BMJ Open

The influence of psychosocial factors in the prognosis of chronic shoulder pain: protocol for a prospective cohort study.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2016-012822
Article Type:	Protocol
Date Submitted by the Author:	26-May-2016
Complete List of Authors:	MARTINEZ-CALDERON, JAVIER; UNIVERSITY OF MALAGA, Department of Physiotherapy STRUYF, FILIP; Universiteit Antwerpen Campus Drie Eiken, Rehabilitation Sciences and Physiotherapy MEEUS, MIRA; Universiteit Antwerpen Campus Drie Eiken, Rehabilitation Sciences and Physiotherapy Miguel Morales-Asencio, Jose; Univ Malaga, Department of Nursing LUQUE-SUAREZ, ALEJANDRO; UNIVERSITY OF MALAGA, Department of Physiotherapy
Primary Subject Heading:	Rehabilitation medicine
Secondary Subject Heading:	Epidemiology
Keywords:	shoulder pain, chronic pain, psychosocial factors

The influence of psychosocial factors in the prognosis of chronic shoulder pain: protocol for a prospective cohort study.

Javier Martinez-Calderon [1], Filip Struyf [2], Mira Meeus [2,3,4], Jose Miguel Morales-Asensio [5], Alejandro Luque-Suarez [1*]

*Corresponding author. Address: Faculty of Health Science, University of Malaga, Arquitecto Francisco Penalosa, 3, 29071 Malaga, Spain. Tel.: + 00 34 951 952 853 Email address: aluques@uma.es

Javier Martínez-Calderon (1) Department of Physiotherapy, University of Malaga, Malaga, Spain. Email address: calderonjmc@uma.es

Filip Struyf (2) Rehabilitation Sciences and Physiotherapy Department, University of Antwerp, Antwerp, Belgium Email address: filip.struyf@uantwerpen.be

Mira Meeus (2,3,4) Rehabilitation Sciences and Physiotherapy Department, University of antwerp, Antwerp, Belgium; (3) Rehabilitation Sciences and Physiotherapy Department, Ghent University, Ghent, Belgium; (4) Pain in Motion International Research Group, www.paininmotion.be Email address: mira.meeus@uantwerpen.be

Jose Miguel Morales-Asensio (5) Department of Nursing, University of Malaga, Spain Email address: jmmasen@uma.es

Alejandro Luque-Suarez (1) Department of Physiotherapy, University of Malaga, Malaga, Spain. Email address: aluques@uma.es

Keywords: Shoulder pain; chronic pain; prognosis; psychosocial factors

Word count: 3829

ABSTRACT

Introduction: Shoulder pain is the third most common musculoskeletal condition presenting to physicians or physiotherapists in primary healthcare. Psychosocial factors such as kinesiophobia, fear avoidance, pain catastrophizing, self-efficacy, anxiety and depression could play an essential role as prognostic factors in shoulder pain. In this study, the influence of psychosocial factors in the prognosis of patients with chronic shoulder pain (CSP) will be evaluated.

Methods and analysis: The study is a longitudinal, prospective cohort study with a 12-month follow-up. It will be conducted in four primary-care centers and one hospital of the province of Malaga, Spain. 242 men / women aged between 18 and 70 years, suffering from different shoulder pain conditions, such as: (i) rotator cuff (RC) tendinopathy; (ii) adhesive capsulitis (AC); (iii) glenohumeral instability; (iv) superior labrum anterior to posterior (SLAP) lesion; (v) acromioclavicular pathology; (vi) and/or shoulder osteoarthritis will be included. Inclusion will be based on clinical tests. Duration of symptoms: more than 3 months. Primary outcomes will include pain, function and self-efficacy, whereas kinesiophobia, fear avoidance, pain catastrophizing, anxiety, depression, age, gender, duration/intensity of symptoms and educational level will be predictive measures. Follow-up: baseline, 3, 6, and 12 months.

Ethics and dissemination: This protocol has been approved by the local ethics committee (The Costa del Sol Ethics Committee, Malaga 28042016). Dissemination will occur through presentations at National and International conferences and publications in international peer-reviewed journals.

Trial registration number: NCT02738372

Strengths and limitations:

- This is the first study to identify possible prognostic biopsychosocial factors for chronic shoulder pain.
- Information bias could be an important limitation of this study. It could be due to the presence of a high proportion of elderly people with lower educational background. These participants may have problems to deal with the questionnaires and to remember any situation associated with their pain and disability at 3, 6 and 12 months of follow-up.

Contribution of the manuscript

- To determine whether psychosocial factors are involved in the prognosis of CSP.
- To acquire detailed knowledge about these factors will permit a better understanding of CSP and, therefore, will help to establish new treatment strategies that could prevent the shoulder chronicity and/or reduce its consequences.

Keywords: Shoulder pain; chronic pain; prognosis; psychosocial factors

INTRODUCTION

Shoulder pain is the third most common musculoskeletal condition presenting to physicians or physiotherapists [1] in primary healthcare after low back and neck pain,[2,3] being a significant cause of morbidity [4] and functional disability in both working [5,6] and general population.[6–8] It affects one in three adults,[7,9,10] accounting 1% of general practitioners (GPs) consultations in primary care.[11]

Incidence rates range from 11.2 to 29.5 per 1000 person-years,[11–14] and the reported prevalence rates range from 4.7 to 46.7 per 1000 person-years.[10,14,15] Both incidence and prevalence rates tend to increase with age,[16] in women,[10,16,17] in subjects from lower socioeconomic groups, and in psychologically stressed populations.[18]

Despite the large group of individuals seeking for primary care services, about 50% of patients with shoulder pain still report persistent pain after 12-18 months.[9,16,18,19] As a result, socio-economic burdens are considerable due to extensive use of heath care services, sickness absence, disability pension, and loss of productivity,[20–24] as well as, patient´s suffering.

The most effective treatment for shoulder pain remains unclear. Successful treatment in early stages of shoulder pain is essential, in order to decrease the likelihood of chronic pain and, eventually to increase the effectiveness of future interventions.[25] Nevertheless, before designing optimal treatment regimens, it is crucial to have a better understanding of prognosis factors for chronic pain to steer treatment.

Therefore, research efforts need to be allocated to the investigation of causes and prognosis factors of CSP, as this understanding is crucial for effective prevention and for decreasing the poor prognosis of this pathology. Although the determination of the mechanisms and prognosis factors related to CSP is challenging, it will allow a better understanding of these pain disorders and will lead to the development of treatment strategies to reduce chronicity.

