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Population based cohort study of incident and persistent arm pain: role of mental health, self-rated health and health beliefs

Dr KT Palmer¹, Dr I Reading¹, Dr C Linaker¹, Professor M Calnan², and Professor D Coggon¹

¹MRC Epidemiology Resource Centre, Community Clinical Sciences, University of Southampton, Southampton General Hospital, Southampton, England SO16 6YD, UK

²MRC Health Services Research Collaboration, Department of Social Medicine, Canynge Hall, Bristol, England BS8 2PR, UK

Abstract

To investigate whether somatising tendency, low mood, and poor self-rated health (SRH) predict incident arm pain, and whether these factors and beliefs about causation and prognosis predict symptom persistence, we conducted an 18-month postal follow-up in 1,798 working-aged subjects, sampled from the registers of five British general practices. At baseline questions were asked about pain in the arm (lasting 1 day in the prior 12 months), mental health (Short-Form 36 (SF-36MH)), somatising tendency (the Brief Symptom Inventory (BSI)), SRH, and beliefs about causation and prognosis. At follow-up we asked about arm pain in the last four weeks, and whether it had been present on 14 days. Associations with incidence and persistence were explored using logistic regression. The 1,256 participants (70% response) comprised 613 free of, and 643 with arm pain initially. Among the former, 21% reported new pain at follow-up, while 53% of the latter reported symptom persistence. The odds of both incident and persistent arm pain were significantly raised (1.7 to 4-fold) in the least vs. most favourable bands of SF-36MH, BSI and SRH. Even stronger associations were found for arm pain on 14 days. Persistent pain was significantly more common among those who attributed their pain to work or stress, and in those who expected symptoms still to be a problem in 12 months. Thus, SRH and mental health indices were strong predictors of incident and persistent arm pain in adults from the community, while persistence was also predicted by beliefs about causation and prognosis.

Keywords

cohort; risk factors; mental health; upper limb pain

Introduction

Pain in the upper limb is common in adulthood. At any one time, for example, shoulder pain affects some 7-34% of people in westernised countries (Bjelle, 1989; Badley and Tennant, 1991) while hand-wrist pain affects 9-23% (Palmer, 2003). For all sites combined, one British community survey estimated the 7-day prevalence to be 41% in men and 44% in women of working age (Palmer, 2003). Such symptoms can cause substantial disability, demand for health care and loss of working time (Walker-Bone et al., 2004). Moreover, they

are often persistent and many patients remain symptomatic for a year or longer (Croft et al., 1996; Van der Windt et al., 1996). Thus, determinants of incidence and persistence are important to characterise.

Historically, most studies of arm pain have been cross-sectional in design and thus unable to distinguish risk factors for incidence from those associated with persistence. Recently, findings from longitudinal studies have started to emerge (Macfarlane et al., 1998; Macfarlane et al., 2000; Andersen et al., 2003), but few such investigations have compared risk factors for incident and persistent arm pain using the same study population. In one study, the pattern of associations differed markedly (Miranda et al., 2001). Such differences, if confirmed, could impact importantly on strategies for prevention, and for the management of established illness.

For the low back, where longitudinal evidence is more extensive, it seems that sociocultural factors, personal mental health, and health beliefs are important influences on the development and persistence of pain (Dionne et al., 1997; Thomas et al., 1999; Oleske et al., 2000; Kopeck et al., 2003). Similarly, for widespread pain, persistence may be predicted by somatisation and poor mental health, illness behaviour and poor self-rated health (SRH) (Gureje et al., 2001; McBeth et al., 2001; Mantyselka et al., 2003; Eriksen et al., 2004). However, such factors have been less commonly considered in relation to arm pain.

