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Chapter 7

The Epidemiology of Shoulder Pain: A Narrative Review of the Literature

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1. Introduction

This chapter provides some findings from the literature on the prevalence of shoulder pain seen in clinical practice that may affect the general population. The findings include a literature-based discussion on risk factors associated with the onset of shoulder pain — including personal, occupational, and psychosocial working factors that may be related to symptomatology of the shoulder.

2. Epidemiology of shoulder pain

In obtaining epidemiological data relevant to the shoulder a number of difficulties exist. According to Bjelle [1] there are four methodological problems associated with epidemiological study of the shoulder:

- criteria and classification
- diagnostic procedure
- study design
- methods of measuring risk factors

An additional concern is the lack of homogenous terminology in identifying specific shoulder disorders in the literature. One disorder will often have several names or another too few.[2] This also relates to the complex structure of the shoulder and close functional biomechanical association with adjacent areas, including the spine. These differences in the reporting of pain prevalence are, at least in part, a consequence of the different definitions of pain used in individual studies. However, other variability can be explained by differing study methodologies and groups, or pools of participants studied. For example, some studies ask participants whether they experienced shoulder pain, yet others use more

specific questionnaires with the incorporation of time of pain and diagrams. A common finding from the literature is the use of a diagram that incorporates the anterior, posterior and lateral aspects of the shoulder including the cervical spines and scapulae in order to define shoulder pain (Figure 1).

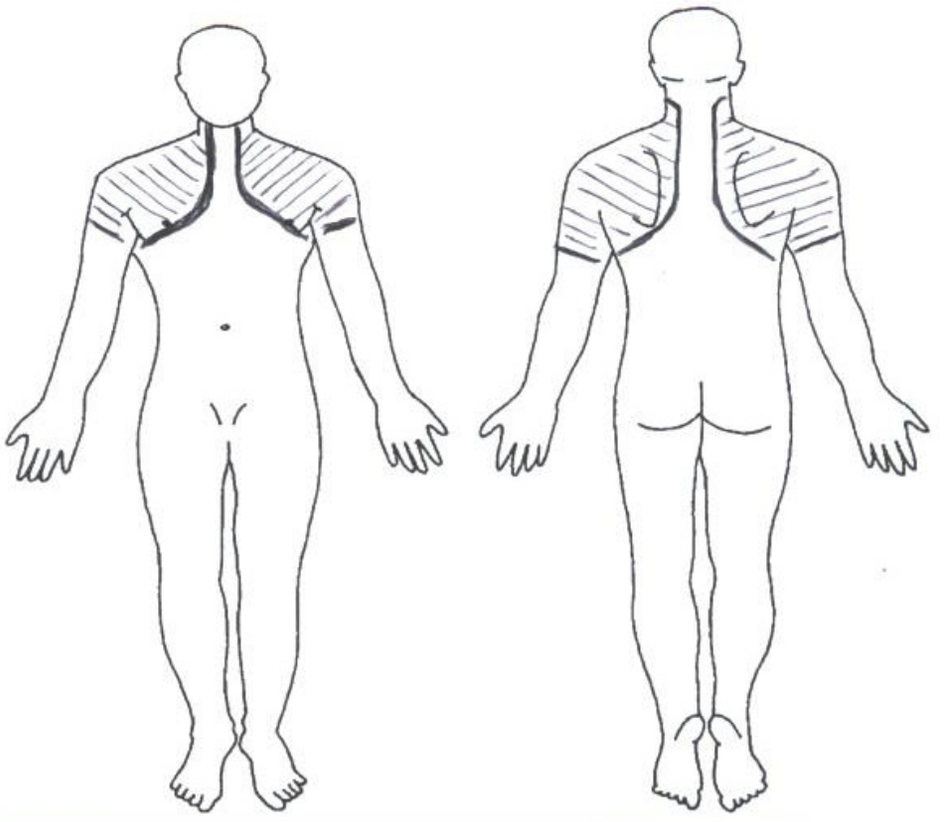

Figure 1. Diagrammatic representation of shoulder pain

Some further causes of variability in reporting relate to that fact that the shoulder may be a primary or secondary source of pain, so many authors and clinicians tend to summarise such a presentation simply as shoulder pain syndrome or just shoulder pain.[3] In order to properly define the anatomical source of pain a thorough history is required, including a detailed physical and orthopaedic examination and possibly the use of diagnostic imaging. As a consequence, by following these standard clinical procedures, it becomes impractical for large-scale epidemiological studies, mainly due to questionable repeatability and validity of certain orthopaedic diagnostic procedures and the cost to image everyone. Therefore, many clinicians and researchers generally use the all-encompassing term of shoulder pain in studies of shoulder pain occurrences.

Many studies have asked directly about the presence of pain in the shoulder.[1,2,3] This relies on the respondents' perceptions as to the anatomical origin of their symptoms. Pain can arise from structures around the shoulder complex and can be felt in a wider area, for example the neck, upper arm or upper trunk, and thus may be undetected with a 'self-perceived' definition.

In spite of the complications with obtaining epidemiological data, the focus of this chapter will be to report some findings from the literature with regards to the prevalence of shoulder pain in the general population, age distribution, occupational and psychosocial risk factors associated with the onset of shoulder-related pain symptoms.

3. The prevalence of shoulder pain

Shoulder pain is a difficult area to research as there are a number of different measures that are used in reporting rates. McBeth et al. discuss the difference between incidence and prevalence of pain and indicate that the incidence may represent the first ever episode (incident) when the patient experienced pain.[4] Shoulder pain can be episodic and large proportions of patients report symptoms that may resolve, only to be experienced again some time in the near (or distant) future. Accordingly as some researchers do report "incident" cases of shoulder pain it is safe to assume that those cases are probably new episodes of pain that have been identified among individuals who were symptom-free at the time of recruitment into the study. Therefore, the following findings will be a report on the prevalence of shoulder pain.

3.1. Prevalence of shoulder pain in the general population

Chronic shoulder pain has large health care costs and a major impact on the health of affected individuals, including absence from work and disability. Shoulder complaints may have an unfavourable outcome, with only about 50% of all new episodes of shoulder complaints presenting in medical practice showing a complete recovery within 6 months.[5,6] After 1 year this proportion increases to 60%.[6] Most of the shoulder pain prevalence data is derived from population-based research. The easiest method for obtaining information about musculoskeletal pain and syndromes is via the use of specially designed self-administered questionnaires that seek specific information from the responding participants. One of the largest and earliest population-based studies that used a self-administered questionnaire was conducted by Hasvold et al.[7] The aim of the study was to determine the prevalence of neck or shoulder pain as part of a general health screening procedure in Norway, and also the direct consequences of these complaints. The sample size was 29,026 with a 75% response rate. The prevalence of shoulder pain was estimated to be 15.4 % in men and 24.9% in women who reported weekly episodes of pain. The study also reported a significant increase in pain prevalence or severity with age most significantly in the 50–56 year age bracket. The study determined that as many as 30% of participants from both sexes reported being significantly disadvantaged at work and unable to perform simple tasks.

Similar prevalence estimations of shoulder pain were also determined by Pope et al.[8] with the total level of suffering in the community from shoulder pain to be as great as 20% of the population. Pope et al. further suggest that most of these will not seek help for their condition so it is important to determine shoulder pain prevalence in order to discuss its

impact on the population. Shoulder pain can be influenced by the case definition,[8] as there are numerous sources of shoulder pain. In order to investigate the influence of case definition the authors of this publication compared estimates of shoulder pain prevalence (based on different definitions of shoulder pain), and restricted the definition of shoulder pain to include only those conditions with associated disability in a cross-sectional population survey of patients registered with a general practice in England. The patients were randomly selected from the sample from either sex with an age distribution between 18–75 years. These participants were asked to fill out a questionnaire. The initial response rate was 312(66%) to the postal survey sent out to the sample. Of the responders 232(74%) underwent an interview. The questionnaire used four definitions of shoulder pain; two were based on questions asking directly about pain in the shoulder or upper trunk and neck region, while the other two involved marking a pain drawing of the shoulder or upper trunk. Those that were interviewed also marked a shoulder pain drawing. If the interviewees were experiencing current pain, they were asked specific questions about the pain plus any associated disability. The study found that prevalence was inversely proportional to the case definition. That is, the prevalence increased as the specificity of the definition decreased. Thus a broader definition to incorporate the upper trunk and neck as well as the shoulder had a higher prevalence compared with a prevalence that was based entirely on a specific gleno-humeral cause of shoulder pain.

The study recommended using a pain drawing-based definition restricted to an area of the shoulder complex when conducting prevalence surveys of shoulder pain in the general community. Studies focusing on shoulder pain report the presence or absence of symptoms, but there is limited information from the literature about the extent to which the pain troubles the individual, or as to the severity of the pain. A recent study by Parsons et al. in 2007 measured the prevalence and troublesomeness or burden of musculoskeletal pain, including the shoulder, in different age groups by means of a cross-sectional postal survey of 4,049 adults registered with 16 Medical Research Council General Practice Research Framework practices.[9] The survey achieved a response rate of 60% with 2,504 participants replying to the survey. Frequency of chronic pain overall and troublesome pain by location and age was calculated. The level of pain was measured using the concept of troublesomeness using the following categories — 'not at all troublesome', 'slightly troublesome', 'moderately troublesome', 'very troublesome' and 'extremely troublesome'. The prevalence of chronic pain was 41%. The prevalence of chronic pain rose from 23% in 18–24-year-olds reaching a peak of 50% in 55–64-year-olds. Moderately troublesome pain over the last four weeks was commonest in the lower back (25%) and shoulder (17%). Troublesome shoulder pain was most prevalent in the 45- to 64-year-age groups. The response rate for this survey was adequate (60%) with some 2,504 participants replying to the survey, which is comparable to other published epidemiological studies. The study provides valuable information on the health impact of pain on the participants with the potential to guide future delivery of health care by assisting health professionals' decision-making based on patients' symptoms rather than a diagnosis. The only flaw of the study relates to the reliability of retrospective reports. The questionnaires used may be unreliable

because of recall and social desirability biases with the prevalence figures based on those participants who replied.