There is a potential mismatch between the origin of pathology and the perception of shoulder pain.[26] The effective diagnosis and treatment of shoulder pain should not only rely on detailed knowledge of the peripheral pathologies that may be present in the shoulder (i.e. AC, SLAP lesion or RC tendinopathy) but also on current knowledge of pain neurophysiology.[27] In this sense, recent literature reviews have demonstrated that central sensitization (CS) plays an essential role in chronic pain conditions such as whiplash,[28] osteoarthritis,[29] chronic fatigue syndrome,[30] rheumatoid arthritis [31] and, specifically, in shoulder pain disorders.[32–35] Understanding that the increase of sensitivity and, thus, increased pain intensity and duration caused by sensitization may contribute to the problem of pathological pain, promising new approaches to rehabilitation in chronic pain conditions have been generated.[36]

Besides the importance of neuroplasticity in the prognosis of CSP, there has been a growing

recognition that the degree of chronic pain is influenced by the beliefs, attitudes and expectations of individuals.[37–39] Given the importance of pain as a mechanism of survival, it is perhaps unsurprising that pain perception is clearly influenced by conscious and unconscious memory, cognitive and emotional functioning and contextual factors that are explicitly included in a biopsychosocial formulation of pain.[40] Inside this biopsychosocial framework, it is clear that psychosocial factors are all potential modulators of pain itself and may subsequently be suitable targets for rehabilitation.[36] Currently, some studies have shown that psychosocial factors such as kinesiophobia, fear avoidance, pain catastrophizing, self-efficacy, anxiety and depression could play an essential role as prognostic factors in shoulder pain.[41–45] Despite the existence of some evidence suggesting this, the cross-sectional nature of the studies preclude drawing firm conclusions on the prognostic role of different factors and their interrelations. Further experimental and prospective studies are required in order to examine the precise influence of psychosocial factors on the prognosis of patients with CSP.

For that reason, knowing and evaluating which psychosocial factors are involved in patients with chronic pain will be of great importance to predict the chronicity of shoulder complaints,[46] to facilitate clinical decision-making and to develop new therapeutic strategies that reduce and/or avoid the consequences of persistent shoulder pain. Hence, the objective of this study will be to evaluate the influence of psychosocial factors in the prognosis of patients with CSP.

Objective

To evaluate the influence of psychosocial factors in the prognosis of patients with CSP.

METHODS AND ANALYSIS

Study design and setting

The present study will be a 12 months multi-center, prospective, cohort study that will be carried out between May 2016 and April 2018 in four primary care centers and one hospital of the province of Malaga, Spain. Participants will be diagnosed by clinical tests, and those fulfilling the inclusion criteria will be asked for participating in this study. Several questionnaires assessing different psychosocial factors will be administrated to these participants. The outcomes will be assessed at baseline (t1) and at 3 follow-ups times (after 3 (t2), 6 (t3) and 12 months (t4)). Ethical approval has been obtained from Costal del Sol Ethics Committee, Malaga, Spain (28042016). The study will be implemented and reported in line with the SPIRIT statement.

Participants

A consecutive sample comprised of participants with chronic shoulder pain will be recruited. General practitioners (GPs) will carry out the recruitment. Then, research assistants who

previously will be instructed by the research team will assess participants for eligibility. If participants satisfy the inclusion criteria, then they will be studied at baseline and 3, 6, and 12 months follow-up.

Inclusion Criteria

1. Men / women aged between 18 and 70 years.

2. Participants suffering from shoulder pain (pain intensity of 3 or more on a 0-10 numerical pain rating scale), will be included in this study, among all these following shoulder pain conditions: RC tendinopathy, AC, glenohumeral instability, SLAP lesion, acromioclavicular pathology and/or shoulder osteoarthritis. Diagnosis will be based on clinical testing.

3. Duration of symptoms: more than 3 months.

Exclusion Criteria

1. Recent shoulder dislocation (1 year prior) and/or systemic diseases such as rheumatoid arthritis, fibromyalgia and/or polymyalgia rheumatic.

2. Shoulder pain considered to be originated from the cervical region and other traumas or if there is a neurological dysfunction (i.e. multiple sclerosis), osteoporosis, hemophilia and / or cancer.

3. Participants receiving shoulder surgery one year previous to the study.

4. Inability to provide informed consent and/or complete written questionnaires.

Procedures

Recruitment

Participants will attend for their routine clinical appointment. Participants who fulfill the selection criteria will be asked whether they wish to be considered for study participation. Examiners will inform participants who are interested in participation.

Anonymized age, gender and visual analogue scale- verbal numerical rating scale (VAS-VNRS) for pain will be collected for those participants who decline to take part in the project, in order to assess the external validity of the recruited sample of participants.

Eligible participants who will be interested in the study will be asked to provide written informed consent to participate. Participants will then complete several questionnaires at baseline, 3, 6 and 12 months after the beginning of the study. Retention of participants will be encourage by researchers providing written feedback to all participants about the results of the "health screenings", maintaining the interest in the study through materials and mailings sent to participants during all the process and using reminders of the upcoming data collection.

Participant data files will be stored in numerical order and in a secure and accessible place and manner. Participant files will be maintained in storage for a period of 3 years after completion of

the study.

Outcomes Measures

Primary Outcomes

Pain and function

1. The Shoulder Pain and Disability Index (SPADI) is a self-administered index consisting of 13 items divided into two subscales: pain and disability.[47] It grades a normal shoulder as 0 and maximally affected as 130, and a 11-point numerical pain rating scale with 0 as normal and 10 as maximal pain.

Self-Efficacy

2. Pain Self-Efficacy Questionnaire (PSEQ) contains 10 questions that will measure the patient's confidence in performing certain activities in spite of pain. Items are scored on a scale from 0 to 6, with a maximum possible score of 60 points. Lower scores indicate less self-efficacy.[48]

Predictive measures

Psychological factors will be assessed through four questionnaires at baseline, 3,6,12 months follow-up.

Kinesiophobia, fear avoidance, pain catastrophizing, anxiety and depression

1. The Fear-avoidance Components Scale (FACS) is a new patient-reported measure designed in order to evaluate fear-avoidance in patients with painful medical conditions. It consists of 20 items that are scored on a 5-point scale.[49]

2. The Pain Catastrophizing Scale (PCS) will be included to assess catastrophic thinking about pain. It consists of 13 items describing different thoughts and feelings that individuals may have when experiencing pain. Items are scored on a 5-point scale. A general score and scores on 3 subscales (i.e., helplessness, magnification, and rumination) will be obtained; higher scores indicate more severe catastrophic thoughts about pain.[50]

3. The Tampa Scale of Kinesiophobia (TSK) is a 17-item questionnaire that will be used to measure the fear of (re) injury due to movement. Scores range from 17 to 68, with scores $\leq$ 37 suggesting low fear of movement and scores > 37 indicating high fear of movement.[51]

4. The Hospital Anxiety and Depression Scale (HADS) is a 14-item scale designed to detect anxiety and depression, independent of somatic symptoms. It consists of two 7-item subscales measuring depression (HADS-D) and anxiety (HADS-A). It uses a 4-point response scale that ranges from 0 (absence of symptoms) to 3 (maximum symptoms), with possible scores for each subscale ranging from 0 to 21.[51] Higher scores indicate higher levels of disorder. The HADS has been widely used as a screening instrument for the detection of comorbid depressive and anxiety disorders in patients with musculoskeletal disorders.[44,52,53]

Age, gender, duration/intensity of shoulder symptoms, educational level and treatments received

1. To be women and having a higher age, higher duration/intensity of symptoms and/or low educational level tend to increase the rates of prevalence in CSP.[10,14,16,17,54,55] It will be evaluated with a basic self-administrated questionnaire.