The present population-based prospective cohort study was undertaken to investigate whether somatising tendency, low mood and poor SRH predispose to incident arm pain in those initially free of symptoms, and whether these factors, and beliefs about causation and prognosis, predict the persistence of arm pain in those initially symptomatic.

methods

Eligible participants were registered with five general practices in north Somerset, England and had participated in a previous cross-sectional study (Palmer et al., 2005). At baseline a questionnaire had been mailed to 4,998 subjects aged 25-64 years randomly selected from participating practices' age-sex registers. Usable responses were received from 2,632 of those mailed, including 1,798 (68%) who signified willingness to be contacted again. A brief follow up questionnaire was mailed to these 1,798 subjects at an interval of 18 months, with a reminder sent to non-respondents, as necessary, after a further 3 weeks. The study was approved by the NHS South West Local Research Ethics Committee.

Baseline

At baseline we asked about age, sex, mental health, SRH, arm pain in the past 12 months, and among those who had such arm pain, about beliefs regarding causation and prognosis.

'Arm pain' was defined as pain lasting a day or longer in the past 12 months in the upper limb, identified as a shaded area on a mannequin (Palmer et al., 2005; see Figure 1), and was sub-categorised according to total duration of pain during the period (≥ 6 months vs. <6 months in total) and the difficulty it caused in sleeping, getting dressed and doing everyday tasks ('disabling' arm pain made all three daily activities difficult or impossible.)

The main risk factors of interest were identified using a series of questions.

1. For depressive symptoms and somatising tendency we used the mental health subscale of the SF-36 (SF-36 MH) (Ware, 1989), categorised into thirds of the distribution, and also elements of the somatic subscale of the Brief Symptom Inventory (BSI) (Derogatis and Melisaratos, 1983), a validated self-reported measure of distress comprising items on bothersome nausea, faintness, dizziness,

weakness, numbness in the body, chest pain and breathing difficulties during the past 7 days. For the latter, each symptom was scored 0 to 4, depending on the distress it caused, scores were summed, and subjects were categorised into three bands, representing approximate thirds of the distribution for the whole sample.

2. We measured SRH using the single question: “In general would you say your health is...excellent/very good/good/fair/poor?” (Eriksson et al., 2001), which has been shown to have predictive validity for a variety of health end points. The response categories ‘good’ and ‘very good’ were combined, as were those for ‘fair’ and ‘poor’ to create a scale with three levels.
3. We asked those with arm pain at baseline (i) whether they were concerned that their upper limb symptoms might be a problem in 12 months time; (ii) whether or not the symptoms were caused or aggravated by work or stress; and (iii) what action someone should take if affected by arm pain. For this last item we scored the number of positive agreements with four statements about avoidance of physical activity being necessary to protect the arm. Items were adapted from those used in the Fear-Avoidance Beliefs Questionnaire (Waddell et al., 1993), but paraphrased to ensure relevance to arm symptoms, and to enable completion by those with and without symptoms. (The FABQ, which has predictive validity for non-recovery from LBP, is designed for completion by patients with back pain.)

Follow-up

At follow-up subjects were asked to report on pain in the arm (defined by the same shaded area on a mannequin) lasting a day or longer during the previous four weeks. We defined four outcome measures: (a) any arm pain; (b) pain on 14 days in the past four weeks (‘frequent’ arm pain); (c) disabling arm pain; (d) arm pain for which prescribed medication had been taken over the past four weeks (‘prescription-treated’ arm pain). All four outcomes were examined in analyses of persistence, but only (a) and (b) were sufficiently common to be included in analyses of incidence.

Analysis

Subjects without arm pain at baseline were eligible for the analysis of new onset pain; those with arm pain at baseline were studied for persistence. Associations between baseline risk factors and outcome measures were assessed using logistic regression, with adjustment for potential confounders. Findings were expressed as odds ratios (OR) with associated 95% confidence intervals (95%CI).

In refining the analytic strategy we first explored the overlap between explanatory variables in simple contingency tables. The association of SRH with categories of SF-36 MH and BSI was strong. Concordance between categories of SF-36 MH and tendency to somatise was more moderate, although quite a number of individuals scored highly on both scales, and both may be markers of a common underlying tendency to be aware of and report symptoms (psychological or physical). Therefore, in addition to considering each risk factor independently, we also defined a newly created composite mental health variable (‘combined mental health score’), based on the joint distribution of SF-36 MH and BSI bands – ‘worst’ being the top third of both scales, ‘best’ being the bottom third of both scales, and ‘intermediate’ comprising other combinations. This variable has been found to have predictive validity in relation to incident and persistent pain at another anatomical site, i.e. the knee (Palmer et al, 2006).