The findings from this survey with respect to the shoulder data concur with two previously published studies investigating the prevalence of chronic pain and its effect on the general population.[10,11] A large European-based survey from 15 countries measured chronic pain prevalence, intensity of pain and duration of pain symptoms.[11] In addition to these basic variables the survey also attempted to determine the impact of chronic pain on psychological wellbeing of participants, effect on work and daily living, and methods of management of the pain. Some findings from the study include that one third of the chronic pain sufferers were currently not being treated, two thirds used non-medication treatments such as massage, acupuncture or physiotherapy, with almost half of the participants taking non-prescription analgesics, and two thirds prescription medicines. According to the authors, 19% of adult Europeans suffer from moderate to severe pain including the shoulder, which has a detrimental effect on their working and daily lives.

In order to provide insight in the prevalence of musculoskeletal health problems of different anatomical sites including the shoulder, in 2003 Picavet et al. carried out a similar population-based survey on musculoskeletal pain in the Netherlands.[12] This survey, besides prevalence figures, sought to determine the direct consequences of pain in the form of health care consultations, time off work, effect on daily life and identifiable risk groups based on general sociodemographic characteristics.

A random sample of 8,000 persons aged 25 years and over was chosen by the authors, with the survey achieving a response rate of 46.9%. The findings from the study found that almost three quarters (74.5%) of the Dutch population aged 25 years and over reported musculoskeletal pain during the past 12 months, 53.9% reported musculoskeletal pain during the survey (point prevalence) and 44.4% reported musculoskeletal pain lasting longer than three months. The majority of those reporting pain, reported pain at more than one site; roughly two thirds for the period prevalence over 12 months and more than half at the time of the survey (point prevalence) which was present greater than three months (chronic pain). The shoulder was the second most commonly affected site behind low back pain with the period prevalence (12 months) of shoulder pain being 30.3%, and point prevalence 20.9 %. The prevalence of chronic shoulder pain was determined to be 15.1%.

Some interesting findings from the study include that 30% of the complaints were described as continuous pain and 55% as recurrent pain. Severe pain was reported in 15% of the study population and mild pain was present in 70%. A third of the study population consulted a general practitioner, medical specialist or physiotherapist, and reported the use of medication for the pain — with 30% reporting limitation in daily life due to their shoulder pain. Some risk factors presented include a greater prevalence of shoulder pain reported in women (26%) compared to men (16%), age, especially those in middle age from 45–64 years, and those participants living by themselves. The differences in male/female prevalence rates

for the 25–44 year age group were (23/13%), 44–65 year age group (21/31%) and over 65 years (13/23%). This study provided a valuable insight in the effect and risk factors associated with musculoskeletal pain including the shoulder, with prevalence figures comparable with the previously cited studies.[10,11,12] The major limitations of this study include the possibility of selective non-response — although the authors state that the general characteristics of the responding and non-responding participants were similar — and the methods used in measuring pain. The prevalence of pain data derived from population-based surveys is determined by the methods used, including the definitions used for the pain, the wording of the questions in the questionnaire, and the length of survey instrument.[8] Hence, the figures derived from this study may be slightly overestimated.

A number of other community-based studies have been cited in the literature with sound methodological quality. These include a study from Finland that demonstrated a shoulder pain prevalence of 17% over a 12-month period in a mixed population of adults from the age of 40–64 years.[13] The definition of shoulder pain used in this study included ache or stiffness in the shoulder or upper arm and a difficulty in movement. A study from the US determined a prevalence of 7%, from a pool of 6,913 participants aged 29–74 years who reported pain in their shoulder for most days over a period of one month.[14]

Two studies from Sweden measured the prevalence of shoulder over two different time frames.[15,16] The first study showed a prevalence of shoulder pain of 13% for males and 15% for females for those who reported shoulder pain for at least one day over the last month.[15] The second study showed that among a group aged between 25–74 years, there was a male prevalence of 18% and female prevalence of 22% for participants who reported pain in the shoulder in the last three months.[16]

A number of further studies report a prevalence of shoulder pain of 16% in participants who have had pain in the shoulder for more than one week over a one-month period,[17] 30% in an adult population over the age of 30 years,[18] 7% from a pool of 21,889 households or 42,826 people over the age of 15 years [19], and 26% in a community survey of the elderly aged 70 years or older.[20]

In the UK, symptoms associated with shoulder problems are a significant cause of morbidity and disability in the general population. The reported overall prevalence of shoulder pain in the UK population is estimated at 7%,[21] which increases according to some authors to 26% in the elderly.[20] Shoulder problems can lead to an inability to work and perform domestic and social activities, as well as leading to serious economic hardship for affected individuals and their families. During 1995, musculoskeletal disorders accounted for 9.9 million days of sick leave in the UK, of which 4.2 million (42%) were related to the upper limb and neck area.[22] Shoulder disorders represent the third most common musculoskeletal presentation to general practice,[23] yet many more patients do not consult their general practitioner (GP). Thus, in the UK, the estimated proportion seeking treatment is between 20 and 50%.[24,25]

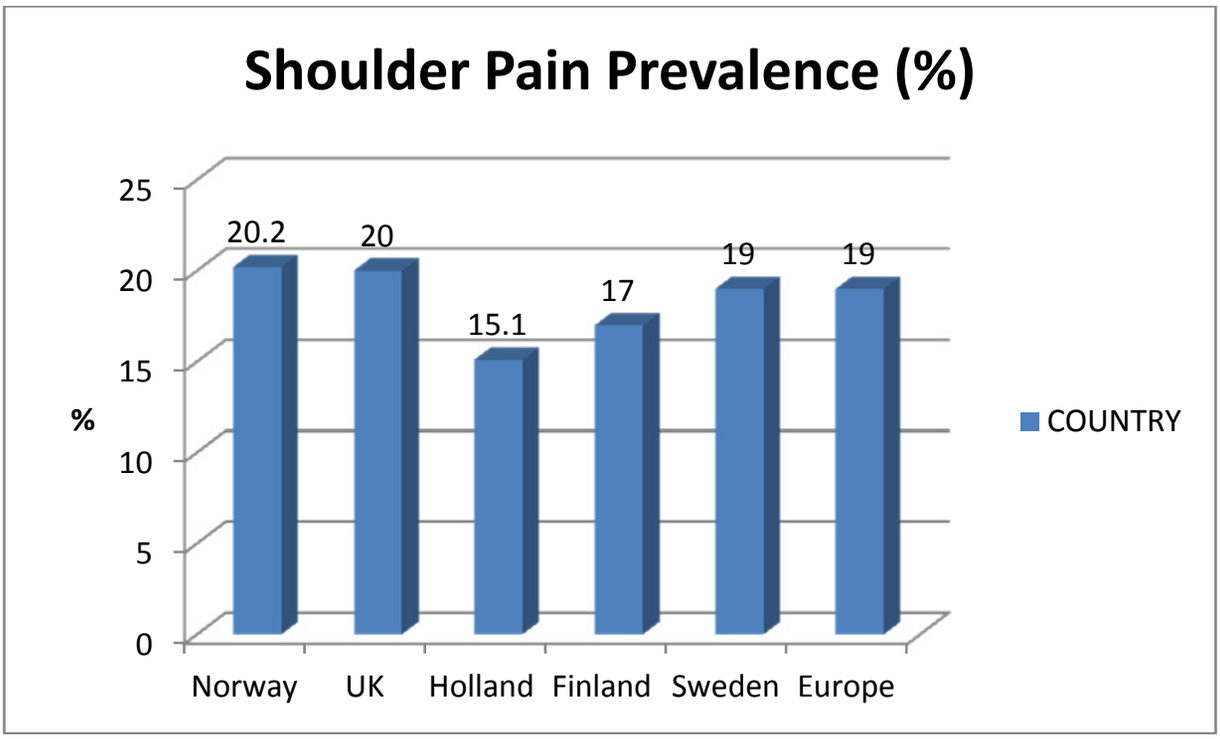

Figure 2. The prevalence of chronic shoulder pain based upon the country of origin of the epidemiological data.

3.2. Prevalence of shoulder pain in medical practice

The prevalence of shoulder pain has been studied in medical practice and represents a common reason for consulting a GP. Data derived from the Netherlands demonstrates a prevalence of 30.3% during a 12-month period during which 30–40% of people reported musculoskeletal pain (including shoulder) during the past year and indicated that they had contacted their GP for these complaints.[12] However, the finer details about these presentations are scarce in the literature, including the nature of the presenting complaints. More detailed research about the prevalence of shoulder pain in general practice is required in order to determine the burden of these complaints on the general population — in other words, the number of people with shoulder complaints that are serious, painful, or annoying enough to seek medical care. Prevalence data on shoulder complaints also helps identify the patient categories that are responsible for the main primary care practitioner workload caused by these complaints.

With respect to chiropractic practice the data is limited, with very few studies citing prevalence figures for shoulder pain presentations. The only data from the profession has been provided by the National Board of Chiropractic Examiners,[26] which conducted a

survey of the job analysis of chiropractors in the US, in order to provide a comprehensive source of information about the scope of chiropractic practice (response rate 26%). The survey demonstrated a prevalence of upper extremity presentations, including the shoulder at 8.3%. A very important finding of the survey was that most chiropractors use a multimodal management approach to manage extremity conditions.

