Patterns of shoulder pain during a 14-year follow-up: results from a longitudinal population study in Norway

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Abstract

Background: Population studies have reported that shoulder pain is the third most frequently reported musculoskeletal pain. Long duration, pain intensity and high level of disability predict persistent complaints. The present study aimed to describe the prevalence of shoulder pain in a general population and follow this over a long period (1990 to 2004). The objective was also to describe the stability of shoulder pain and patterns of co-occurrence with neck and upper back pain.

Methods: Data were obtained from a self-reported questionnaire in a population in Ullensaker municipality, north-east of Oslo. The Standard Nordic Questionnaire was sent in 1990, 1994 and 2004 to inhabitants belonging to six birth cohorts from 1918–20 to 1968–70.

Results: The 1-year prevalence of shoulder pain was 46.7% (95% CI, 44.9% to 48.6%) in 1990, 48.7% (95% CI, 46.8% to 50.5%) in 1994, and 55.2% (95% CI, 53.5% to 56.9%) in 2004. Approximately three-quarters of the persons with shoulder pain at one given time also reported shoulder pain at the next follow-up.

Conclusions: Prevalence of shoulder pain during a 14-year period was high and slightly increasing. Shoulder pain was reported most frequently in co-occurrence with neck pain. Classification models should include neck pain as well as other co-occurring pain sites.

Keywords

Co-existing pain, prevalence, shoulder pain, stability of pain

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Introduction

Shoulder pain is the third most prevalent reported musculoskeletal pain site in population studies, including our own Ullensaker Study in Norway.^{1–4} There are large variations in prevalence figures between different studies. Picavet et al. reported that 20.9% in a general Dutch population had shoulder pain.⁵ In a systematic review, Luime et al. found that between 4.6% and 47.0% in population studies reported shoulder pain during a given year.⁶ This great gap in prevalence is probably mostly explained by different case definitions, age groups and gender differences.^{7–10}

Even though 50% of all new episodes of shoulder complaints presented in primary care show complete recovery within 6 months, only an additional 10% recover after 1 year.^{11–14} Additionally, shoulder pain often recurs.

Shoulder pain is considered to have multifactorial causes and is often presented together with other pain symptoms.^{15–17} The exact mechanisms underlying shoulder pain is understood poorly. Structural changes

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increase with age also in asymptomatic subjects.^{15,18,19} Several studies have shown that shoulder pain of long duration, at high intensity, and with a high level of disability predict persistent complaints.^{12,20,21} The factors that start an episode of shoulder pain are not necessarily the same as those that contribute to persistent and chronic pain.^{22,23}

Most studies on musculoskeletal pain have focused on pain at a single site (e.g. the shoulder) or regional distribution (e.g. neck and shoulder pain).^{8,24–26} Prevalence rates of pain at specific regions give a fragmented picture.²⁷ In health surveys in the general population that have recorded multiple pain sites, most people report more than one symptom at any given time.^{1,3,28–30} There may be a link between symptoms in different bodily regions, which involves shared pathology, common mechanical risk factors or some aspects of psychological distress.^{31,32}

Shoulder pain is more commonly clustered with neck pain than with, for example, elbow and wrist/hand pain and is also often reported as radiating pain (from the neck to the shoulder, elbow, or hand).^{14,33–36} The co-occurrence of shoulder and neck pain with upper back pain has been investigated infrequently.³⁷

In the present study, we aimed to estimate the prevalence of shoulder pain across gender and age in the general population over three time points during a 14-year follow-up (1990, 1994 and 2004). A second objective was to describe the stability of shoulder pain reports over the 14-year follow-up period. Our third aim was to explore patterns of co-occurrence with neck and upper back pain at the three time points.

Materials and methods

Ullensaker is a community situated 40 km north-east of Oslo, Norway, and had 23,700 inhabitants in 2004. A postal questionnaire about musculoskeletal pain, the validated Standard Nordic Questionnaire for musculoskeletal problems, was applied.³⁸ The questionnaire is developed for epidemiological studies and not for clinical diagnosis.^{38,39} It was sent to the inhabitants belonging to the six birth cohorts of 1918–20, 1928–30, 1938–40, 1948–50, 1958–60 and 1968–70 in 1990 and 1994.^{1,40} In 2004, the sample population was supplemented by persons born in 1978–80 and this group was included in the cross-sectional analyses from 2004. The data in this study were longitudinal, self-reported musculoskeletal pain in the Ullensaker population.^{1,41} The project is approved by the regional committee of medical ethics.⁴¹

