at work: ^c				
No	626	238	38	1
Yes	1143	579	51	1.2 (1.1 to 1.5)

^aAnalysis was based on all 1769 subjects.

^bMutually adjusted relative risks derived from a single Cox regression model, also adjusted for general practice (in five bands).

^cActivities defined as in Table 1.

Table 3
Estimates of the proportion of arm pain attributable to arm-straining occupational activities and comparison with reported attribution to work according to the characteristics of participants

Population group	Number with arm pain	Association of arm pain with arm-straining activities				Reported as caused by work		Reported as caused or made worse by work	
		RR	P ^a	PAF % ^b	(95% CI)	% of cases	Ratio to PAF % ^b	% of cases	Ratio to PAF % ^b
All subjects:	817	1.24	70.9	13.9	(6.6 to 21.3)	24.5	1.76	53.9	3.87
Age (years):									
<50	461	1.16	69.9	9.8	(0.6 to 19.1)	23.4	2.40	52.9	5.43
50	356	1.35	72.2	18.6	(8.1 to 28.3)	25.8	1.39	55.1	2.96
Sex:									
Male	367	1.27	73.6	15.7	(3.6 to 26.8)	27.3	1.73	53.4	3.39
Female	450	1.22	68.7	12.4	(4.3 to 21.9)	22.2	1.79	54.2	4.38
Social class:									
Non-manual	584	1.24	66.4	13.1	(5.9 to 20.6)	21.8	1.66	50.9	3.89
Manual	233	1.21	82.0	14.1	(-4.7 to 30.2)	31.3	2.22	61.4	4.35
Self-rated health:									
Excellent	82	1.48	69.5	22.6	(-1.2 to 45.1)	25.6	1.14	53.7	2.38
Very good/good	634	1.23	70.4	13.0	(5.4 to 20.7)	25.1	1.94	53.6	4.14
Fair/poor	101	1.11	75.3	7.5	(-14.3 to 28.6)	19.8	2.63	55.5	7.38
Combined mental health score:									
Best	87	1.43	63.2	19.1	(1.0 to 39.1)	19.5	1.02	41.4	2.16
Intermediate	511	1.25	69.7	13.9	(5.3 to 22.6)	23.7	1.70	52.3	3.76
Worst	219	1.15	76.7	9.9	(-2.6 to 23.4)	28.3	2.86	62.6	6.31

^aP' = prevalence of exposure to at least one arm-straining occupational activity among cases of arm pain.

^bPopulation attributable fraction expressed as a percentage.