One of the first investigations into the prevalence of shoulder pain in medical practice was conducted in the Netherlands by van der Windt et al.[27] who studied the incidence of shoulder disorders in Dutch general practice by means of an observational study. Eleven general practices participated in the study with a total of 35,150 registered patients. All shoulder complaints were recorded over a 12-month period. The term shoulder complaint describes four intrinsic shoulder syndromes, according to the Dutch College of General Practitioners guidelines. These include capsular syndrome, acute bursitis, acromioclavicular syndrome and subacromial syndrome. In the recording period, 754 consultations were recorded in 472 patients with the presence of shoulder pain confirmed in 392 patients. The cumulative incidence varied slightly between practices, but was estimated to be 14.7 per 1,000 per year on average. The incidence was also greater for women (11.1/1000/year) than men (8.4/1000/year) who made up 44 and 56% of the sample size respectively. A previous history of shoulder pain was noted in 54% of men and 46% of women, and the disorder most commonly diagnosed was rotator cuff tendinitis at 29%.

A more recent study in 2005 conducted by Bot et al. collected data from 195 general practitioners (GPs) from 104 practices across the Netherlands in order to record all contacts with patients during 12 consecutive months to determine the prevalence of neck and upper extremity musculoskeletal complaints.[28] The total number of GP contacts during the registration period of one year was 1,524,470. The most commonly reported complaint was neck symptoms (incidence 23.1 per 1000 person-years), followed by shoulder symptoms (incidence 19.0 per 1000 person-years), which translates to approximately 8% of all people registered consulting their GP at least once with a shoulder complaint. The number of consultations for a shoulder complaint/complaint was higher in females (31.4 per 1000) and 23.2 for males. The prevalence of shoulder complaints also increased with age, peaking in the 40–49 and 50–59 year age brackets with a higher ratio of female compared to male presentations.

The prevalence of shoulder pain has also been investigated in a community-based rheumatology practice.[29] Eleven thousand patients from a large general practice were referred for assessment over a nine-month period. Each patient underwent a pain history, shoulder examination — including passive, active and resisted — as well as an assessment of the cervical spine. Diagnosis was based on an accurate history with a directed examination. The most common source of pain in the shoulder was found to be soft tissue lesions (81%), of which the bulk were lesions of the rotator cuff (65%), peri scapular soft tissue (11%), acromioclavicular joint pain (10%) and cervical referred pain (5%). Shoulder pain forms a large part of a specialist rheumatologist's new patient workload.

These prevalence findings are in contrast to a large-scale population-based study recently conducted in the UK.[30] This study attempted to estimate the national prevalence and incidence of adults consulting for a shoulder condition and to investigate patterns of diagnosis, treatment, consultation and referral three years after the initial presentation. Prevalence and incidence rates were estimated for 658,469 patients aged 18 years and over in the year 2000 using a primary care database — the International Medical Statistics (IMS) Disease Analyzer-Mediplus UK. A cohort of 9,215 incident cases was followed-up prospectively for three years beyond the initial consultation. The results demonstrate the annual prevalence and incidence of people consulting for a shoulder condition was 2.36% and 1.47% respectively.

Prevalence increased linearly with age while incidence peaked at around 50 years then remained static at around 2%. Around half of the incident cases consulted once only, while 13.6% were still consulting with a shoulder problem during the third year of follow-up. During the three years following initial presentation, 22.4% of patients were referred to secondary care, 30.8% were prescribed non-steroidal anti-inflammatory drugs and 10.6% were given an injection by their general practitioner (GP). The authors conclude that the prevalence of people consulting for shoulder problems in primary care is substantially lower than community-based estimates of shoulder pain with most referrals occurring within three months of initial presentation, but only a minority of patients are referred to orthopaedic specialists or rheumatologists. GPs may lack confidence in applying precise diagnoses to shoulder conditions.[30] In the United Kingdom it is estimated that approximately 1% of adults will consult a medical practitioner for a new episode of shoulder pain during the course of a year.

In summary, shoulder pain is a common musculoskeletal pain syndrome seen in medical practice, however, the available data demonstrate significant variability in cited prevalence levels. These differences are mainly due to the different definitions of pain used in the individual studies, but may also be explained by differing methodologies used in the various studies and the groups studied. The broader the definition used in the studies yielded a higher prevalence level, however once the definition was reduced to point prevalence the levels were significantly reduced. Future research should define an area, and include all pain in this area as shoulder pain, even though pain from the shoulder may be felt or referred to a wider area distal to the shoulder, or pain may be referred from the spine or internal organs to the shoulder.

Across the cited studies a number of different questionnaires and tests were used for the physical examination, with very little discussion on the validity and reliability of these tests; unfortunately, due to the lack of availability of gold standard diagnostic tests, this may also influence the cited prevalence levels.

The number of consultations for shoulder pain in medical practice may also be influenced by the level of individual insurance coverage.[28] In some countries, such as Holland and

even Australia, individuals with public health insurance are reimbursed in full, whereby individuals with private insurance need to pay a gap fee. Hence, the greater numbers of medical consultations occur in individuals with public insurance, so accordingly this has the potential to influence prevalence levels.[28]

Very little research has been conducted with respect to the prognosis and treatment of shoulder pain in medical practice and including chiropractic clinical practice, therefore more research is needed for this clinically challenging area.

In the author's opinion, all of the above comments would also apply for chiropractic, physiotherapy and manipulative therapy clinical practice. Prevalence information for shoulder pain would be useful to estimate the demand for management of shoulder and upper extremity complaints, and possibly determine a further need for chiropractors to undergo additional training in managing these complaints.

4. Features associated with the prevalence of shoulder pain

Features that may be associated with the development or perpetuation of a health problem are represented by the term "risk factors". The presence of risk factors may predispose a person to developing a particular problem and continuing to suffer from it over a long period of time. A number of risk factors that may predispose a person to developing shoulder pain have been cited and studied in the literature. Risk factors for shoulder pain are usually subdivided in to personal risk factors, work-related physical risk factors and work-related psychosocial risk factors.

4.1. Personal risk factors

4.1.1. Age and gender

Age and gender represent personal risk factors that may be associated with shoulder pain, with the presence of pain increasing with an advancing age. Shoulder pain is particularly prevalent in the adolescent age group. A recent study that examined chronic pain prevalence (regardless of location) in children and adolescents (age birth to 18 years) reported that prevalence increased with age, peaking in the 12–15-year-old group, with 33% of adolescents reporting chronic pain.[31]

Siivola et al. conducted a longitudinal study to estimate the prevalence and incidence of neck and shoulder pain in young adults based on a seven year follow up.[32] In the study a random sample of 826 high school students was investigated when they were 15 to 18 years old and again at 22 to 25 years of age. Altogether, 394 (48%) patients participated in both surveys. The outcome variable was weekly neck and shoulder pain during the past 6 months in adulthood, and the explanatory variables included some sociodemographic factors, leisure time activities, self-assessed physical condition, psychosomatic stress symptoms, and symptoms of fatigue and sleep difficulties. In 7 years, the prevalence of weekly neck and shoulder pain increased from 17% to 28%.

Among those who were asymptomatic at baseline, 6-month incidence of occasional or weekly neck and shoulder pain was 59% 7 years later. In females, neck and shoulder pain in adolescence was associated with prevalent neck and shoulder pain in adulthood. Psychosomatic stress symptoms predicted neck and shoulder pain in adulthood. The authors conclude that the prevalence of shoulder pain is high with a multifactorial association of symptom development. The correlation with gender and shoulder pain in the adolescent age group does not appear to be a significant factor as there is a lack of population-based research in this area. Yet some publications demonstrate a higher prevalence of shoulder pain among girls when compared to boys,[33] and a significantly higher prevalence of chronic pain in adolescent females when compared to males.[29] This was also confirmed in a recent study by Vikat et al. who investigated the prevalence and determinants of self-reported neck or shoulder pain (NSP) among 12–18-year-olds by mailing a questionnaire to a nationally representative sample of 11,276 12-, 14-, 16- and 18-year-olds.[34] Shoulder pain was perceived at least once a week by 15% of 12–18-year-olds with symptoms more prevalent among girls than among boys, with the prevalence increasing with age. Participants with shoulder pain also demonstrated perceived psychosomatic symptoms. The study concludes that shoulder pain is frequent among 16–18-year-old girls and, due to the strong association of psychosomatic symptoms, the results suggest that the pain state could be more psychosomatic than nocieceptive in character. A further study correlated gender and age in a biennial cross-sectional survey conducted amongst Finnish adolescents.[35] Pain was more common among girls and older groups: pain of the neck and shoulder affected 24% of girls and 12% of boys in 14-year-olds, 38% of girls and 16% of boys in 16-year-olds, and 45% of girls and 19% of boys in 18-year-olds. Data from this cross-sectional survey has been tracked over a 15-year period with findings suggesting pain in the neck and shoulder is becoming more common in Finnish adolescents, which may suggest a new disease burden of degenerative musculoskeletal disorders in future adults.