Thus, SRH, BSI, SF-36 MH, and combined mental health score were considered as risk factors for incidence and persistence of pain in separate regression models. All models were

adjusted *a priori* for the practice from which subjects were recruited and for age (in seven bands) and sex (for which empirical evidence suggests possible effects on incidence and/or persistence (Macfarlane et al., 1998; Andersen et al., 2003; Miranda et al., 2001; Dionne et al., 1997; Thomas et al., 1999; Kopec et al., 2003; Gureje et al., 2001; Eriksen et al., 2004). For persistence we also explored the effect of adjusting for pattern of pain at baseline – categorised in four bands according to each permutation of duration (<6 vs. ≥6 months) with disability (present vs absent) – as both duration and severity may modify outcome (Macfarlane et al., 1998; Dionne et al., 1997; Thomas et al., 1999). Finally, we explored the relation of persistence to beliefs about causation and prognosis, including analyses that allowed for pattern of pain at baseline (again in four bands) and combined mental health score (in three bands). All analyses were conducted in STATA version 9.2.

Results

After excluding 56 subjects with missing information on arm pain at baseline or follow-up, usable responses were obtained from 1,256 individuals (70% of the 1798 mailed and 48% of those who had participated in the previous cross-sectional survey). Although respondents at follow-up tended to be older than those mailed, and were somewhat less likely to have had poor SRH, differences were minor and response rates varied little by gender, severity or duration of pain at baseline, or indices of mental health (Table 1). Moreover, those finally studied were very similar to participants in the earlier cross-sectional survey in terms of age, sex, pattern of arm pain (duration and disability), and indices of SRH and mental health (data available on request).

The final sample included 613 participants who were free of arm pain and 643 who reported pain in the past 12 months at baseline. Table 2 describes the prevalence of arm pain in the last four weeks of follow-up in each of these groups. Some 53% (95%CI 49-57%) of those who were symptomatic at baseline still had symptoms at follow-up, including 164 (26%) who had frequent arm pain and 83 (13%) who had prescription-treated arm pain. Among those initially asymptomatic, some 21% (95%CI 18-25%) developed new incident arm pain, among whom about one in ten were taking prescription treatment.

Incident pain

Incident arm pain was somewhat more common in the youngest age band, but showed little trend with age thereafter, and was of similar frequency in men and women. Table 3 shows the associations of new onset arm pain with SRH and psychological health at baseline after adjustment for age, sex and recruitment practice (the effects of adjustment were slight – data available on request). The odds of arm pain at follow-up were raised 1.7 to 2.7-fold for those in the least favourable as compared with the most favourable band of health, the trend being strongest for combined mental health score and weakest for SF-36 MH score. All associations were significant at the 5% level.

For frequent arm pain, the pattern was similar. Risk estimates were based on smaller numbers of cases and had wider associated confidence intervals. But findings tended to be more extreme. Thus, the OR of this outcome was 4.4 (95%CI 1.2-16.1) in those with the worst vs. the best category of combined mental health score and 3.6 (95%CI 1.1-11.9) in those with fair to poor vs. excellent SRH.

Persistent pain

Persistence of arm pain was more common in women than men and tended to be more common after age 50 years. After allowing for age, sex and centre of recruitment, clear and strong associations were also evident for persistence of arm pain (Table 4). Thus, in the least

favourable bands of health at baseline the odds of pain at follow-up were raised 2.1 to 4.0-fold (Model 1), or 1.9 to 3.1-fold after adjusting for the severity and duration of pain at baseline (Model 2).