Variables

The Standard Nordic Questionnaire asks about the experience of pain and discomfort from nine areas:

neck, shoulder, elbow, hand/wrist, upper back, lower back, hip, knee and ankle/foot (with yes or no as the available answers). These questions also include a posterior view of a body map illustrating the nine body areas.¹ The body map is assumed to ensure a common interpretation of the body regions.³⁹ The respondents were asked to report pain and/or discomfort from any of these body areas during two time periods: the last 7 days and the last 12 months.¹ In the present study, we used the last 12 months and report 1-year prevalence rates. Shoulder pain was defined on this chart as the body region below the neck and including the scapula and upper part of the arm. The upper back was localized in the middle between the two shoulder blades as illustrated in Figure 1.

Shoulder pain: categorization and data presentation

We defined localized shoulder pain if the shoulder was indicated as the only pain site without neck or upper back pain. Regional shoulder pain was defined according to its co-occurrence with either neck or upper back pain, or both.

We analyzed cross-sectional data collected in 1990, 1994, and 2004. The data for participants at each time point were included. We also analyzed the data which formed a cohort and comprised those who responded at

Figure 1. Posterior view of body map.

all three time points (1990, 1994 and 2004). This cohort included 1443 persons.

Statistical analysis

The prevalence of shoulder pain was calculated and is presented with 95% confidence intervals (CIs) and stratified by age and gender. Prevalence estimates were also calculated for shoulder pain co-occurring with neck and upper back pain in 1990, 1994 and 2004. When calculating the 95% CIs for the prevalence estimates, the one-sample test was applied.

We calculated the percentage of persons who reported shoulder pain during the three follow-up time points based on the cohort. A responder/non-responder analysis according to gender and age group across the three time points was also performed.

Missing values were not included in the analyses. The analyses were performed using SPSS, version 18.0 (IBM Corp., Armonk, NY, USA).

Results

In 1990, after one reminder 2722 of 4050 potential participants (67.2%) returned the Standard Nordic Questionnaire. The response rates were 63.1% (2890 of 4577 persons) in 1994 and 54.4% (3325 of 6108 persons) in 2004. In 1990, the lowest response rates were seen among those born 1968–70 (20 years to 22 years). Also in 1994 the lowest response rate was seen in the youngest birth cohort (Table 1). The response rate was approximately 10% lower for men than women. In 2004, fewer participants in the oldest age group (born 1918–20) participated (36.0%). The group that dropped out between 1990 and 2004 comprised more men in the younger age groups.

The cohort of 1443 persons responded at all three time points and comprised 52.9% of the responders in 1990, 49.9% of those in 1994 and 43.4% of those in 2004, with a higher proportion of women.

Prevalence of shoulder pain in 1990, 1994 and 2004

The 1-year prevalence rates of shoulder pain were 46.7% (95% CI, 44.9% to 48.6%) in 1990, 48.7% (95% CI, 46.8% to 50.5%) in 1994 and 55.2% (95% CI, 53.5% to 56.9%) in 2004. The highest prevalence (61.3%) was seen in 2004 for those 44 years to 46 years (born in 1958–60). Table 2 presents the prevalence of shoulder pain across age groups. The highest prevalence estimates were found in the birth cohorts 1938–40, 1948–50 and 1958–60 at all three time points (Figure 2 and Table 2). According to Figure 2, the highest prevalence occurs between the middle of the

Table 1. Questionnaires sent and received in 1990, 1994 and 2004 according to birth cohorts.

Birth cohort	1990		1994		2004	
	Questionnaires sent	Questionnaires received	(% of total sent)	Questionnaires sent	Questionnaires received	(% of total sent)
1918–20	347	222	(64.0)	306	187	(61.1)
1928–30	458	348	(76.0)	454	347	(76.4)
1938–40	652	482	(74.1)	669	485	(72.5)
1948–50	873	586	(67.1)	936	672	(71.8)
1958–60	729	470	(64.8)	888	516	(58.1)
1968–70	991	613	(61.9)	1309	684	(52.3)
1978–80					896	(35.6)
Total	4050	2721		4562	2891	
					3325	

Table 2. Prevalence of shoulder pain in the past year in 1990, 1994 and 2004 with 95% confidence intervals (CIs).