The onset of shoulder pain has a strong correlation with adult age, possibly due to the fact that aging is associated with degenerative processes and changes of the shoulder and rotator cuff tendon, which may explain the increase in symptom reporting as we age. With age, repetitive shoulder pain episodes may lead to the accumulation of symptoms and therefore the development of chronic pain. Prevalence of shoulder pain in adults has been extensively studied in the literature and it is accepted that the prevalence of shoulder pain increases with age.[36]

Gender also plays a prominent role in the prevalence of shoulder pain and pain in the upper extremity in general, with the presence of shoulder symptoms more prevalent in females as opposed to men.[37–39] Data from a recent population-based survey showed an increase in shoulder pain prevalence with age, especially in the middle-age group, but also a strong gender correlation.[12] In the age range of 25–44 years the demonstrated prevalence of shoulder pain was 13.3% for men and 22.8% for women, a peak prevalence of 21.4% in men and 30.9% in women in the 45–64 years age group, and for the 65 years plus age group a

prevalence of 13.2% in men and 23.1% in women. A prevalence of shoulder pain of 17% in the middle-age bracket of 40–64 years was also demonstrated in a study by Takala et al. in 1982[13] and Parsons et al. in 2007 [9] who also determined the highest prevalence of shoulder pain (17%) in the middle-age group from 45–64 years of age. This age group also reported the pain to be the most troublesome, with the greatest impact on daily and working life. The prevalence of chronic pain rose from 23% in 18–24-year-olds reaching a peak of 50% in 55–64-year-olds. Once again, prevalence and chronicity of shoulder pain increase with advancing age especially in the middle-age bracket.

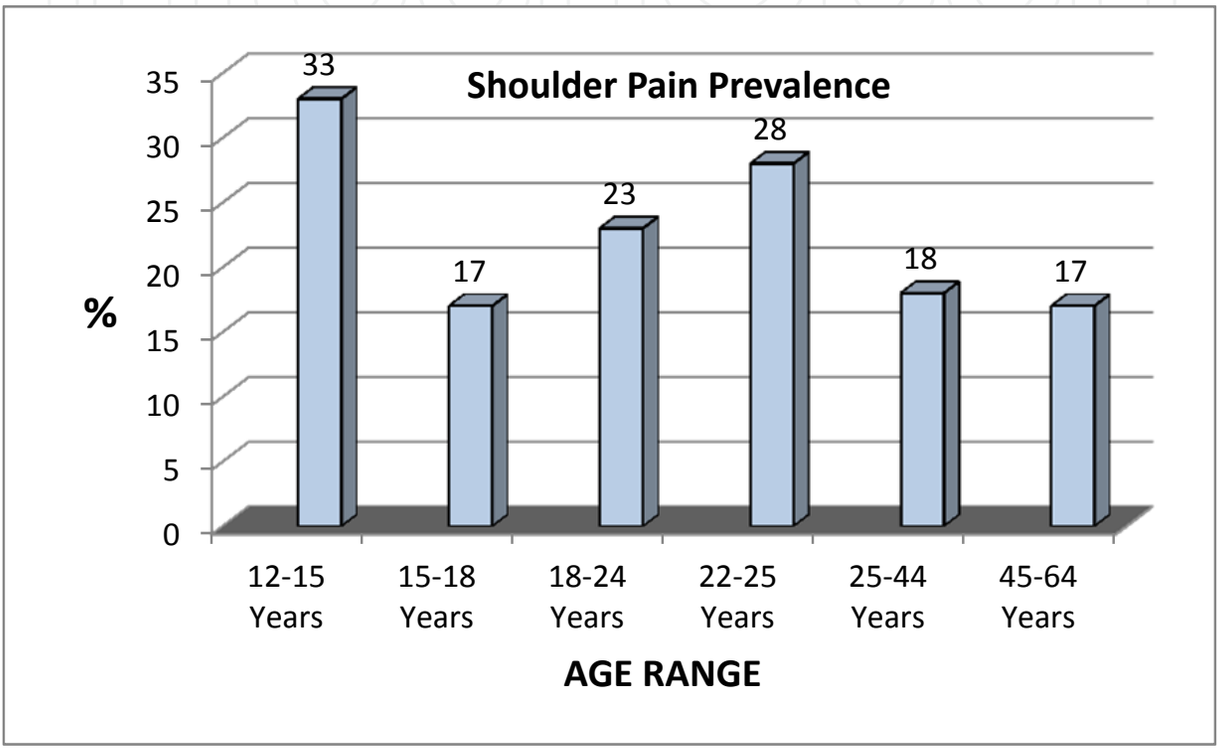

Figure 3. The prevalence of chronic shoulder pain based upon the age range.

A number of hypotheses potentially explain why shoulder symptoms may be more prevalent in women, with one explanation being that women's jobs, more often than men's, involve work tasks with static load on the neck and shoulder muscles, high repetitiveness, low control and high mental demands that maybe potential risk factors for neck or shoulder pain.[40] Some further citations from the literature that may explain excess symptom reporting by women include a tendency to label stimuli as more noxious,[41] an increased sensitivity to pain and significant differences between genders in mean pain thresholds, with women recording lower pain thresholds[42] and an increased exposure to risk factors for symptom onset.[43] Reports in the literature have correlated also gender as a risk factor for the development of shoulder pain, with females particularly at risk, according to two large epidemiological surveys.[44,45]

In the older age group there is a tendency of decreasing shoulder symptoms that could be attributed to a change in those risk factors associated with further symptom onset or

persistence, such as a change in workplace risk factors after retirement.[4] Although a reduced prevalence of shoulder pain in the older age group, compared to the middle aged group is evident a number of studies have still demonstrated a reasonably high prevalence. Chard et al. conducted a hospital-based survey and found that 21% of patients presenting to an acute care geriatric clinic had a symptomatic shoulder disorder.[46] A later study by Chard et al.,[20] was based on a community survey to try to discover the true prevalence of shoulder disorders in the elderly. A random sample of 644 individuals over the age of 70 was selected from two general medicine practices. The conditions diagnosed after examination included rotator cuff tendinitis, 'frozen shoulder' (adhesive capsulitis), chronic rotator cuff rupture or impingement, A-C joint arthritis, glenohumeral joint rheumatoid or osteoarthritis, and shoulder pain without obvious shoulder pathology that represented referred pain. Of the participants, 27 % reported shoulder pain with 21% having an identifiable disorder present. The gender differences were male17% and female 25%. This study also confirmed that the female gender appears to be a risk factor associated with the development of a shoulder problem in the elderly age group.

In at least 70% of shoulder disorders the rotator cuff was primarily involved with the most frequent condition being rotator cuff tendinopathy. At least 50% of conditions involved chronic rotator cuff rupture or impingement. Duration of pain varied from one month to many years dependent on the disorder. The impact of shoulder pain as reported by the patients was disability in personal care (washing) and with household chores, and difficulty in lifting and doing tasks above the level of the shoulder. In the older age group more than 40% of patients consulted their GP with their pain, however more than 50% generally have had previous undocumented episodes of shoulder pain.[20]

A recent study of shoulder pain in the elderly age group attempted to determine the prevalence of shoulder pain and identify factors associated with this pain, to assess the pattern of coexisting joint pain and to evaluate the impact of this pain on physical functioning.[47] The study was a cross-sectional study of Black and White men and women aged 70–79 years. The results demonstrated a shoulder pain prevalence of 18.9% with Black women having the highest prevalence of shoulder pain (24.3%). The correlates of both neck and shoulder pain were female gender, no education beyond high school, poorer self-rated health, depressive symptomatology and a medical history of arthritis, heart attack, and angina. Increasing severity of both neck and shoulder pain was associated with an increased prevalence of joint pain at other body sites and with poor functional capacity. Measures of physical performance involving the upper extremity were also decreased. The authors conclude that neck and shoulder pain, either alone or in conjunction with pain in other joints, has a substantial impact on the function and wellbeing of the older adults in this cohort.

Some further personal risk factors derived from epidemiological studies from America and Europe have demonstrated sleep disturbances, smoking and the consumption of caffeine to be associated with shoulder pain.[45,48,49] Immigrant status is another factor that can be

associated with shoulder pain, which was demonstrated by Ekberg et al. in an epidemiological survey conducted in 1995.[44] A small amount of evidence is emerging in the literature demonstrating a correlation between race, ethnicity and pain. A study from the US demonstrated when Caucasian populations are compared with participants from African American and Hispanic groups they report more severe pain levels, have a lower tolerance to pain stimuli, and are more likely to seek health care for their symptoms.[50] All these citations from the literature represent personal risk factors associated with the development of shoulder pain.

The cited publications demonstrate a correlation with age and gender with respect to the onset of shoulder pain, with prevalence densities increasing with age especially in the age bracket above 40 years. Women appear to be more affected by shoulder pain — often due to jobs characterised by static loads on shoulder musculature, monotonous and repetitive tasks, but also due to additional stresses from unpaid work such as child minding and household duties. However, strong conclusions cannot be drawn from the available research due to the significant differences in methodology between the studies with respect to lack of uniform criteria for describing shoulder pain and poor diagnostic uniformity.