Table 4 focuses on the outcome 'any' pain in the final month of follow-up. Although not tabulated, we performed additional analyses for the other outcomes. Risk estimates were greater, but less precise (being based on smaller numbers). Thus, with Model 1, the OR for frequent arm pain was 8.1 (95%CI 3.3-20.2) in the worst vs. the best category of combined mental health score and 5.7 (95%CI 1.9-17.2) in the worst vs. the best category of SRH; for prescription-treated arm pain the corresponding risk estimates were 9.2 (95%CI 2.1-40.3) and 17.6 (95%CI 2.3-135.9) respectively. After adjusting for pain pattern at baseline (Model 2), the estimates for combined mental health score were 6.1 (frequent pain) and 9.9 (treated pain), and those for SRH fell to 3.7 and 11.6 respectively, but all associations remained significant at the 5% level.

Finally, table 5 presents risk estimates for persistence of arm pain according to baseline beliefs and concerns about prognosis. Three models are presented in relation to 'any' pain at follow-up with adjustment for (i) age, sex and practice (Model 1); (ii) Model 1 factors plus pattern of pain at baseline (Model 2); and (iii) Model 2 factors plus combined mental health score. The odds of reporting persistent pain at follow-up, as estimated by the first model, were raised 1.8-fold among those who believed their pain to be caused or made worse by work or stress, and 2.6-fold in those who expected that their pain would still be a problem in 12 months time. Risk estimates were weakened but still elevated after adjustment for pain characteristics and combined mental health score at baseline (ORs 1.5 to 1.8 in the fully adjusted model). By contrast, no significant association was found between persistence and beliefs that physical activity should be avoided to protect the arm.

A similar pattern, but with higher risk estimates, was found for the other follow-up outcomes. Thus, among those who expected that their pain would still be a problem in 12 months time, the odds of frequent pain were raised 3.6-fold (95%CI 2.1-6.4) and those of prescription treated pain 4.6-fold (95%CI 1.8-11.7) with Model 1, and by 2.0 and 2.5-fold with Model 3.

Discussion

Our survey indicates that SRH and various indices of mental health are strong predictors both of incident arm pain and of persistence of arm pain in working-aged adults from the general community. It also suggests that persistence is predicted by certain patterns of belief about causation and prognosis, even after allowance for mental health and severity and duration of symptoms at baseline. Patterns of association were clear-cut and consistent, we observed several dose-response relationships, especially with BSI, SRH and combined mental health score, and associations were stronger for severe categories of outcome than for arm pain as a whole.

In appraising these findings certain strengths and limitations of the study should be weighed. Almost everyone in Britain registers with a general practice, making the original sampling frames comprehensive, and representative of the communities served by participating practices. Response was incomplete, both at baseline and at follow-up, but particularly at follow-up was relatively high (the response rate at follow-up is the most important in relation to the internal validity of a cohort study (Hennekens et al., 1987). Those lost to follow-up showed no important differences in comparison with those mailed, either in demographic characteristics, or in pattern of pain, mental health profile, or beliefs at baseline. Thus, we have no reason to suppose that they would differ from participants in

terms of the associations studied, and it seems unlikely that selection or response bias could lead to the dose-response gradients so consistently observed. Reassuringly, those successfully followed were also very similar to participants in the earlier cross-sectional survey in demographic, mental health and pain characteristics, a point supporting generalisability of the findings.

On the other hand (for reasons of brevity) no direct information was collected at baseline on the localisation of pain within the arm, and at follow-up we did not have the opportunity to examine and classify subjects according to detailed diagnosis. Further research could usefully explore these extra issues.

Our definition of incident arm pain required subjects to be free of symptoms for the 12 months preceding baseline inquiry. It should be noted, however, that a 'new' episode over follow-up may not represent the first ever onset of arm pain for all individuals; regional pain often follows a recurrent course, although there is less information on this for the arm than for the back.

The tables present all of the arm pain outcomes and all of the mental health variables for which we collected information. In addition, we also asked about physical and psychosocial exposures in the work environment, but as this information could only be applied to a subset of those in employment, not all activities were relevant to the arm, and those that were relevant carried a fairly low RR in workers), we did not employ these measures as factors of adjustment in this analysis.