2. Current treatment will be evaluated through a checklist divided in 4 groups (no treatment, pharmacological treatment, injections and physical therapy).

The summary of predictive and outcome measures will be presented in **table 1**.

Construct	Type	Staff Member	Baseline (T1)	3 months (T2)	6 months (T3)	12 months (T4)
Shoulder Problems						
	Have you been treated of this pathology?	Interviewer	X	X	X	X
	What modality of treatment? (Pharmacological/Physical therapy/Injections/No treatment)	Interviewer	X	X	X	X
	Side of shoulder problem (right, left, both)	Interviewer	X			
	Duration of shoulder pain	Interviewer	X			
	History of previous	Interviewer	X			

	shoulder problems					
	Shoulder ROM-free of pain	Interviewer	X			
	Shoulder Pain and Disability Index (SPADI)	Interviewer	X	X	X	X
Psychological Factors						
	TSK	Interviewer	X	X	X	X
	FACS	Interviewer	X	X	X	X
	PSC	Interviewer	X	X	X	X
	PSEQ	Interviewer	X	X	X	X
	HADS	Interviewer	X	X	X	X
Other Health Problems						
	Co-morbidities	Interviewer	X	X	X	X
Treatment Experiences, Preferences, Expectations						
	Previous experience of treatment and/or medication	Interviewer	X			
	Treatment preferences	Interviewer	X			
	Expectations about different treatments	Interviewer	X			
	Confidence in treatment	Interviewer	X	X	X	X
	Treatment satisfaction	Interviewer	X	X	X	X
	Current/most recent job title and nature of work	Interviewer	X	X	X	X
	Work status including alteration in hours/duties	Interviewer	X	X	X	X
	Work absence	Interviewer	X	X	X	X

	Work performance	Interviewer	X	X	X	X
Socio Demographics Data						
	Age, gender	Interviewer	X			
	Height, weight	Interviewer	X			
	Educational Level	Interviewer	X			

Table 1. Overview of measurement instruments and time of assessment

Sample size estimation

Assuming that 50% of patients with CSP in primary care does not obtain a complete recovery after 3 years,[56] a relative risk (RR) of 1.38,[57] an expected incidence of 0.5, our calculations indicate that, with a confidence level of 95% and for an alpha of 5%, and drop-out rate of 20%, it should be needed a total of 242 patients.

Statistical Analysis

Dataset will be carried out using SPSS for Windows (version 22, SPSS Inc. Chicago, IL) There will be 4 measurements in the study, T1= at baseline, T2= 3 months T3= 6 months, T4= 12 months follow-up. Kolmogorov-Smirnov test will analyze the normal distribution of the variables ($P > 0.05$). Continuous variables will be presented in mean, median, standard deviation and 25-75% percentile and categorical variables in frequencies and percentages. Rank sums and Wilcoxon signed Rank will be used in case the distribution will be no normal. For identification of prognostic factors, the variables will be divided in domains (participant characteristic; complaint specific characteristic; social and psychological factors) and regression tree analysis will be carried out to detect which factors predict SPADI-score in-time and self-efficacy. After that, the variables with highest or lowest rate will be introduced in an x^2 analysis by dichotomized all variables through YES or NO questions about each factor. The effect sizes will be expressed with Odds Ratios (OR).

Finally, sensitivity analysis through COX regression will be conducted to determine whether other demographics or complaints factors produce worse SPADI and/or PSEQ or will be potentially confusing (i.e. medical status). A p-value < 0.05 will be considered statistically significant.

Nevertheless, we propose to test non-inferiority using two analysis sets; the intention-to-treat set, considering all patients regardless of whether they received or not outside of the study, and the "per protocol" analysis set. Criteria for determining the "per protocol" group assignment would be established by the Steering Committee and approved by the PSMB [*Performance and Safety*

Monitoring Board] before the study begins. Given our expectation that very few patients will crossover or be lost to follow-up, these analyses should agree very closely.

Data collection and management

To ensure accurate, complete and reliable data, the following procedures will be followed. All study-related information will be stored securely at the study site. All participant information will be stored in locked file cabinets in areas with limited access. Reports, data collection, process, and administrative forms will be identified by a coded ID number only to maintain participant confidentiality. All records that contain names or other personal identifiers, such as locator forms and informed consent forms, will be stored separately from study records identified by code number. To ensure the safety of the participants in the study and to ensure accurate, complete and reliable data, it will be kept records of paper instruments and clinical records in patient files as source documents for the study at the site. The principal investigator (ALS), the co-principal investigator (JMC) and the other steering committee members (FS, MM, JMA) will be given access to the cleaned data sets.

Committees

Organizational structure and responsibilities

Principal Investigator

Design and conduct of Study

Preparation of protocol and revisions

Organizing steering committee meetings

Publication of study reports

Steering committee (SC)

Agreement of final protocol

All lead investigators will be steering committee members

One lead investigator per country will be nominated as national, coordinator. Reviewing progress of study and if necessary agreeing changes to the protocol and/or investigators brochure to facilitate the smooth running of the study.

Modification of the Protocol

Any modifications to the protocol that may affect the conduct of the study, potential benefit of the patient or may affect patient safety, including changes of study objectives, study design, patient population, sample sizes, study procedures, or significant administrative aspects will require a formal amendment to the protocol.

Such amendment will be agreed upon this research group**,** and approved by Costa del Sol Ethics Committee, Malaga, Spain, prior to implementation and notified to the health authorities in

accordance with local regulations.

Administrative changes of the protocol are minor corrections and/or clarifications that have no effect on the way the study is to be conducted. These administrative changes will be agreed upon this research group, and will be documented in a memorandum.

The Costa del Sol Ethics Committee may be notified of administrative changes at the discretion of the research group.

Ethical considerations and dissemination

Ethics approval of the study was obtained from the Costa del Sol Ethics Committee, Malaga (reference no. 28042016). The trial is registered in Clinicaltrials.gov: NCT02738372.

Informed Consent

Examiners are responsible for ensuring that patients understand the potential risks and benefits of participating in the study, and should answer any questions the patient may have throughout the study and share in a timely manner any new information that may be relevant to the patient's willingness to continue his or her participation in the study. An informed consent form, will be used to explain the potential risks and benefits of study participation to the patient in simple terms before the patient is entered into the study and to document that the patient is satisfied with his or her understanding of the risks and benefits of participating in the study and desires to participate in the study. Examiners are responsible for ensuring that informed consent is given by each patient. The appropriate signatures and dates on the informed consent form must be obtained before beginning of the study.

The protocol and the template informed consent form have been reviewed and approved by The Costa del Sol Ethics Committee, Malaga (28042016) with respect to scientific content and compliance with applicable research and human subjects regulations.