	All (95% CI)	Born 1918–20 (95% CI)	Born 1928–30 (95% CI)	Born 1938–40 (95% CI)	Born 1948–50 (95% CI)	Born 1958–60 (95% CI)	Born 1968–70 (95% CI)	Born 1978–80 (95% CI)
Cross-sectional								
Shoulder pain 1990 (n = 1272)	46.7% (44.9 to 48.6)	41.9% (35.4 to 48.4)	49.7% (44.4 to 55.0)	54.9% (50.4 to 59.3)	52.4% (48.3 to 56.4)	43.6% (39.1 to 48.1)	37.4% (33.4 to 41.2)	
Shoulder pain 1994 (n = 1406)	48.7 (46.8 to 50.2)	36.4% (29.4 to 43.3)	44.2% (39.0 to 49.5)	51.6% (47.1 to 56.0)	54.8% (51.0 to 58.5)	50.0% (45.7 to 54.3)	45.2% (41.4 to 48.9)	
Shoulder pain 2004 (n = 1836)	55.2% (53.5 to 56.9)	35.6% (23.0 to 48.2)	39.3% (33.2 to 45.4)	55.7% (51.1 to 60.2)	60.4% (56.8 to 64.1)	61.3% (57.4 to 65.2)	55.8% (52.6 to 59.0)	46.4% (40.9 to 51.9)

forties and the middle of the fifties (between 45 years and 55 years) and the age patterns were similar for 1990, 1994 and 2004. The maximum prevalence occurred at age 50 years and decreased with age past 60 years. There was a small increase in prevalence rates in 2004 compared with 1990 and 1994; however, as shown in Table 2, the 95% CIs mostly overlapped.

More women than men reported shoulder pain at the three time points (Table 3). Shoulder pain reported during the 14-year follow-up period increased in men from 36.4% (95% CI, 34.4% to 39.9%) in 1990 to 46.6% (95% CI, 44.1% to 51.0%) in 2004 and in women from 56.3% (95% CI, 54.4% to 60.1%) in 1990 to 62.3% (95% CI, 58.2% to 64.1%) in 2004.

Prevalence of shoulder pain in the cohort

Among the 1443 persons who responded at all three time points, the prevalence estimates were similar compared to the cross-sectional data sets and showed a small increase in the prevalence of shoulder pain over the 14-year period (Table 4).

The cohort consisted of 617 (42.8%) men and 826 (57.2%) women (data not shown). The distribution of men and women reporting shoulder pain in this cohort showed an increase in men from 1990 to 2004 (37.6% in 1990 to 47.3% in 2004) with a smaller increase in women (56.2% in 1990 to 59.7% in 2004).

Stability and change in shoulder pain reported over time

Of the 698 persons (48.2%) in the cohort reporting shoulder pain in 1990, 505 (72.3%) reported shoulder pain in 1994 and 391 (77.4%) still reported shoulder pain in 2004 (Figure 3). The stability in shoulder pain was similar for the 4 years from 1990 to 1994 and for the 10 years from 1994 to 2004 (Figure 3). A parallel observation was made for the 747 (51.8%) persons who reported no shoulder pain in 1990, whereas 528 (70.7%) of them had no shoulder pain in 1994 and 357 (67.6%) still reported no shoulder pain at the follow-up in 2004. The stability and size of the change was almost the same in these two time periods. The group that had changed shoulder pain status from pain in 1990 to no pain in 1994 were approximately equally distributed (50%) in reporting shoulder pain or no shoulder pain in 2004. A little higher frequency of shoulder pain report (58% versus 50%) was seen in 2004 for those without shoulder pain in 1990 but with shoulder pain in 1994. As shown in Figure 3, persons who reported shoulder pain at one time point, more often reported shoulder pain at the next follow-up.

Figure 2. Reported shoulder pain in 1990, 1994 and 2004.

Table 3. Cross-sectional prevalence of shoulder pain in the last year according to gender with 95% confidence intervals (CIs).

Shoulder pain (all) according to the last year	Shoulder pain (% with 95% CI)	Women (all) (% with 95% CI)	Men (all) (% with 95% CI)
1990 (n = 2722)	46.7% (44.9 to 48.6)	56.3% (54.4 to 60.1)	36.4% (34.4 to 39.9)
1994 (n = 2890)	48.7% (46.8 to 50.2)	57.7% (55.2 to 60.2)	38.5% (35.9 to 41.1)
2004 (n = 3325)	55.2% (53.5 to 56.9)	62.3% (58.2 to 64.1)	46.6% (44.1 to 51.0)

Table 4. Prevalence of shoulder pain in the cohort (n = 1443) the last year in 1990, 1994 and 2004.