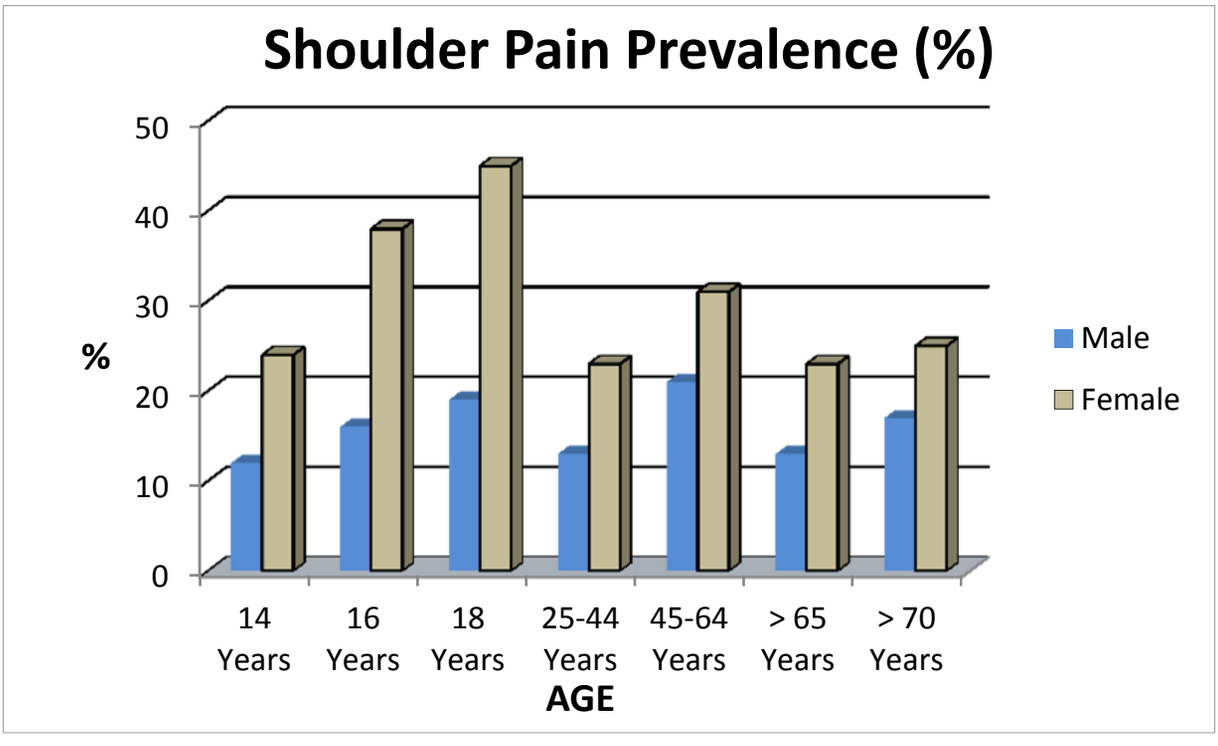

Figure 4. The prevalence of chronic shoulder pain based upon gender.

Shoulder pain also appears to have a relatively high prevalence in the younger population especially in the age group from 12–18 years, particularly in teenage girls. The data derived from the Finnish studies with sound methodology suggest that shoulder pain is becoming more frequent, which has the potential to cause further long-term and chronic musculoskeletal disorders in their adult lives.[34,35] The increasing pain levels appear to correlate with the substantial changes seen in western societies today with respect to

increased level of computer usage, access to internet, and high usage of computer games. The high level of shoulder pain symptoms may relate to risk factors such as repetitive movements, static postures and static muscular activation patterns as seen with computer mouse usage.[51]

4.2. Occupational factors

Numerous studies in an occupational setting have demonstrated work-related physical risk factors associated with the development of shoulder pain. The transition from no or minor pain to more severe pain was influenced by physical and psychosocial workplace factors together with individual and health-related factors.[52] Work-related risk factors associated with the onset of shoulder pain have been cited in the literature including: repetitive work, high force demand and vibration, work-related posture, computer work and psychosocial factors.

4.2.1. Repetitive work

The correlation between repetitive work and the onset of shoulder pain has been cited in a number of studies. In 2004, Leclerc et al. conducted a study to determine the predictiveness of personal and occupational factors for the onset of shoulder pain in occupations requiring repetitive work from a sample of workers in five activity sectors who completed a self-administered questionnaire in 1993–94 and again three years later.[53] Both questionnaires included questions about shoulder pain. The associations between various factors at baseline and subsequent shoulder pain were studied among participants free from shoulder pain at baseline. The results show the incidence of shoulder pain was associated with several independent risk factors: depressive symptoms, low level of job control, and biomechanical constraints. After adjustment for other risk factors, the presence of depressive symptoms predicted occurrence of shoulder pain. A low level of job control was also associated with the onset of shoulder pain in both sexes. For men, repetitive use of a tool was a strong predictor, while the two most important biomechanical risk factors for women were use of vibrating tools and working with arms above shoulder level. The results confirm the role of several biomechanical constraints in developing shoulder pain with psychological symptoms and a low level of job control also playing an important role. Two systematic reviews also demonstrate a significant relationship between repeated movements and upper extremity disorders in general and also a consistent relationship specifically between neck or shoulder pain and repeated movements.[54,55]

Van der Windt et al. systematically reviewed the literature for occupational risk factors of shoulder pain.[55] The review determined potential risk factors related to physical load and included heavy work load, awkward postures, repetitive movements, vibration and duration of employment, with consistent findings found for the latter three items. Nearly all studies that assessed psychosocial risk factors reported at least one positive association with shoulder pain, but the results were not consistent across studies for either high

psychological demands, poor control at work, poor social support, or job dissatisfaction. The authors conclude that it seems likely that shoulder pain is the result of many factors, including physical load and the psychosocial work environment.

4.2.2. High force demands (physical demands) and vibration

Occupation is a very important factor in the aetiology of shoulder pain. The occurrence of pain is generally more common in participants with moderate to heavy physical demands, and the pain tends to occur during the course of the working day (i.e., it is occupationally dependant).[56] Bergenudd et al. classified participants according to occupational workload into three groups: light physical demands (teachers, clerks), moderate physical demand (Nurses, light industry workers), and heavy physical demands (carpenters, bricklayers).[56]

The findings from the study showed a relationship between shoulder pain prevalence and occupational workload. It demonstrated that participants in the moderate to heavy physical demand groups were more likely to have pain and require sick leave due to disability. Factors that may contribute to increased shoulder pain are muscle loading, prolonged static work, repetition and working with hands at or above shoulder level. The major psychosocial factor that was affected by the pain sufferers was poor job satisfaction.

In 2000, Ariens et al. conducted a systemic review of the literature and determined some evidence for a correlation between the work-related force requirements in the arms and neck or shoulder pain, as well as between heavy lifting (arm force), arm posture, vibration and workplace design on the development of neck or shoulder pain.[57] These findings were also confirmed by Malchaire et al. who found a correlation between forceful hand and wrist work on the development of shoulder pain.[58]

A recent prospective cohort study conducted by Grooten et al. in 2007 demonstrated that three simultaneous work-related exposures influenced the development of shoulder pain; these included manual handling (physical load), working with the hands above shoulder level, and working with vibrating tools.[59] The presence of any of these three variables also influenced the long-term prognosis of workers with shoulder pain.

A most recent investigation by Miranda et al. investigated whether occupational physical load predicted subsequent chronic shoulder disorders.[60] A comprehensive national survey was carried out among a representative sample (n = 7,217) of the Finnish adult population in 1977–80. Twenty years later, 1,286 participants from the previous survey were invited to be re-examined, and 909 (71%) participated. After excluding those with diagnosed shoulder disorders at baseline, 883 participants were available for the analyses. The prevalence of shoulder pain at follow-up was 7%. Work exposure to repetitive movements and vibration at baseline increased the risk of a shoulder disorder. The adverse effects of physical work were seen even among those older than 75 years at follow-up. These statistically and clinically significant risk factors differed between genders: for men vibration and repetitive

movements, and for women lifting heavy loads and working in awkward postures. This is the first prospective study in a general population showing that occupational physical loading increases the risk of a subsequent clinical shoulder disorder and the effects seem to be long term. According to these results ergonomical assessment of the workplace and implementation of strategies that may reduce the exposure of the worker to the associated risk factors may have long-lasting health benefits for the shoulder and potentially reduce the prevalence and adverse effects of work-related shoulder pain.

Certain occupational groups have been studied in the literature — including manual handlers, delivery drivers, technicians, customer services computer operators, and general office staff — on reported physical and psychosocial working conditions and symptoms of neck and upper limb disorders by the use of a self-administered questionnaire.[60] The respondents from that survey were classified into one of four exposure groups: high physical and high psychosocial, high physical and low psychosocial, low physical and high psychosocial and low physical and low psychosocial. The definition of high physical exposure criterion is deemed as lifting greater than 16 kg more than or equal to once per hour would classify a worker as high physical exposure. A worker would also be classified as having high physical exposure if a 6–15 kg load was lifted more than or equal to once per hour and, additionally, vibration while sitting — for example, driving — was experienced for more than or equal to half the working day. The prevalence of shoulder pain among workers from the low physical and low psychosocial group was 39%, low physical and high psychosocial 34%, high physical and low psychosocial 57% and high physical and high psychosocial 69%. The study showed that workers highly exposed to both physical and psychosocial workplace risk factors were more likely to report shoulder symptoms than workers highly exposed to one or the other.

When certain occupations have been studied individually there is a strong correlation between manual work (physical demands) on the development of shoulder pain. In a study of Finnish forest workers,[61] the prevalence of mild or severe shoulder pain was 14% over a 12-month period. Higher age, obesity and mental stress as well as physically strenuous work and working with trunk forward flexed or with a hand above shoulder level increased the risk of incident shoulder pain. The findings from the study support the view that shoulder pain is the result of many factors, including occupational and individual factors such as heavy physical work with a heavy load, awkward work postures and mental stress. This study also linked obesity as a risk factor for the development of shoulder pain.

Stenlund et al. confirmed a relationship between shoulder tendinitis and heavy manual work and exposure to vibration.[62] The prevalence of shoulder pain in their study over the previous 12 months was 40% among the rock blasters and 8–15% among bricklayers. In 1999, Frost et al. investigated the association of shoulder impingement syndrome with shoulder-intensive work.[63] The prevalence of shoulder pain in slaughterhouse workers was 60%. The slaughterhouse worker activities included monotonous and manually intensive work with their upper arms raised to at least 30 degrees of shoulder abduction for

half of the working day (48%), and raising the arms above 30 degrees of shoulder abduction at least 10 times per minute.