The protocol, site-specific informed consent forms, participant education and recruitment materials, and other requested documents — and any subsequent modifications — also have been reviewed and approved by The Costa del Sol Ethics Committee. All the authors declare to have no conflict of interests.

The results of the study will be disseminated at several research conferences and as published articles in peer-reviewed journals.

DISCUSSION

The present study will be the largest cohort study that prospectively will analyze the influence of psychosocial factors in the prognosis of CSP. The main research question will be to determine which of these psychosocial factors are more underlying to predict a better and/or poorer

prognosis in patients with CSP at 3, 6 and 12 months. The inclusion of a multi-center design will increase the external validity of the study findings because of a long list of GPs (recruiters) implicated and a large geographical area for patient recruitment.

Justification for selection of psychosocial variables

Pain related self-efficacy is a construct that describes a person's perceived confidence in their ability of successfully carrying out daily and/or work activities or behavior despite their pain.[55] This concept is associated with expectancy and behavior [58] and the mediation of developing disability.[59] It has been shown to play an important role in the recovery of shoulder pain.[42] Furthermore, self-efficacy is formally specified as an intermediate factor in the cognitive aspect of patient reassurance.[60]

Kinesiophobia is a major construct that could be probably involved in many chronic musculoskeletal conditions. It suggests that people feel fear to make some movements because of pain, to avoid worsening their condition or avoid causing a new problem.[61] This fear leads to two responses: confront (reducing gradually their fear of that movement) or avoid the activity (leading to physical disability in a middle-long term).[61,62] Kinesiophobia plays an essential role of shoulder pain intensity and disability.[63]

Fear avoidance is referred to the avoidance of movements or activities based on fear.[64] This pain-related fear can induce avoidance behavior meant to avert the perceived danger.[65,66] There is not much information about the role of fear avoidance in shoulder pain. Nevertheless, it could seem to be associated with an increase of disability and shoulder complaints at baseline.[67] Moreover, as a consequence of pain is typically no longer a sign of actual danger (e.g., the injury has healed, despite persistent pain) avoidance behavior loses its adaptive function as a protective strategy and may initiate a pathway towards functional disability [68] a middle-long term.

Pain catastrophizing is a multidimensional construct that describes a person's irrational and exaggerated interpretation of their present situation about the pain and the likely outcome.[48,69] Higher levels of pain catastrophizing are associated with higher levels of pain intensity, pain behavior, and disability [70] which has been described previously in shoulder disorders.[42,63]

Depression is a multimodal construct extremely connected with pain catastrophizing and anxiety in chronic pain conditions.[71] It is often associated with a complex set of overlapping symptoms, including emotional and physical complaints.[72] Depressive symptoms commonly occur with painful symptoms, causing more pain complaints and greater impairment,[72] specifically in shoulder pain.[42,43]

Anxiety is a construct that commonly occur with pain catastrophizing and depression in chronic pain disorders.[71] It is a feeling or emotion of dread, apprehension, and impending disaster but

not disabling, often associated with shoulder pain conditions.[43,44]

Therefore, identifying what prognosis factors are involved in a better and/or poorer prognosis of CSP might allow to GPs and physiotherapists a better understanding of the awareness of the relationship between disability, pain intensity and to the patient`s cognitive-behavioral profile, which may supply valuable information to predict the prognosis and to steer treatments. Nevertheless, information bias could be an important limitation of this study. It could be due to the presence of a high proportion of elderly people with lower educational background. These participants may have problems to deal with the questionnaires and remember any situation associated with their pain and disability at 3, 6 and 12 months follow-up. These patients might be also more likely to deny participation or abort follow-up. However, adding a drop-out rate of 20% in sample size calculation should alleviate this risk. In addition to this, with the inclusion of 242 patients, it will be probably the largest study to investigate the influence of psychosocial factors on the prognosis of CSP.

In summary, despite the neuroanatomical and biomechanical basis of shoulder pain are interminable and not completely understood, this prospective cohort study may contribute to a new vision about which are the main prognosis psychosocial factors involved in the prognosis of CSP and, hence, to increase the body of knowledge in this field. Therefore, detailed knowledge about these factors could permit a better understanding of this pathology and help to detect global changes that could be produced in maintaining CSP (reduced function, avoidance of a movement or activity) and elicit a large amount of information to establish new treatment strategies that could avoid the shoulder chronicity.

Current study status

The recruiting patients will begin in August 2016.

Author's Contribution

ALS conceived the study. ALS and JMC initiated the study design and FS and MM helped with the final version of this protocol. ALS and FS provided statistical expertise in longitudinal trial design and JMA will be conducting the primary statistical analysis. All authors contributed to the refinement of the study protocol and approved the final manuscript.

Funding statement

This study is supported by University of Malaga, Spain. The funding source has no role in study design, in data collection, analysis and interpretation, in the writing of the report, or in the decision to submit the paper for publication.

Competing Interest Statement

None authors have any conflicts of interest to declare.

Ethics Approval: The Costa del Sol Ethics Committee approved the study 28th April 2016.

REFERENCES

1 Klintberg IH, Cools AMJ, Holmgren TM, *et al.* Consensus for physiotherapy for shoulder pain. *Int Orthop* 2015;39:715–20.

2 Urwin M, Symmons D, Allison T, *et al.* Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Ann Rheum Dis* 1998;57:649–55.

3 Green S, Buchbinder R, Hetrick S. Physiotherapy interventions for shoulder pain. *Cochrane Database Syst Rev* 2003;:CD004258.

4 House J, Mooradian A. Evaluation and management of shoulder pain in primary care clinics. *South Med J* 2010;103:1129–35; quiz 1136–7.

5 Eriksen W. The prevalence of musculoskeletal pain in Norwegian nurses' aides. *Int Arch Occup Environ Health* 2003;76:625–30.

6 Roquelaure Y, Ha C, Leclerc A, *et al.* Epidemiologic surveillance of upper-extremity musculoskeletal disorders in the working population. *Arthritis Care Res* 2006;55:765–78.

7 Chard MD, Hazleman R, Hazleman BL, *et al.* Shoulder Disorders in the Elderly : a Community Survey. *Arthritis Rheum* 1991;34:766–9.

8 Walker-Bone K, Palmer KT, Reading I, *et al.* Prevalence and impact of musculoskeletal disorders of the upper limb in the general population. *Arthritis Rheum* 2004;51:642–51.

9 van der Heijden GJ. Shoulder disorders: a state-of-the-art review. *Baillieres Best Pract Res Clin Rheumatol* 1999;13:287–309.

10 Picavet HS, Schouten JS. Musculoskeletal pain in the Netherlands: Prevalences, consequences and risk groups, the DMC3-study. *Pain* 2003;102:167–78.

11 van der Windt DA, Koes BW, Boeke AJ, *et al.* Shoulder disorders in general practice: prognostic indicators of outcome. *Br J Gen Pract* 1996;46:519–23.

12 Bot SD, van der Waal JM, Terwee CB, *et al*. Incidence and prevalence of complaints of the neck and upper extremity in general practice. *Ann Rheum Dis* 2005;64:118–23.