The cohort (n = 1443)	All (%)	Born 1918–20 (n = 41) (%)	Born 1928–30 (n = 183) (%)	Born 1938–40 (n = 317) (%)	Born 1948–50 (n = 385) (%)	Born 1958–60 (n = 253) (%)	Born 1968–70 (n = 264) (%)
Shoulder pain 1990	698 (48.2)	13 (31.7)	96 (52.5)	172 (54.3)	198 (51.4)	119 (47.0)	98 (37.1)
Shoulder pain 1994	724 (50.2)	13 (31.7)	84 (45.9)	160 (50.5)	214 (55.6)	130 (51.4)	123 (46.6)
Shoulder pain 2004	785 (54.4)	14 (34.1)	70 (38.3)	173 (54.6)	219 (56.9)	164 (64.8)	145 (54.9)

Pattern of co-occurrence with other pain sites

Strictly localized shoulder pain, reported as shoulder pain without neck or upper back pain, was reported by 7.7% of the respondents in 1990, 8.7% in 1994 and 8.6% in 2004 (cross-sectional data) (Table 5).

In the cohort, the corresponding values were (8.0% in 1990, 8.9% in 1994 and 9.1% in 2004).

Shoulder pain was more frequently reported with co-occurring pain and most frequently reported together with neck pain (20.2% to 21.5%) than the other combinations (Table 5). Shoulder pain together with upper

The cohort, $n = 1443$

Year

Figure 3. Long-term course of shoulder pain in 1990, 1994 and 2004. Shoulder pain status, unchanged for the entire period, is outlined in bold.

Table 5. Cross-sectional frequencies of shoulder pain last year and shoulder pain in co-occurrence with neck and upper back pain in 1990, 1994, and, 2004.

Cross-sectional	1990 ($n = 2722$) (%)	1994 ($n = 2890$) (%)	2004 ($n = 3325$) (%)
Shoulder pain without neck or upper back pain	210 (7.7)	251 (8.7)	285 (8.6)
Shoulder and neck pain	552 (20.2)	593 (20.5)	715 (21.5)
Shoulder and upper back pain	44 (1.6)	40 (1.4)	51 (1.5)
Shoulder, neck and upper back pain	466 (17.1)	522 (18.1)	785 (23.6)
Total shoulder pain	1272	1406	1836

The categories given above are exclusive and do overlap with each other.

back pain was almost never reported without neck pain [shoulder pain with only upper back pain (1.4% to 1.6%); shoulder pain with neck and upper back pain was reported more often (17.1% to 23.6%)]. The patterns of co-occurrence were similar in the cohort (data not shown).

Discussion

The present study has three main findings. First, a high and slightly increasing prevalence of shoulder pain was found in our local community population as reported in 1990, 1994 and 2004. Second, and essentially, the percentage of respondents reporting shoulder pain was relatively stable; of those who reported shoulder pain in 1990, 72.3% still reported shoulder pain in 1994 and 77.4% of those in 1994 also reported shoulder pain in 2004. Correspondingly, of those without shoulder pain in 1990, 70.7% had no shoulder pain in 1994 and 67.6% of those in 1994 were still without shoulder pain in 2004. Third, shoulder pain was frequently reported in co-occurrence with neck pain (20.2% to 21.5%) and with both neck and upper back pain (17.1% to 23.6%).

One strength of this study is that it included a large number of persons and that the Ullensaker population is considered to be quite representative of the adult Norwegian general population.¹ Another strength is that a relative large number of persons responded at all three time points during the 14-year period. The age and gender distributions and the pain reports were comparable at each of the three cross-sectional time points (1990, 1994 and 2004) and the prevalence figures in the three cross-sectional data sets and the cohort were similar.

An additional strength of the present study is that the same validated questionnaire and the same standardized survey method was applied in the same municipality, ensuring that the prevalence of symptoms was derived from the same case definition throughout the study period.