Longitudinal data concerning arm pain and the risk factors of our inquiry are currently sparse. However, a few published observations tend to support our findings. Thus, in a two-year cohort study from British general practice, Macfarlane et al found that the incidence of forearm pain was raised 1.7 to 3.8-fold among subjects characterised at baseline as having high scores for somatisation, illness behaviour, and GHQ (General health Questionnaire) caseness (Macfarlane et al., 2000). Andersen et al found that 'distress' (measured by the stress profile questionnaire of Setterlind) increased the incidence of neck-shoulder pain and examination tenderness by almost three-fold in a cohort of 3123 Danish industrial workers, followed for four years (Andersen et al., 2003). And a second study by Macfarlane et al reported that GHQ caseness increased the risk of persistent arm pain 2.6-fold in subjects recruited from a cross-sectional population screening (Macfarlane et al., 1998). More generally, persistent pain at various other sites has been linked with somatisation (Dionne et al., 1997; McBeth et al., 2001; Hendriks et al., 2005), personal stress (Oleske et al., 2000), poor mental health/depression (Dionne et al., 1997; Gureje et al., 2001; Eriksen et al., 2004), GHQ caseness (Thomas et al., 1999), and poor SRH (Dionne et al., 1997; Thomas et al., 1999; Oleske et al., 2000; Gureje et al., 2001; Eriksen et al., 2004); while reports suggest that incident pain may be predicted by chronic stress (Kopec et al., 2003), poor mental health (Eriksen et al., 2004) and poor SRH (Kopec et al., 2003; Eriksen et al., 2004). Finally, although health beliefs appear not to have been studied much in cohort studies of arm pain, pessimism over prognosis has been found to predict non-recovery in patients with low-back pain (Karjalainen et al., 2003). Fear-avoidance beliefs also appear to influence persistence of back pain (Waddell et al., 1993; Gheldof et al., 2005), although in this study we observed no relation between our modified fear-avoidance scale and persistent arm pain.

We have found one other study in which risk factors for incidence and persistence of arm pain have been directly compared (Miranda et al., 2001), and a few concerning pain at multiple sites (Gureje et al., 2001; Eriksen et al., 2004) or sites unspecified (Elliot et al., 2002). In a long-term follow-up of Finnish forestry workers, Miranda et al reported that a high measure of self-reported mental stress ('much or rather much' vs. 'not at all') doubled

the risk of incident shoulder pain (lasting >7 days), assessed at an interval of one year, but did not significantly affect the risk of persistent shoulder pain (lasting >30 days); but the authors did not address SRH, somatising tendency SF-36 MH, or illness beliefs as potential risk factors. Two other population studies investigated generalised long-term pain (>6 months). The authors of a World Health Organisation cross-national multi-centre survey reported that the incidence of such pain at follow-up was influenced by SRH (OR 1.7) and baseline depression or anxiety disorder (OR 2.4), but that only the latter (OR 1.5) and age predicted persistence (Gureje et al., 2001). By contrast, in a six-year follow-up of a Danish population sample, poor SRH and poor mental health were factors in both incidence and persistence, raising risks some 2.5 to 3-fold (Eriksen et al., 2004). And in a four-year follow-up study from the Scottish Grampians, which like our own sampled from registrations in British general practices, associations were found between poor SF-36 MH and incident and persistent chronic pain (Elliot et al., 2002).

As judged by our data, the risk factors for incidence and persistence are similar. SRH, BSI, SF-36 MH and combined mental health score were all significantly associated with each end point. Moreover, as associations with combined mental health score were stronger than with BSI or SF-36 MH individually, it seems that low mood and tendency to somatise each make independent contributions to the frequency of symptoms. Pessimistic views about prognosis and belief that symptoms are caused by an external event or stressor also predicted persistence, even after adjusting for severity and duration of pain and mental health status. It may thus be (as now assumed for low-back pain), that health beliefs and expectations contribute to symptom chronicity.