13 Feleus A, Bierma-Zeinstra SM, Miedema HS, *et al*. Incidence of non-traumatic complaints of arm, neck and shoulder in general practice. *Man Ther* 2008;13:426–33.

14 Linsell L, Dawson J, Zondervan K, *et al.* Prevalence and incidence of adults consulting for shoulder conditions in UK primary care; patterns of diagnosis and referral. *Rheumatology*

(Oxford) 2006;45:215–21.

15 Luime J, Koes B, Hendriksen I, *et al.* Prevalence and incidence of shoulder pain in the general population; a systematic review. *Scand J Rheumatol* 2004;33:73–81.

16 Greving K, Dorrestijn O, Winters JC, *et al.* Incidence, prevalence, and consultation rates of shoulder complaints in general practice. *Scand J Rheumatol* 2012;41:150–5.

17 Bergman S, Herrström P, Högström K, *et al.* Chronic Musculoskeletal Pain , Prevalence Rates , and Sociodemographic Associations in a Swedish Population Study. *J Rheumatol* 2001; 28:1369-77.

18 McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. *Best Pract Res Clin Rheumatol* 2007;21:403–25.

19 Croft P, Pope D, Silman A. The clinical course of shoulder pain: prospective cohort study in primary care. Primary Care Rheumatology Society Shoulder Study Group. *BMJ* 1996;313:601–2.

20 Luime JJ, Koes BW, Miedem HS, *et al.* High incidence and recurrence of shoulder and neck pain in nursing home employees was demonstrated during a 2-year follow-up. *J Clin Epidemiol* 2005;58:407–13.

21 Smith KL, Harryman DT, Antoniou J, *et al.* A prospective, multipractice study of shoulder function and health status in patients with documented rotator cuff tears. *J Shoulder Elb Surg* 2000;9:395–402.

22 Roquelaure Y, Mariel J, Fanello S, *et al.* Active epidemiological surveillance of musculoskeletal disorders in a shoe factory. *Occup Environ Med* 2002;59:452–8.

23 Greenberg DL. Evaluation and Treatment of Shoulder Pain. *Med Clin North Am* 2014;98:487–504.

24 van den Dolder PA, Ferreira PH, Refshauge KM. Effectiveness of soft tissue massage and exercise for the treatment of non-specific shoulder pain: a systematic review with meta-analysis. *Br J Sports Med* 2014;48:1216–26.

25 Health and Safety Executive. Work Related Musculoskeletal Disorder Statistics (WRMSDs) in Great Britain. 2015.http://www.hse.gov.uk/Statistics/causdis/musculoskeletal/index.htm (accessed 14 Jan 2016)

26 Gwilym SE, Oag HCL, Tracey I, *et al.* Evidence that central sensitisation is present in patients with shoulder impingement syndrome and influences the outcome after surgery. *J Bone Joint Surg Br* 2011;93:498–502.

27 Struyf F, Lluch E, Falla D, *et al.* Influence of shoulder pain on muscle function: implications for the assessment and therapy of shoulder disorders. *Eur J Appl Physiol*

2015;115:225–34.

28 Van Oosterwijck J, Nijs J, Meeus M, *et al*. Evidence for central sensitization in chronic whiplash: a systematic literature review. *Eur J Pain* 2013;17:299–312.

29 Lluch E, Torres R, Nijs J, *et al*. Evidence for central sensitization in patients with osteoarthritis pain: a systematic literature review. *Eur J Pain* 2014;18:1367–75.

30 Nijs J, Meeus M, Van Oosterwijck J, *et al*. In the mind or in the brain? Scientific evidence for central sensitisation in chronic fatigue syndrome. *Eur J Clin Invest* 2012;42:203–12.

31 Meeus M, Vervisch S, De Clerck LS, *et al*. Central sensitization in patients with rheumatoid arthritis: a systematic literature review. *Semin Arthritis Rheum* 2012;41:556–67.

32 Roosink M, Van Dongen RT, Buitenweg JR, *et al.* Multimodal and widespread somatosensory abnormalities in persistent shoulder pain in the first 6 months after stroke: An exploratory study. *Arch Phys Med Rehabil* 2012;93:1968–74.

33 Littlewood C, Malliaras P, Bateman M, *et al.* The central nervous system--an additional consideration in 'rotator cuff tendinopathy' and a potential basis for understanding response to loaded therapeutic exercise. *Man Ther* 2013;18:468–72.

34 Struyf F, Meeus M. Current evidence on physical therapy in patients with adhesive capsulitis: what are we missing? *Clin Rheumatol* 2014;33:593–600.

35 Sanchis M, Lluch E, Nijs J, *et al.* The role of central sensitization in shoulder pain: A systematic literature review. *Semin Arthritis Rheum* 2015;44:710-6.

36 Lotze M, Moseley GL. Theoretical Considerations for Chronic Pain Rehabilitation. *Phys Ther* 2015;95:1316-20.

37 Turk DC, Okifuji A. Psychological factors in chronic pain: evolution and revolution. *J Consult Clin Psychol* 2002;70:678–90.

38 Diatchenko L, Fillingim RB, Smith SB, *et al.* The phenotypic and genetic signatures of common musculoskeletal pain conditions. *Nat Rev Rheumatol* 2013;9:340–50.

39 Thompson EL, Broadbent J, Bertino MD, *et al.* Do Pain-related Beliefs Influence Treatment adherence? A Systematic Review. *Clin J Pain* 2016;32:164-78.

40 Rajapakse D, Liossi C, Howard RF. Presentation and management of chronic pain. *Arch Dis Child* 2014;99:474–80.

41 George SZ, Wallace MR, Wu SS, *et al.* Biopsychosocial influence on shoulder pain: risk subgroups translated across preclinical and clinical prospective cohorts. *Pain* 2015;156:148–56.

42 Menendez ME, Baker DK, Oladeji LO, *et al*. Psychological Distress Is Associated with Greater Perceived Disability and Pain in Patients Presenting to a Shoulder Clinic. *J Bone*

Jt Surg 2015;97:1999–2003.

43 Roh YH, Lee BK, Noh JH, *et al*. Effect of depressive symptoms on perceived disability in patients with chronic shoulder pain. *Arch Orthop Trauma Surg* 2012;132:1251–7.

44 Cho CH, Jung SW, Park JY, *et al*. Is shoulder pain for three months or longer correlated with depression, anxiety, and sleep disturbance? *J Shoulder Elb Surg* 2013;22:222–8.

45 Gill TK, Shanahan EM, Taylor AW, *et al*. Shoulder pain in the community: an examination of associative factors using a longitudinal cohort study. *Arthritis Care Res (Hoboken)* 2013;65:2000–7.

46 Struyf F, Geraets J, Noten S, *et al*. A Multivariable Prediction Model for the Chronification of Non-traumatic Shoulder Pain : A Systematic Review. *Pain Physician* 2016;19:1-10.