The population was unselected and not recruited according to a diagnosis of shoulder pain. Clinicians may regard the inclusion of populations with nonspecific shoulder pain as a limitation, because of their belief in diagnostic criteria and the importance of a specific diagnosis.^{42,43} However, in research, it is recommended to include populations with nonspecific shoulder pain because of the lack of uniform diagnostic criteria for shoulder diagnostics.⁴²

The present study also has some limitations to be considered when interpreting these results. The definition of shoulder pain may represent pain with different causes and factors from different possible sources might contribute to the shoulder pain. The list of the body

parts as presented in the Nordic Questionnaire is supplemented with only a posterior body map and we are not sure whether anterior shoulder pain has been fully captured. A universal and multidisciplinary classification system for complaints of the arm, neck, and/or shoulder (CANS) model has been developed and accepted in a Delphi process.⁴⁴ This classification system contributes to compare research in general populations but was developed some years after the start of this survey.⁸ However, this way of classification gives some support to our definition and report of shoulder pain.

Another concern is the response rate, which is slightly lower than in other similar recent postal surveys.^{16,45} There is some evidence that people with complaints tend to respond more often in surveys and that young people respond less often because they experience less complaints.⁴⁶ This is consistent with our observation that more of the nonresponders were younger men and that women respond more often than men. This might reflect a tendency towards a higher response rate in persons with musculoskeletal pain. Other studies also support our finding that musculoskeletal pain is more prevalent in women and persons between 40 years and 60 years.^{3,47} However, some other studies conclude that more pain is more common among nonresponders.^{48,49} Nonresponder bias might cause underestimation (a 'healthy volunteer' effect), as well as overestimation (higher participation among persons with musculoskeletal pain) of prevalence figures.

Fewer persons in the highest age group (born 1918–20) participated in 2004, which might be because they have been more acceptant of their complaints and some may also have reduced their demands on their shoulder.⁵⁰ Another possible explanation is that in 2004 they are older (84 years to 86 years) and do not want or are not capable of participating.

We decided to use data on the 1-year prevalence of shoulder pain instead of using a shorter time frame such as 1 week.⁴¹ The 1-year prevalence provides information about both episodic and chronic shoulder pain. However, recall bias may lead to some reduction in the prevalence figures because minor or episodic pain might have been forgotten over the long period.⁵¹ Recall bias can be reduced by using a shorter time frame; however, 1-year prevalence is the most frequently and consistently reported recall period used in the literature making comparison with other studies possible.^{10,35,52} Hence, we decided to use the 1-year data in the present study.

The wording of the questionnaire was formulated in a way that some minor or transient symptoms might also have been reported.²⁴ We did not record the intensity of pain for each pain site and therefore do not know what the respondents considered as the worst

pain site. Many persons would probably not consider themselves as in need of treatment or been classified by a physician as a shoulder pain patient.²⁴ The prevalence figures in questionnaires based on population studies have many possible sources of error. Therefore, it is important to underline that a report of shoulder pain, as in the present study, does not imply a need for treatment or be interpreted as a health problem.

We also lack information about pain duration, which prevents us from stating whether each report of shoulder pain was the first episode of pain or part of a recurrent or more comprehensive shoulder problem.

No superior alternatives to self-reporting exist. The HUNT study by Hagen et al. reported good agreement between interview and questionnaire about musculoskeletal pain (kappa value = 0.63).⁵³

The prevalence of shoulder pain over time has not been studied in a Norwegian general population before. However, previous cross-sectional studies on the prevalence of different types of musculoskeletal pain in both Norway and other European countries have shown similar results, both according to gender and to age.^{16,41,50,53–55} For example, the HUNT study in Norway by Svebak et al. found shoulder pain to be most prevalent in women between 50 years and 59 years.⁵⁵

Comparing the prevalence estimates of shoulder pain between populations and over time is challenging because of methodological heterogeneity across studies.^{6,54} Prevalence estimates vary by case definitions, recall periods, and the age and gender distributions. For example, a case definition of shoulder pain the past year may give different prevalence rates compared with a definition of continuous shoulder pain for at least 3 months.