Our study identifies several potential psychological ('yellow flag') risk factors that could be helpful to doctors in assessing the prognosis of patients with arm pain, and several potential targets for intervention. Important concomitant research questions concern the stability of these risk indicators within individuals, and their capacity to be beneficially improved. Such evidence is sketchy at present, but encouraging in at least one instance: thus, it appears that somatising tendency can fluctuate over time (Gureje and Simon, 1999), can be recognised by clinicians (Rosendal et al., 2003), and can perhaps be modified therapeutically (Schilte et al., 2001; Lidbeck, 1997). Health beliefs and response to illness have also proved a useful target for individual and population-level interventions to prevent disability from low-back pain, and thus encourage trials of similar initiatives in the management of non-specific arm pain.

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Figure 1.
The upper limb, as defined in the questionnaire

Table 1Participation and response rates **according to baseline characteristics**

Characteristic	No at baseline (n = 2,632)	No. (%) [¶] willing to be contacted again (n = 1,798)	No. (%) [*] at follow-up (n = 1,256)
Sex:			
Male	1,191	816 (69%)	562 (69%)
Female	1,425	979 (69%)	694 (71%)
Unknown	16	3 (19%)	0 (0)
Age group (years):			
<35	368	236 (64%)	131 (56%)
35 - 39	295	189 (64%)	114 (60%)
40 - 44	349	241 (69%)	165 (68%)
45 - 49	383	268 (70%)	188 (70%)
50 - 54	395	266 (67%)	200 (75%)
55 - 59	482	354 (73%)	274 (77%)
60	360	244 (68%)	184 (75%)
Pain during past 12 months:			
Any	1213	908 (75%)	643 (71%)
>6 months	335	252 (75%)	189 (75%)
Disabling	236	157 (67%)	104 (66%)
Self rated health:			
Fair/poor	348	247 (71%)	148 (60%)
Somatisation score:			
Worst band	958	685 (72%)	461 (67%)
SF-36 MH score:			
Worst band	905	617 (68%)	406 (66%)
Combined mental health score:			
Worst band	501	345 (69%)	216 (63%)

[¶]% of those who participated at baseline^{*}% of those mailed a follow-up questionnaire

Table 2

Prevalence of arm pain in the last 4 weeks of follow-up according to pain status at baseline

Pain in final 4 weeks of follow-up	Status at baseline [*]					
	Arm pain absent (n = 613)			Arm pain present (n = 643)		
	N	%	(95% CI)	N	%	(95% CI)
Any	131	21.4	(18.2 - 24.8)	338	52.6	(48.6 - 56.5)
Pain 14 days	40	6.5	(4.7 - 8.8)	164	25.5	(22.2 - 29.1)
Treated by prescription	16	2.6	(1.5 - 4.2)	83	12.9	(10.4 - 15.7)
Disabling	12	2.0	(1.0 - 3.4)	73	11.4	(9.0 - 14.1)

^{*} Pain in the arm in the past 12 months.

Table 3

Associations of new onset arm pain with self-rated health and mental health at baseline

Characteristic at baseline	No. in sample [*]	Pain in last 4 weeks at follow-up		
		Any pain	Pain lasting 14 days	
		N with pain	OR (95% CI)	N with pain
Self rated health				
Excellent	116	21	1.0	7 1.0
Good/very good	462	97	1.2 (0.7 – 2.0)	26 0.9 (0.4 – 2.2)
Fair/poor	33	12	2.1 (0.9 – 5.2)	7 3.6 (1.1 – 11.9)
Somatisation score				
Best	241	34	1.0	8 1.0
Intermediate	201	50	1.9 (1.2 – 3.1)	18 2.8 (1.2 – 6.8)
Worst	159	41	2.0 (1.2 – 3.4)	13 2.5 (1.0 – 6.3)
SF-36 score				
Best	273	52	1.0	17 1.0
Intermediate	170	31	0.9 (0.6 – 1.5)	6 0.5 (0.2 – 1.4)
Worst	167	47	1.7 (1.1 – 2.8)	17 1.7 (0.8 – 3.7)
Combined mental health score				
Best	142	19	1.0	4 1.0
Intermediate	397	88	1.8 (1.1 – 3.2)	28 2.7 (0.9 – 7.9)
Worst	62	19	2.7 (1.3 – 5.7)	7 4.4 (1.2 – 16.1)

Separate models were constructed for each row variable. All risk estimates were adjusted for age (in 7 bands), sex, and practice.