Similarly, some early investigations by Herbets et al. demonstrated the relationship between shoulder pain and heavy manual labour in shipyard welders.[64] According to their research, the general population demonstrates shoulder pain prevalence of 15–25% in persons between the ages of 40–50 years, and in shipyard industry the prevalence increases to 30–40%. Localised muscle fatigue appears to be a relevant factor in the onset of shoulder pain. It normally arises as a consequence of sustained muscle contractions in differing work situations with the arms at or above shoulder level, repetitive elevations or muscular work and generalised shoulder muscle load. The workers often work in situations aggravated by awkward posture and the use of heavy equipment, as well as the very difficult environment encountered in a shipyard when exposed to the climactic elements (heat and cold).

A number of other studies investigating heavy manual work and high physical demands also correlate a high prevalence of shoulder related disorders.[45,65–69]

4.2.3. Work related posture

Work-related posture is a well-documented risk factor associated with the development of shoulder-related disorders. This entails prolonged and/or repetitive periods of sustained shoulder or neck positions, either awkward or extreme.[40] such as severe shoulder flexion or abduction.[55,60]

In 2006, Sim et al. determined an age-standardised one-month period prevalence of neck and upper limb pain at 44% from a cohort of industrial and manual workers.[70] Significant independent associations for shoulder pain were demonstrated with actions involving repeated lifting of heavy objects, working with arms at/above shoulder height (postural position) and psychosocial variables including little job control and little supervisor support. The population attributable fractions were (24%) for exposure to work activities and (12%) for exposure to psychosocial factors. Some further findings show that the highest prevalence of shoulder pain was seen in the 55–64 year age group, and predominantly in women. The results of the study demonstrate a high prevalence of shoulder pain over a four-week period, which may be slightly inflated due to the preselected study. This category of workers are already exposed to risk factors, hence the results may not be a true reflection of the prevalence, as it may have been if the sample was chosen from the general population incorporating a large variety of occupations. Irrespective of the methodological weaknesses of this study the findings suggest that with modification of the work environment up to one in three cases of shoulder pain can be prevented.

From a population-based study of occupational risk factors for shoulder pain — including physical exposures, working conditions, and psychosocial aspects of the workplace — Pope et al. also identified some further risk factors, including those for workers who reported working with hands above shoulder level, using wrists or arms in a repetitive way, or

stretching down to reach below knee level.[71] This action had about twice the risk of shoulder pain and disability. Leclerc et al. also confirmed a postural association (working with arms above shoulder level) with shoulder pain. This was particularly demonstrated in the female gender, with the use of vibrating tools an additional risk factor.[53]

Numerous other publications have confirmed posture as a risk factor for the development of shoulder pain among workers, as evident in a number of recent cross-sectional and case-controlled studies that have confirmed this correlation with shoulder pain.[72,73]

In 2000 van der Windt et al. conducted a systematic review of the literature in order to evaluate the available evidence on occupational risk factors of shoulder pain.[55] The review involved a search of databases so that details could be extracted on the study populations, exposures (physical load and psychosocial work environment), and results for the association between exposure variables and shoulder pain. According to the authors, the number of epidemiological studies reporting on potential risk factors for shoulder pain has greatly increased in the past decade, with work-related factors playing an important part in the development of shoulder pain with many studies conducted in various occupational settings. However, a number of the published papers did not consider shoulder pain specifically or did not use systematic methods for the selection of papers, assessment of methodological quality, or data extraction and analysis, hence with somewhat unreliable methodology. Therefore, after conducting a systematic review and laying down a standardised checklist for the assessment of methodological quality of cross sectional studies), case-control studies and prospective cohort studies the authors were able to identify six papers with good methodological quality that confirmed the relationship between awkward postures — including twisted postures, working with forward flexed trunk, and working with arms above shoulder — and shoulder pain, and three studies that identified conducting the same activity for a prolonged period—such as typing or driving a car and shoulder pain.

4.2.4. Computer work

With the rapid development of information technology a number of changes in working life have ensued. It is estimated that more than half of the working population in western societies currently use personal computers at work.[74] The time spent in front of the computer and the use of a computer mouse has also increased rapidly over the years. This entails prolonged and sustained postures, constant force and highly repetitive movements as well as psychosocial factors such as time constraints and high quantitative demands at work.[40] This has resulted in an increase in shoulder-related disorders especially amongst adolescents and the youth.[32–35]

This is exacerbated with ready access to the internet, mobile phone use, and playing of computer games that have all opened up a new pathway of risk factors associated with shoulder pain in adolescents. Hakala et al. recruited adolescents aged from 14–18 years in a study who reported a weekly prevalence of shoulder pain at 26%.[75] The authors conclude

that daily use of computers exceeding two to three hours seems to be a threshold for neck or shoulder pain, which may explain why with an increase in computer-related activities there is an increase in shoulder-related pain among the youth. A further study also evaluated the prevalence of neck or shoulder, and arm pain with computer use in Dutch adolescents.[76] The survey was distributed to a pool of 12–16-year-olds attending a secondary school in Amsterdam. The study demonstrated an overall prevalence of neck or shoulder pain of 11.5%. The prevalence of pain was higher among girls and adolescents not living with both parents. The study also found a correlation with depressive symptoms and neck or shoulder pain.

In 2007, Eltayeb et al. conducted a study to investigate the prevalence of arm, neck and shoulder pain in a Dutch population of computer workers and also to develop a questionnaire aimed at measuring workplace physical and psychosocial risk factors for the presence of these complaints.[77] The authors used a questionnaire to determine sociodemographic characteristics (age, gender, and employment status) to assess potential risk factors with regard to (1) work station, (2) posture during work, (3) quality of break time, (4) job demands, (5) job control, and (6) social support. In addition, a number of items assess the quality of the work environment and the frequency and nature of extremity complaints, in the neck, shoulder, upper and lower arm, elbow, hand and wrist. The study demonstrated a prevalence of shoulder pain over the past 12 months that lasted for at least one week to be 31% overall, with a prevalence of 20% in males and 42% in females. A further study concentrated on determining factors of computer work that predict musculoskeletal symptoms in the shoulder, elbow, and low-back regions.[78] A questionnaire on ergonomics, work pauses, work techniques, and psychosocial and other factors was delivered to 5,033 office workers with the results showing the prevalence of shoulder pain at 18% with symptoms more prevalent among female workers. The authors conclude that work pauses, reduction of glare or reflection, and screen height are important factors in the design of future computer workstations. Previous symptoms were a significant predictor of recurrent symptoms in the shoulder.

There are few publications that have investigated prolonged or chronic shoulder pain and their association with the use of the computer. One study reported in a publication from Denmark evaluated the prevalence of moderate to severe neck and shoulder pain among frequent computer users, and the associated effect of mouse and keyboard use.[79] The study followed a pool of participants over a 12-month period determining a prevalence of moderate-to-severe pain in the neck and right shoulder at 4.1% and 3.4%, respectively, and the one-year incidence for no or minor baseline symptoms at 1.5% and 1.9%, respectively. These findings indicate that computer mouse use is associated with an increased risk of moderate-to-severe pain in the neck and right shoulder, especially with prolonged mouse and keyboard use.

In contrast to previous publications, Anderson et al. studied the effect of keyboard and computer mouse usage as a predictor for the onset of acute, prolonged and chronic pain in the neck and shoulder.[80] The study measured three different pain patterns, namely:

(1) acute pain (measured as weekly pain), (2) prolonged pain (no or minor pain in the neck and shoulder region over four consecutive weeks followed by three consecutive weeks with a high pain score), and (3) chronic pain (reported pain or discomfort lasting more than 30 days and ''quite a lot of trouble'' during the past 12 months). The study showed that in any one week during the study period, 9.8% males and 10.2% females reported severe shoulder pain. Risk for acute neck pain and shoulder pain increased linearly by 4% and 10%, respectively, for each quartile increase in weekly mouse usage time. Mouse and keyboard usage time did not predict the onset of prolonged or chronic pain in the neck or shoulder. Women had higher risks for neck and shoulder pain. The authors conclude that there seems to be no relationship between computer use and prolonged and chronic neck and shoulder pain. The major weakness of the study was the non-standard definition of shoulder pain, hence this may have contributed to the authors' conclusions. The cohort members were mouse users more than they were keyboard users. The mean mouse usage was around six hours per week and total computer use was 9.2 hours per week and was strongly correlated with mouse use Keyboard usage was at a low level, so the results for keyboard users should be cautiously interpreted and may not hold for heavy keyboard users.

The presence of shoulder pain and symptoms associated with dysfunction of the shoulder girdle in workers that use the computer on a daily basis can lead to sickness, absence and chronic disability, but also reduced work effectiveness.

The results of a British national survey in 1995 showed that musculoskeletal disorders of the neck and upper extremity were responsible for the loss of 4.2 million working days in a 12-month period, hence this represents a significant form for society.[81] Many workers still go to work despite the feeling that, in the light of their health, they should have taken sick leave. This phenomenon is known as sickness presenteeism.[82] Although the workers are physically present at work, their productivity could be reduced due to functional limitations. The extent of productivity loss while present at work is uncertain, but it has been suggested that it accounts for the majority of lost productivity costs associated with chronic pain.[83,84] A recent cross-sectional population-based study of computer workers investigated the effect of shoulder, neck pain and loss of productivity among the working population.[85] From the study population a total of 10% reported shoulder and neck symptoms and, on average, in 26% of the cases reporting symptoms, productivity loss was involved. If symptoms of the hand and arm were also present the productivity loss was 36%. The productivity loss was caused by sickness absence and by a decreased performance at work (decreased work speed and working hours but no sickness absence). In the study psychosocial load was defined as effort–reward imbalance and job satisfaction, which was strongly associated with productivity loss.