We found higher point prevalence rates of shoulder pain among women than men, in line with other studies.^{7,16} The gender differences have been explained by different thresholds in perception and reporting of pain between women and men,^{3,56} as well as the fact that women are more likely to report shoulder pain because of lifestyle factors such as psychosocial demands both at work and outside work.^{16,50,57,58} Another explanation might be that women have more pain than men, which supports our findings. Consistent with other studies, the prevalence decreased with increasing age over 60 years.^{26,54} However, the study of Walker-Bone et al. reported 1-week prevalence comparable to our 1-year prevalence rates.²⁶ In addition, Bot et al. found that this decrease in prevalence started about 10 years earlier for women.⁵⁴

Normal age degeneration of tissue (biological processes within individuals) is a predisposing factor for shoulder pain.^{10,59,60} Additionally, some shoulder joint disorders, in particular acromioclavicular and

glenohumeral osteoarthritis, are seen more frequently within elderly.^{61,62} However, it appears that the age effect of osteoarthritis and other degenerative changes might be obscured by other factors, resulting in the observed decrease in shoulder pain prevalence within this age group. A possible reduction in exposure to some risk factors such as workplace factors and psychosocial demands in elder people might explain some of the reduction in symptoms.^{3,7} In addition, elderly might be more acceptant of their musculoskeletal complaints, and other chronic diseases and conditions might be more dominating.^{5,54} The small increase in prevalence over time might be more related to a period effect rather than an age effect.^{10,63} A period effect is often due to population-wide changes in behaviours and exposures independent of ageing; for example, psychosocial demands (both at work and outside work) or general cultural influences.^{59,60,64} This may affect the awareness and reporting of symptoms and involve different age groups.^{16,65–67} The increase in prevalence might also be affected by cohort effects (i.e. influences of population-wide exposures before the study period, such as environmental differences), which create common exposure for an entire birth cohort.⁶⁴ An increase in overall prevalence figures for shoulder pain could be expected to be caused by a combination of age, period and cohort effects.^{10,57,63} Because the prevalence of shoulder pain reported decreases after 60 years and our study population was aging during the observation period, the expected age effect should have caused a slight reduction in shoulder pain prevalence over time. This puts more emphasis on the period and perhaps some unknown cohort effects when explaining the increase in shoulder pain prevalence between 1990 and 2004. However, the nature of such period and cohort effects cannot be inferred from the present study.

Nonspecific shoulder and neck pain are often studied together in population-based surveys of prevalence and prognosis.^{3,8,16,36,52,68} It might be difficult to clearly discriminate between shoulder and neck complaints. Pain at these pain sites are considered to have multifactorial origins, which may involve shared pathology (similar underlying attributes), shared mechanical risk factors, common aspects of psychological distress and similar prognostic factors.^{16,23,27,69}

We observed that upper back pain was seldom reported as the only pain site together with shoulder pain. The literature supports the findings that upper back pain is most often reported in co-occurrence with other pain sites, especially neck pain.^{37,70,71}

Almost 75% of the respondents reported the same to the question about shoulder pain as they had done the previous time point, irrespective of the time difference of 4 years (1990–94) or 10 years (1994–2004) between

surveys. The reason for approximately the same change in shoulder pain status during the two different time periods is not clear but indicates that shoulder pain can be a stable and persistent symptom. The stable pattern of shoulder pain over time can be better described with more frequent and numerous registrations. However, in our opinion, the finding that approximately 75% of the population showed a stable pattern of shoulder pain over time have not been described previously and adds knowledge to the natural course of shoulder pain. Correspondingly, approximately 70% of those without shoulder pain were without shoulder pain at the next follow-up.

Persons with shoulder pain often report concomitant regional pain. There is consistent evidence that having one persistent pain site is associated with a higher likelihood than expected of having another.³¹ The relationship between prior pain, more pain sites and persistent pain has been confirmed by others.^{12,20,21,27,36,41}

In line with a previous proposal for neck pain, we propose that classification models of shoulder pain should include co-occurring pain sites.⁴¹ This is also consistent with a Delphi consensus on persistent shoulder pain in primary care comparing three different prognostic models.⁷² The importance of symptom duration and multisite pain were confirmed in this consensus and the expert panel also selected coexisting neck pain and age among the 10 key predictors.

Conclusions

We found a high and slightly increasing prevalence of shoulder pain during a 14-year period. The report of shoulder pain was persistent across the time period in approximately 75% of the respondents and the co-occurrence of shoulder pain was reported more frequently with neck pain than with upper back pain. We propose that classification models for shoulder pain should include co-existing pain, especially neck pain. The possible predictive value of this proposal should be tested in other populations.

Author contributions

KBE, MG and BN were involved in the planning, design, review and writing of the paper. KBE, MG and BN discussed the statistical analyses. KBE, MG and BN discussed the results and commented on the paper.

Declaration of Conflicting Interests

None declared.

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