47 Luque-Suarez A, Rondon-Ramos A, Fernandez-Sanchez M, *et al.* Spanish version of SPADI (shoulder pain and disability index) in musculoskeletal shoulder pain: a new 10-items version after confirmatory factor analysis. *Health Qual Life Outcomes* 2016;14:32.

48 Nicholas MK. The pain self-efficacy questionnaire: Taking pain into account. *Eur J Pain* 2007;11:153–63.

49 Neblett R, Mayer TG, Hartzell MM, *et al.* The Fear-avoidance Components Scale (FACS): Development and Psychometric Evaluation of a New Measure of Pain-related Fear Avoidance. *Pain Pract* 2015;16:435–50.

50 Sullivan MJL, Bishop SR, Pivik J. The pain catastrophizing scale: development and validation. *Psychol Assess* 1995;7:524–32.

51 Kori SH, Miller RP, Todd DD. Kinesiophobia: a new view of chronic pain behaviour. *Pain Manag* 1990;3:35–43.

52 Pallant JF, Bailey CM. Assessment of the structure of the Hospital Anxiety and Depression Scale in musculoskeletal patients. *Heal Qual Life Outcomes* 2005;3:82.

53 Härter M, Reuter K, Gross-Hardt K, *et al*. Screening for anxiety, depressive and somatoform disorders in rehabilitation--validity of HADS and GHQ-12 in patients with musculoskeletal disease. *Disabil Rehabil* 2001;23:737–44.

54 Engebretsen K, Grotle M, Bautz-Holter E, *et al*. Predictors of shoulder pain and disability index (SPADI) and work status after 1 year in patients with subacromial shoulder pain. *BMC Musculoskelet Disord* 2010;11:218.

55 Reilingh ML, Kuijpers T, Tanja-Harfterkamp AM, *et al.* Course and prognosis of shoulder symptoms in general practice. *Rheumatology (Oxford)* 2008;47:724–30.

56 Macfarlane GJ, Hunt IM, Silman AJ. Predictors of chronic shoulder pain: a population based prospective study. *J Rheumatol* 1998;25:1612–5.

57 Grooten WJ, MUSIC Norrtälje Study Group. Predictors for persistent neck/shoulder pain, medical care-seeking due to neck/shoulder pain and sickness absence. *Clin Rehabil* 2007;21:648–59.

58 Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev* 1977;84:191.

59 Lee H, Hübscher M, Moseley GL, *et al.* How does pain lead to disability? A systematic review and meta-analysis of mediation studies in people with back and neck pain. *Pain* 2015;156:988–97.

60 Pincus T, Holt N, Vogel S, et al. Cognitive and affective reassurance and patient outcomes in primary care: a systematic review. *Pain* 2013;154:2407–16.

61 Trocoli TO Botelho RV. Prevalence of anxiety, depression and kinesiophobia in patients with low back pain and their association with the symptoms of low back spinal pain. *Rev Bras Reum* 2016;S0482-5004(16)00023-1.

62 de Moraes Vieira EB, de Góes Salvetti M, Damiani LP, *et al*. Self-efficacy and fear avoidance beliefs in chronic low back pain patients: coexistence and associated factors. *Pain Manag Nurs* 2014;15:593–602.

63 Das De S, Vranceanu AM, Ring DC. Contribution of kinesophobia and catastrophic thinking to upper-extremity-specific disability. *J Bone Jt Surg Am* 2013;95:76–81.

64 Vlaeyen JW Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain* 2000;85:317–32.

65 Trost, Z, France CR, Thomas JS. Pain-related fear and avoidance of physical exertion following delayed-onset muscle soreness. *Pain* 2011;152:1540–7.

66 Vlaeyen JW, Kole-Snijders AM, Boeren RG, *et al*. Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. *Pain* 1995;62:363–72.

67 Kromer TO, Sieben JM, de Bie RA, *et al*. Influence of fear-avoidance beliefs on disability in patients with subacromial shoulder pain in primary care: a secondary analysis. *Phys Ther* 2014;94:1775–84.

68 Zale EL, Lange KL, Fields SA, *et al*. The relation between pain-related fear and disability: a meta-analysis. *J Pain* 2013;14:1019–30.

69 Osman A, Barrios FX, Gutierrez PM, *et al*. The Pain Catastrophizing Scale: further psychometric evaluation with adult samples. *J Behav Med* 2000;23:351–65.

70 Sullivan M, Thorn B, Haythornthwaite JA, *et al*. Theoretical perspectives on the relation between catastrophizing and pain. *Clin J Pain* 2001;17:52–64.

71 Scott EL, Kroenke K, Wu J, *et al*. Beneficial Effects of Improvement in Depression, Pain Catastrophizing, and Anxiety on Pain Outcomes: A 12-Month Longitudinal Analysis. *J*

Pain 2016;17:215–22.

72 Bair MJ, Robinson RL, Katon W, *et al*. Depression and pain comorbidity: a literature review. *Arch Intern Med* 2003;163:2433–45.

SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents*

Section/item	Item No	Description	Page Number
Administrative information			
Title	1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	**(Page 1)**
Trial registration	2a	Trial identifier and registry name. If not yet registered, name of intended Registry	**(Page 2)**
	2b	All items from the World Health Organization Trial Registration Data Set	**(N/A)**
Protocol version	3	Date and version identifier	**(N/A)**
Funding	4	Sources and types of financial, material, and other support	**(Page 13)**
Roles and responsibilities	5a	Names, affiliations, and roles of protocol contributors	**(Page 1, 13)**
	5b	Name and contact information for the trial sponsor	**(N/A)**
	5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	**(Page 13)**
	5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)	**(Page 10)**
Introduction			
Background and rationale	6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention	**(Page 3-4)**
	6b	Explanation for choice of comparators	**(N/A)**
Objectives	7	Specific objectives or hypotheses	**(Page 4)**

Trial design	8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory) **(Page 4)**

Methods: Participants, interventions, and outcomes

Study setting	9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained. **(Page 4)**
Eligibility criteria	10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists) **(Page 5)**
Interventions	11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered **(Page 5)**
	11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving/worsening disease) **(N/A)**
	11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return, laboratory tests) **(Page 5)**
	11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial **(N/A)**
Outcomes	12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended **(Page 6-7)**
Participant timeline	13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure) **(Page 7-9)**
Sample size	14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations **(Page 9)**
Recruitment	15	Strategies for achieving adequate participant enrolment to reach target sample size **(Page 5)**

Methods: Assignment of interventions (for controlled trials)

Allocation:

Sequence generation	16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions **(N/A)**
Allocation concealment mechanism	16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned **(N/A)**
Implementation	16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions **(N/A)**
Blinding (masking)	17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how **(N/A)**
	17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial **(N/A)**

Methods: Data collection, management, and analysis

Data collection methods	18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol **(Page 6-7)**
	18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols **(Page 5)**
Data management	19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol **(Page 10)**