4.2.5. Psychosocial factors

A number of work-related psychosocial variables have been identified in the literature and appear to be linked with shoulder-related symptoms. Workers who are highly exposed to

both physical and psychosocial workplace risk factors were more likely to report symptoms of musculoskeletal disorders, including the shoulder, than workers highly exposed to one or the other.[61] Devereux et al. defined psychosocial exposure criteria at work into high psychosocial exposure criteria, which represents high mental demands, low job control, and low social support; and low psychosocial exposure criteria, which is represented by low mental demands at work, high job control, and high social support.[61]

The results from the study demonstrate an interaction between physical and psychosocial risk factors in the workplace that increased the risk of reporting symptoms in the upper limbs. Symptoms of the shoulder are more prevalent in workers with high psychosocial exposure. Associations between both physical and psychosocial exposures in the work environment and seeking care for neck or shoulder pain have also been found in the literature. Long-term exposure to a hindrance at work, an increase of exposure to reduced opportunities to acquire or use new knowledge, or lack of opportunity to participate in planning of the work are associated with seeking care because of neck or shoulder pain. The presence of these factors in the work environment represented risk factors for the development of work-related shoulder pain.

In attempt to identify whether psychosocial and mechanical risk factors related to a new onset of shoulder pain, or whether these factors can predict onset of shoulder pain in newly employed workers, Harkness et al. conducted a two-year prospective study of newly employed workers from twelve diverse occupational settings.[86] New onset of shoulder pain was reported by 15% of participants at 12 months. An increased risk of symptom onset was found in participants reporting mechanical exposures involving heavy weights, including lifting with one or two hands, carrying on one shoulder, lifting at or above shoulder level, and pushing or pulling. Working with hands above shoulder level was also predictive of new onset shoulder pain. When considering psychosocial variables, participants were asked about the following with respect to their current job: job satisfaction, whether they felt their work was monotonous or boring, work pace, stress/worry, control over work, ability to learn new things, and support from work colleagues and supervisors. Most of the psychosocial factors were modestly associated with new onset shoulder pain. However, monotonous work was a strong risk factor for new onset shoulder pain. The strength of the study was its prospective cohort design following a pool of participants from a variety of occupations over a two-year period. Most available data on psychosocial variables has been obtained from cross-sectional studies,[55] hence the practical implications of this research are that by targeting the perception of monotonous or tedious work by applying more interesting or varied tasks in the workplace with more breaks and better job opportunities, the onset of shoulder pain may be reduced.

In a more recent study[70] of psychosocial factors related to work and the occurrence of shoulder pain the authors asked participants a number of questions a number of questions on a five-point adverbial scale (‘none of the time’ to ‘all of the time’):

- Can/could you control the way you worked in this job?
- Is/was your work physically demanding in this job?
- Do/did the tasks and activities that you perform/performed in this job change during your time in the job?
- Do/did you get job satisfaction from your work in this job?
- On the whole, are/were your supervisors/managers supportive?

This method of collecting information on work-related psychosocial factors has been previously used.[87] The results demonstrate that factors such as little job control, physically demanding work, and little supervisor support were strongly associated with the occurrence of work related shoulder pain. High levels of psychological demand (hectic work and conflicting demands) and physical exertion in the workplace were significant predictors of work-related repetitive strain injury in the shoulder.[88]

These findings have also been confirmed in a prospective study of newly employed workers from 12 diverse occupational groups.[86] In addition to the above mentioned factors this study also identified a number of variables associated with the development of shoulder pain including: lack of control over work, seldom learning new things, and dissatisfaction with job and dissatisfaction with support from colleagues. Aspects of job demand, poor support from colleagues, and work dissatisfaction were all associated with increased odds of reported pain onset and presented very strong predictors for associated shoulder symptoms.

A recent systemic review of the literature of occupational risk factors for shoulder pain identified the following psychosocial factors including: duration of employment, psychological work demands, job control, social support, job satisfaction and stimulation at work.[55]

According to van der Windt et al. psychosocial factors seem to be important in both the development and maintenance of sub-acute and chronic shoulder problems.[55] Pain behaviour may be learned over time and may eventually cause the pain problem to persist, even after physical healing has occurred. In this model, pain is considered to be more than a neurophysiological entity, having both cognitive and behavioural dimensions. A poor social work environment, together with an inadequate personal capacity to cope with these factors, may increase work-related stress. The increase in stress may increase muscle tone directly, or strengthen the relation between physical work load and musculoskeletal symptoms. This may result in an enhancement of the perception or reporting of symptoms, or a reduction of the capacity to cope.

In summary, it is important to identify risk factors (physical and psychosocial) associated with the development of shoulder pain as a number of these variables can be controlled and, in some instances, significantly reduced, which may improve the health of the adult population including workers. Musculoskeletal disorders including the shoulder are some of the most frequent reasons for long-term absence from work, with a major impact on daily living and quality of life. From a public health perspective the information derived

from these studies may contribute to reducing the population burden of shoulder and upper limb pain. Therefore, there may be appreciable scope for preventive modification of the physical and psychosocial work environment to reduce the impact of shoulder and upper limb pain.

From a research point of view it would be interesting to determine to what extent these identified risk factors are common across specific and non-specific disorders of the shoulder. Perhaps this maybe a new avenue of investigation for future prospective or longitudinal studies.

5. Predictors of outcome

In clinical practice it is important to know more about the prognostic value of clinical, psychosocial, and occupational factors in patients with shoulder disorders. It may help to provide patients with adequate information regarding the most likely course of their symptoms.

A number of recent studies have investigated the course and prognosis of patients presenting to a primary care practitioner with shoulder pain. In 2008, Reilingh et al. investigated the course and prognosis of shoulder pain in the first 6 months after presentation to the general practitioner.[89] The authors also separately studied patients with acute, sub-acute and chronic shoulder pain, as duration of symptoms at presentation has been shown to be the strongest predictor of outcome. A prospective cohort study was conducted with 6-month follow-up of a pool of patients with shoulder pain, which also included patients with a new episode of shoulder pain. Patients were categorised as having acute (symptoms <6 weeks), sub-acute (6–12 weeks) or chronic (>3 months) shoulder pain in predefined area of the shoulder. The course of shoulder pain, functional disability and quality of life was analysed over 6 months. Patient and disease characteristics, including physical and psychosocial factors, were investigated as possible predictors of outcome. The results demonstrated that acute shoulder symptoms showed the most favourable course over a 6-month follow-up, with more pain reduction and improvement of functional disability. Patients with chronic shoulder symptoms showed the poorest results. Predictors of a better outcome at 6 months for acute shoulder pain were lower baseline disability scores and higher baseline pain intensity scores. Predictors of a better outcome for chronic shoulder pain were lower scores on pain catastrophising scale at baseline. The authors conclude that, besides a different course of symptoms in patients presenting with acute or chronic shoulder pain, predictors of outcome may also differ with psychosocial factors being more important in chronic shoulder pain.

A similar observational, prospective cohort study was conducted in general practice to describe the clinical course and to identify predictors of recovery, changes in pain intensity, and changes in functional disability in patients with neck or shoulder symptoms at three, and 12-month follow-up.[90] The study involved 443 patients who consulted their general practitioner with neck or shoulder symptoms. Baseline scores of pain and

disability, symptom characteristics, sociodemographic factors, psychological factors, social support, physical activity, general health, and co-morbidity were investigated as possible predictors of recovery, changes in pain intensity, and changes in functional disability using multiple regression analyses. The results showed a low recovery rate; 24% of the patients reported recovery at three months and 32% reported recovery at 12-month follow-up. This study also showed that duration of the symptoms before consulting the GP and also a previous history neck or shoulder symptoms increased the probability of an unfavourable outcome. A number of psychological variables were noted, including less vitality and more worrying, and were consistently associated with poorer outcome after three and 12 months. In conclusion, the results from the study indicate that besides clinical characteristics, psychological factors also predict the outcome of neck and shoulder symptoms.

In a narrative review of the literature a number of prognostic indicators of a favourable outcome within three months have been described including: mild trauma preceding symptoms, early presentation, preceding overuse and heavy and unusual activities of the upper extremity.[91] Factors that were reported to predict a poor outcome at 3 months were severe pain at first presentation, a prior episode, a severe restriction of the passive abduction range, concomitant neck pain, cervical spondylosis and radicular symptoms, higher age, involvement of the dominant side and sick leave from work. The reported evidence for these factors is weak and, according to the reviewers, is based on studies with weak methodology. However, a number of more recent studies suggest strong evidence for 'high pain intensity' as a predictor of poor outcome.[92,93]

Kuijpers et al. also found high pain intensity to be a strong predictor of persistent symptoms at short-term (six weeks) and long-term (six months) follow-up.[91] There is evidence that high pain intensity in primary care populations and middle age (45–54 years) in occupational populations are strong predictors for a poor prognosis; that long duration of complaints and high disability score at baseline are predictors for a poor prognosis in primary care populations.[92]

A number of psychological factors, such as inadequate pain cognitions and pain behaviour are likely to predict a poor outcome of painful musculoskeletal conditions.[91] In addition, psychosocial work environment (e.g., decision authority and job satisfaction) [55] and heavy physical work load (e.g., pushing and pulling, repetitive work) may be associated with an increased risk of new episodes of shoulder pain.[55, 94]

In summary, the major predictor of outcome for patients presenting with shoulder pain to primary care practitioners appears to be the level of pain intensity on the first consultation, and a previous history of shoulder problems. Due to the small number of studies available with heterogeneous methodologies strong conclusions cannot be drawn at this stage. This area of research necessitates further studies that will enable better decisions on the choice of interventions and help generate guidelines for indexing patients into high- or low- risk categories for persistent shoulder pain, which may allow caregivers to predict the likelihood

of recovery. New focused studies should emphasise the importance of the predictive value of sociodemographic and clinical factors, but also psychological factors and work-related risk factors for shoulder pain.