* A few respondents failed to answer all the questions.

Table 4

Associations of persistent arm pain with self-rated health and mental health at baseline

Characteristic at baseline	No. in sample*	Pain in past 4 weeks at follow up		
		No with pain	Model 1 OR (95% CI)	Model 2 OR (95% CI)
Self-rated health				
Excellent	54	18	1.0	1.0
Good/very good	472	240	2.0 (1.1 - 3.6)	1.8 (1.0 - 3.3)
Fair/poor	115	79	3.5 (1.7 - 7.1)	2.5 (1.2 - 5.4)
Somatisation score				
Best	134	43	1.0	1.0
Intermediate	179	84	1.8 (1.1 - 3.0)	1.7 (1.0 - 2.8)
Worst	302	194	3.6 (2.3 - 5.7)	2.7 (1.7 - 4.3)
SF-36 score				
Best	218	95	1.0	1.0
Intermediate	176	85	1.3 (0.8 - 1.9)	1.1 (0.7 - 1.7)
Worst	239	151	2.1 (1.4 - 3.1)	1.9 (1.2 - 2.9)
Combined mental health score				
Best	78	24	1.0	1.0
Intermediate	386	198	2.4 (1.4 - 4.1)	2.2 (1.2 - 3.8)
Worst	154	100	4.0 (2.2 - 7.2)	3.1 (1.7 - 5.9)

Separate models were constructed for each row variable.

In Model 1, risk estimates were adjusted for age, sex, and general practice.

In Model 2, risk estimates were adjusted for age, sex, general practice, and pattern of pain at baseline (duration and disability).

* A few respondents failed to answer all the questions

Table 5

Associations of beliefs and concerns about prognosis with persistence of arm pain

Belief at baseline		No. in sample*	Pain in past 4 weeks at follow up		
	No with pain		Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Causation:					
Pain caused or made worse by work					
No	323	145	1.0	1.0	1.0
Yes	320	193	1.8 (1.3 - 2.5)	1.6 (1.1 - 2.2)	1.5 (1.0 - 2.1)
Pain caused or made worse by stress					
No	510	252	1.0	1.0	1.0
Yes	110	74	1.8 (1.2 - 2.9)	1.9 (1.1 - 3.0)	1.5 (0.9 - 2.5)
Physical activity might harm the arm/ should be avoided					
0	120	69	1.0	1.0	1.0
1	200	102	0.9 (0.5 - 1.4)	0.8 (0.5 - 1.2)	0.8 (0.5 - 1.3)
2	172	89	0.9 (0.5 - 1.4)	0.8 (0.5 - 1.4)	0.9 (0.5 - 1.4)
3	123	65	0.8 (0.5 - 1.4)	0.8 (0.4 - 1.3)	0.8 (0.4 - 1.3)
Prognosis:					
Concerned pain will still be a problem in 12 months					
No	164	54	1.0	1.0	1.0
Yes	474	281	2.6 (1.8 - 3.9)	2.1 (1.4 - 3.1)	1.8 (1.2 - 2.7)

Separate models were constructed for each belief.

* A few respondents failed to answer all the questions

In Model 1, risk estimates adjusted for age, sex and practice.

In Model 2, risk estimates adjusted for age, sex, practice, and pattern of pain at baseline (duration and disability).

In Model 3, risk estimates adjusted for age, sex, practice, pattern of pain at baseline (duration and disability), and combined mental health score.