Statistical methods	20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol **(Page 9-10)**
	20b	Methods for any additional analyses (eg, subgroup and adjusted analyses) **(Page 9-10)**
	20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation) **(Page 9-10)**
Methods: Monitoring		
Data monitoring	21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed **(N/A)**
	21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial **(N/A)**
Harms	22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct **(N/A)**
Auditing	23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor **(N/A)**
Ethics and dissemination		
Research ethics approval	24	Plans for seeking research ethics committee/institutional review board (REC/IRB) approval **(Page 11)**
Protocol amendments	25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators) **(Page 10-11)**
Consent or assent	26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32) **(Page 5,11)**
	26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable **(N/A)**
Confidentiality	27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial **(Page 10)**
Declaration of interests	28	Financial and other competing interests for principal investigators for the overall trial and each study site **(13)**

Access to data	29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators **(Page 10)**
Ancillary and post-trial care	30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation **(N/A)**
Dissemination policy	31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions **(Page 11)**
	31b	Authorship eligibility guidelines and any intended use of professional Writers **(N/A)**
	31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code **(N/A)**
Appendices		
Informed consent materials	32	Model consent form and other related documentation given to participants and authorised surrogates **(N/A)**
Biological specimens	33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable **(N/A)**

*It is strongly recommended that this checklist be read in conjunction with the SPIRIT 2013 Explanation & Elaboration for important clarification on the items. Amendments to the protocol should be tracked and dated. The SPIRIT checklist is copyrighted by the SPIRIT Group under the Creative Commons "Attribution-NonCommercial-NoDerivs 3.0 Unported" license.

BMJ Open

The influence of psychosocial factors in the prognosis of chronic shoulder pain: protocol for a prospective cohort study.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2016-012822.R1
Article Type:	Protocol
Date Submitted by the Author:	10-Oct-2016
Complete List of Authors:	MARTINEZ-CALDERON, JAVIER; UNIVERSITY OF MALAGA, Department of Physiotherapy STRUYF, FILIP; Universiteit Antwerpen Campus Drie Eiken, Rehabilitation Sciences and Physiotherapy MEEUS, MIRA; Universiteit Antwerpen Campus Drie Eiken, Rehabilitation Sciences and Physiotherapy Miguel Morales-Asencio, Jose; Univ Malaga, Department of Nursing LUQUE-SUAREZ, ALEJANDRO; UNIVERSITY OF MALAGA, Department of Physiotherapy
Primary Subject Heading:	Rehabilitation medicine
Secondary Subject Heading:	Epidemiology
Keywords:	shoulder pain, chronic pain, psychosocial factors

The influence of psychosocial factors in the prognosis of chronic shoulder pain: protocol for a prospective cohort study.

Javier Martinez-Calderon [1], Filip Struyf [2], Mira Meeus [2,3,4], Jose Miguel Morales-Asensio [5], Alejandro Luque-Suarez [1*]

*Corresponding author. Address: Faculty of Health Science, University of Malaga, Arquitecto Francisco Penalosa, 3, 29071 Malaga, Spain. Tel.: + 00 34 951 952 853 Email address: aluques@uma.es

Javier Martínez-Calderon (1) Department of Physiotherapy, University of Malaga, Malaga, Spain. Email address: calderonjmc@uma.es

Filip Struyf (2) Rehabilitation Sciences and Physiotherapy Department, University of Antwerp, Antwerp, Belgium Email address: filip.struyf@uantwerpen.be

Mira Meeus (2,3,4) Rehabilitation Sciences and Physiotherapy Department, University of antwerp, Antwerp, Belgium; (3) Rehabilitation Sciences and Physiotherapy Department, Ghent University, Ghent, Belgium; (4) Pain in Motion International Research Group, www.paininmotion.be Email address: mira.meeus@uantwerpen.be

Jose Miguel Morales-Asensio (5) Department of Nursing, University of Malaga, Spain Email address: jmmasen@uma.es

Alejandro Luque-Suarez (1) Department of Physiotherapy, University of Malaga, Malaga, Spain. Email address: aluques@uma.es

Keywords: Shoulder pain; chronic pain; prognosis; psychosocial factors

Word count: 2990

ABSTRACT

Introduction: Shoulder pain is the third most common musculoskeletal condition presenting to physicians or physiotherapists in primary healthcare. Psychosocial factors such as kinesiophobia, fear avoidance, pain catastrophizing, self-efficacy, anxiety and depression could play an essential role as prognostic factors in shoulder pain. In this study, the influence of psychosocial factors in the prognosis of patients with chronic shoulder pain (CSP) will be evaluated.

Methods and analysis: The study is a longitudinal, prospective cohort study with a 12-month follow-up. It will be conducted in four primary-care centers and one hospital of the province of Malaga, Spain. 242 men / women aged between 18 and 70 years, suffering from different shoulder pain conditions, such as: (i) rotator cuff (RC) tendinopathy; (ii) adhesive capsulitis (AC); (iii) glenohumeral instability; (iv) superior labrum anterior to posterior (SLAP) lesion; (v) acromioclavicular pathology; (vi) and/or shoulder osteoarthritis will be included. Inclusion will be based on clinical tests. Duration of symptoms: more than 3 months. Primary outcomes will include pain, function and self-efficacy, whereas kinesiophobia, fear avoidance, pain catastrophizing, anxiety, depression, age, gender, duration/intensity of symptoms and educational level will be predictive measures. Follow-up: baseline, 3, 6, and 12 months.

Ethics and dissemination: This protocol has been approved by the local ethics committee (The Costa del Sol Ethics Committee, Malaga 28042016). Dissemination will occur through presentations at National and International conferences and publications in international peer-reviewed journals.

Trial registration number: NCT02738372

Strengths and limitations:

- This is the first study to identify possible prognostic biopsychosocial factors for chronic shoulder pain.
- Information bias could be an important limitation of this study. It could be due to the presence of a high proportion of elderly people with lower educational background. These participants may have problems to deal with the questionnaires and to remember any situation associated with their pain and disability at 3, 6 and 12 months of follow-up.

Contribution of the manuscript

- To determine whether psychosocial factors are involved in the prognosis of CSP.
- To acquire detailed knowledge about these factors will permit a better understanding of CSP and, therefore, will help to establish new treatment strategies that could prevent the shoulder chronicity and/or reduce its consequences.

Keywords: Shoulder pain; chronic pain; prognosis; psychosocial factors

INTRODUCTION

Shoulder pain is the third most common musculoskeletal condition presenting to physicians or physiotherapists [1] in primary healthcare after low back and neck pain,[2,3] being a significant cause of morbidity [4] and functional disability in both working [5,6] and general population.[6–8] It affects one in three adults,[7,9,10] accounting 1% of general practitioners (GPs) consultations in primary care.[11]

Incidence rates range from 11.2 to 29.5 per 1000 person-years,[11–14] and the reported prevalence rates range from 4.7 to 46.7 per 1000 person-years.[10,14,15] Both incidence and prevalence rates tend to increase with age,[16] in women,[10,16,17] in subjects from lower socioeconomic groups, and in psychologically stressed populations.[18]

Despite the large group of individuals seeking for primary care services, about 50% of patients with shoulder pain still report persistent pain after 12-18 months.[9,16,18,19] As a result, socio-economic burdens are considerable due to extensive use of heath care services, sickness absence, disability pension, and loss of productivity,[20–24] as well as, patient´s suffering.