6. Shoulder pain and sport

The prevalence of shoulder pain in sport is quite high, especially in overhead sports that require the repetitive overhead use of the shoulder – such as swimming, baseball, tennis and overhead athletes. Overhead sports subject the shoulder to stress, fatigue, microtrauma, laxity of static stabilisers, and muscular imbalances of shoulder dynamic stabilisers that can create altered mechanical functioning of the shoulder and predispose it to injury.

Numerous sports have been studied in the literature including swimming and activities involving overhead throwing. The cause of shoulder pain in the athlete involved in overhead sports (e.g., tennis, volleyball) or throwing (e.g., cricket, baseball) maybe due to the repetitive and high-energy forces going through the shoulder, leading to chronic stresses placed on the stabilising structures of the shoulder. When the stresses are applied to the shoulder at a rate that exceeds repair this will result in progressive damage to stabilising structures. With continued stress, the static stabilisers of the shoulder become hyperelastic, enabling anterior glenohumeral subluxation. Initially the dynamic stabilisers can compensate for this mild instability with increased muscle activity. However, with increased activity fatigue results, which in turn leads to overloading of these compensatory mechanisms. Consequently, the humeral head may sublux anteriorly, come in contact with the coracoacromial arch, ultimately leading to subacromial impingement. This form of athletic injury is known as anterior glenohumeral instability of the shoulder and, as such, can be a secondary cause of impingement. This mechanism of injury was first described by Jobe et al. in 1989.[95]

In the swimming population the shoulder joint is particularly vulnerable with 92% of propulsive forces coming from the upper extremity. The shoulder is the most injured area in swimmers with many publications citing different prevalence levels.[96–98] In a survey of 1,262 competitive swimmers from the United States the prevalence of shoulder pain ranged from 38–75%,[96] from a 1997 study up to 65% of swimmers reported shoulder pain.[97] A study on high-level swimmers demonstrated a prevalence of interfering pain necessitating a cessation or reduction of practice in 23% of athletes.[98] Signs of impingement with orthopaedic evaluation was revealed in 50% of the swimmers with pain, and a positive apprehension sign indicative of anterior instability was also seen in 50% of swimmers with pain. A study of collegiate and masters level swimmers reported a similar percentage prevalence of shoulder pain with 47 and 48%, respectively, experiencing shoulder pain lasting three weeks or more, despite the lesser distances and intensities associated with the latter group.[99]

Other sports have also been extensively studied in the literature with volleyball players also reporting a high prevalence of shoulder pain. A recent study from The Netherlands investigated the epidemiology of injuries in volleyball players and determined a prevalence of 32% for overuse injuries of the shoulder, causing a mean absence from the sport of 9.4 weeks throughout a competitive year.[100] Shoulder pain syndromes represent the third most common injury among both female and male volleyball athletes and the second most common overuse-related condition, accounting for 8–20% of all volleyball injuries.[101] Elite volleyball players, but also baseball pitchers and tennis players are highly skilled sportspeople, but because of the intense practise, short recreational time, high intensity, and arm repetitive loads caused by specialisation on certain tasks in the game this will predispose the shoulder to injury. In volleyball the majority of the force imparted to the ball during a spike originates from the torso. It has been estimated that the elite volleyball athlete performs as many as 40,000 spikes in a season.[101] During a spike the scapula is involved in transferring kinetic energy to the upper limb and provides a stable base of support so that the upper limb can be correctly positioned in space during the performance of overhead skills. The dynamic stabilisers of the scapula and the humeral head are critical to maintaining the functional integrity of the glenohumeral joint; a change in one of the components of the shoulder girdle leads to a complete change in shoulder motion. This leads to depression and lateralisation of the dominant scapula compared with the non-dominant side.

Interestingly, similar physical adaptations have subsequently been reported to occur among other overhead athletes, and the constellation of findings has been characterised in the literature as the 'SICK scapula' (scapular malposition, inferior medial border prominence,

coracoid pain and malposition, and scapular dyskinesis).[102] The SICK scapula is associated with shoulder pain due to the spectrum of rotator cuff pathologies and functional instabilities.

The prevalence of shoulder pain among professional male and female beach volleyball players is considerably lower than that in most other team sports; however, data from a recent cohort study showed the presence of three most common overuse conditions, low back pain (19%), knee pain (12%), and shoulder problems (10%).[103]


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Shoulder injuries are also common in quarterbacks (in American Football) who are at risk for shoulder injury secondary to both the throwing motion as well as from contact injury.[104] Shoulder injuries are the second most common injury reported (15.2%). Overuse injuries were responsible for 14% of the injuries, the most common being rotator cuff tendinitis (6.1%) followed by biceps tendinitis (3.5%).

Previous or present pain in the dominant shoulder was reported by 52% of recreational badminton players,[105] and in a survey of world class players showed that previous or present shoulder pain on the dominant side was reported by 52% of the players.[106] Previous shoulder pain was reported by 37% of the players and ongoing shoulder pain by 20% of the players.

In the professional golfer, the shoulder is the third most commonly injured body area, after the lumbar spine and the wrist or hand, whereby for amateur golfers in the United States, the shoulder has been cited as the fourth most commonly affected site, trailing the lumbar spine, the elbow, and the wrist or hand.[107] The non-dominant shoulder is particularly vulnerable to injury, with most golf injuries occurring as a result of the golf swing, and mostly at impact of the head of the golf club with the turf. The prevalence of golf-related shoulder pain has been demonstrated at 12%.[108] Rotator cuff disease and subacromial impingement involving the lead shoulder are among the most common problems in golfers.[107]

Shoulder pain has a very high prevalence in sports especially overhead sports due to the highly repetitious actions of the glenohumeral joint and high velocity forces transmitted through static and dynamic stabilising structures of the articulation, which eventually leads to breakdown of normal shoulder functioning. Inherently, the glenohumeral joint is

capable of exceptional range of motion, however, this leads to a compromise in stability. Hence, when the dynamic stabilisers of the humeral head are placed under repetitive load — as seen in amateur and elite athletes such as swimmers, volleyball, softball or baseball players — this can lead to fatigue and failure of the dynamic stabilising structures, especially the rotator cuff. The net effect is disruption of the glenohumeral force couple leading to humeral superior migration and repetitive impingement of subacromial structures.

Epidemiological research in sports is necessary to determine the prevalence of sports-related injuries, and also to quantify the risk factors for injury inherent to individual sports, and to characterise the injury pattern typical of a sport. Injury to the athletic population leads to time lost from training and competition, and general participation in sports.

Risk factors for the development of a shoulder problem in athletes can be divided into intrinsic and extrinsic.[103] The modifiable intrinsic risk factors include: biomechanical considerations, conditioning and core stability, range of motion deficits, scapula dysfunction; while the non-modifiable factors include anatomy, sex and a history of previous injury that represents a strong risk factor for future injury. Extrinsic risk factors include the competitive situation and load placed on the joint, as seen in sports such as volleyball or tennis. The identification of risk factors will help implement prevention strategies aimed at improving technique, training and rehabilitation.

By improving or modifying technique, loads placed on the shoulder can be minimised, while through modification of training practices tissue overload can also be reduced allowing injured structures to repair and heal. Prevention of further injuries or recurrence of injury depends on providing the athlete with an accurate diagnosis and implementing a structured rehabilitation program so that any underlying biomechanical maladaptations are addressed that might precipitate reoccurrences of injury

When considering the sources of shoulder pain in athletes, most are derived from local structures located within the shoulder. The most common clinical diagnosis involves dysfunction of the rotator cuff with signs of impingement seen in 74% of shoulder pain sufferers.[109–111]

An ultimate goal of future research in the field of sports medicine should be a focus on injury prevention so that the athlete can remain competitive in the sporting arena. More research is needed in the identification of sports specific risk factors, but also effective interventions that may effectively reduce not only the risk of primary injury but also secondary re-injury so that the ability of athletes, whether amateur or elite, to participate and enjoy their sports is not compromised.

7. Conclusions

The findings from this narrative epidemiological review confirm that shoulder pain is a common complaint seen in the population and it is also a common presenting symptom to

health care practitioners in clinical practice. The available data is mainly derived from the literature, with no quality descriptive data available on the chiropractic profession.

The prevalence of shoulder pain varies widely across different populations that have been studied (from 1–67%) and is probably due to different definitions used for defining shoulder pain. Using a pain drawing-based definition of shoulder pain restricted to an area in and around the shoulder complex is a recommendation for surveys assessing the prevalence of shoulder symptoms in the general population and clinical practice. To solve the problem of the poor specificity associated with symptom-based definitions it is useful to incorporate an additional classification to restrict the definition to more disabling problems.

Shoulder pain is most prevalent in middle age (45–64 years, from 21–55%), which may be attributed to the normal aging process of shoulder structures including the rotator cuff. This would most likely be due to degeneration, acute injury or pathology. Shoulder pain is also common in the younger age group (adolescents aged 12–18 years, from 12–57%) and can be attributed to a postural relationship associated with increased periods of sitting, advancement of technology with greater usage. In summary, the prevalence of shoulder pain is influenced by a number of factors: it tends to increase with age, has a strong gender relationship and is more common in women, and is particularly prevalent in psychologically stressed populations, especially women and adolescents.

Shoulder pain is common in working populations and is due to a multitude of factors including physical and psychosocial. It is one of the most common musculoskeletal problems seen in workers and demonstrates a strong age and female gender relationship. Physical factors associated with the onset and prevalence of shoulder pain in the working population include physical load and vibration, repetitive movements, work-related posture, and also the duration of computer and mouse use in a work setting. A number of psychosocial variables correlate with shoulder pain in workers including high mental demands, low job satisfaction and poor social support.

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