Research efforts need to be allocated to the investigation of prognosis factors of CSP, as this understanding is crucial for decreasing the poor prognosis of this pathology. This will allow a better understanding of these pain disorders and will lead to the development of treatment strategies to reduce chronicity.

There is a potential mismatch between the origin of pathology and the perception of shoulder pain.[25] The effective diagnosis and treatment of shoulder pain should not only rely on detailed knowledge of the peripheral pathologies that may be present in the shoulder (i.e. Adhesive capsulitis, SLAP lesion or rotator cuff tendinopathy) but also on current knowledge of pain neurophysiology.[26] In this sense, there has been a growing recognition that the degree of chronic pain is influenced by the beliefs, attitudes and expectations of individuals.[27–29] Given the importance of pain as a mechanism of survival, it is perhaps unsurprising that pain perception is clearly influenced by conscious and unconscious memory, cognitive and emotional functioning and contextual factors that are explicitly included in a biopsychosocial formulation of pain.[30] Inside this biopsychosocial framework, psychosocial factors are all potential modulators of pain itself and may subsequently be suitable targets for rehabilitation.[31] Currently, some studies have shown that psychosocial factors such as kinesiophobia, fear avoidance, pain catastrophizing, self-efficacy, anxiety and depression could play an

essential role as prognostic factors in shoulder pain.[32–36] Despite the existence of some evidence suggesting this, the cross-sectional nature of the studies preclude drawing firm conclusions on the prognostic role of different factors and their interrelations. Further experimental and prospective studies are required in order to examine the precise influence of psychosocial factors on the prognosis of patients with CSP.

For that reason, knowing and evaluating which psychosocial factors are involved in patients with chronic pain will be of great importance to predict the chronicity of shoulder complaints,[37–39] to facilitate clinical decision-making and to develop new therapeutic strategies that reduce and/or avoid the consequences of persistent shoulder pain. Our hypothesis is that higher levels of psychosocial factors at baseline, such as kinesiophobia, fear-avoidance, depression, anxiety and pain catastrophizing are associated with a worse perception of shoulder pain and disability in CSP. Hence, the primary objectives of this study will be: (i) to evaluate the presence and distribution of psychosocial factors among patients with CSP; (ii) to analyze the level of association between psychosocial factors and pain-disability prospectively in order to assess their prognostic role. As a secondary objective, the role of catastrophizing as mediator for the relationship between anxiety and depression, and shoulder pain-disability will be studied.

METHODS AND ANALYSIS

Study design and setting

The present study will be a 12 months multi-center, prospective, cohort study that will be carried out between May 2016 and April 2018 in four primary care centers and one hospital of the province of Malaga, Spain. Several questionnaires assessing different psychosocial factors will be administrated to these participants. The outcomes will be assessed at baseline (t1) and at 3 follow-ups times (after 3 (t2), 6 (t3) and 12 months (t4)). Ethical approval has been obtained from Costal del Sol Ethics Committee, Malaga, Spain (28042016). The study will be implemented and reported in line with the SPIRIT statement.

Participants

A consecutive sample comprised of participants with CSP will be recruited. General practitioners (GPs) will carry out the recruitment. Then, research assistants who previously will be instructed by the research team will assess participants for eligibility.

If participants satisfy the inclusion criteria, they will be invited to participate in this study and then they will be evaluated at baseline and 3, 6, and 12 months follow-up.

Inclusion Criteria

1. Men / women aged over 18 years.

2. Participants suffering from shoulder pain (pain intensity of 3 or more on a 0-10 numerical pain rating scale), will be included in this study, among all these following shoulder pain conditions: RC tendinopathy, AC, glenohumeral instability, SLAP lesion, acromioclavicular pathology and/or shoulder osteoarthritis. Diagnosis will be based on clinical testing.

3. Duration of symptoms: more than 3 months.

Exclusion Criteria

1. Recent shoulder dislocation (1 year prior) and/or systemic diseases such as rheumatoid arthritis, fibromyalgia and/or polymyalgia rheumatic.

2. Shoulder pain considered to be originated from the cervical region and other traumas or if there is a neurological dysfunction (i.e. multiple sclerosis), osteoporosis, hemophilia and / or cancer.

3. Participants receiving shoulder surgery one year previous to the study.

4. Inability to provide informed consent and/or complete written questionnaires.

Procedures

Recruitment

Anonymized age and gender will be collected for those participants who decline to take part in the project, in order to assess the external validity of the recruited sample of participants.

Eligible participants who will be interested in the study will be asked to provide written informed consent to participate. Participants will then complete several questionnaires at baseline, 3, 6 and 12 months after the beginning of the study.

Participant data files will be stored in numerical order and in a secure and accessible place and manner. Participant files will be maintained in storage for a period of 3 years after completion of the study.

Outcomes Measures

Primary outcome

Pain and function

1. The Shoulder Pain and Disability Index (SPADI) is a self-administered index consisting of 13 items divided into two subscales: pain and disability.[40] It grades a normal shoulder as 0 and maximally affected as 130, and a 11-point numerical pain rating scale with 0 as normal and 10 as maximal pain.

Secondary outcome

Self-Efficacy

2. Pain Self-Efficacy Questionnaire (PSEQ) contains 10 questions that will measure the patient's confidence in performing certain activities in spite of pain. Items are scored on a scale from 0 to 6, with a maximum possible score of 60 points. Lower scores indicate less self-efficacy.[41]

Potential Prognostic Factors

Psychological factors will be assessed through four questionnaires at baseline, 3,6,12 months follow-up.

Kinesiophobia, fear avoidance, pain catastrophizing, anxiety, depression and recovery expectancies

1. The Fear-avoidance Components Scale (FACS) is a new patient-reported measure designed in order to evaluate pain-related fear-avoidance and kinesiophobia in patients with painful medical conditions. It consists of 20 items that are scored on a 5-point scale.[42]

2. The Pain Catastrophizing Scale (PCS) will be included to assess catastrophic thinking about pain. It consists of 13 items describing different thoughts and feelings that individuals may have when experiencing pain. Items are scored on a 5-point scale. A general score and scores on 3 subscales (i.e., helplessness, magnification, and rumination) will be obtained; higher scores indicate more severe catastrophic thoughts about pain.[43]

3. The Hospital Anxiety and Depression Scale (HADS) is a 14-item scale designed to detect anxiety and depression, independent of somatic symptoms. It consists of two 7-

item subscales measuring depression (HADS-D) and anxiety (HADS-A). It uses a 4-point response scale that ranges from 0 (absence of symptoms) to 3 (maximum symptoms), with possible scores for each subscale ranging from 0 to 21.[44] Higher scores indicate higher levels of disorder. The HADS has been widely used as a screening instrument for the detection of comorbid depressive and anxiety disorders in patients with musculoskeletal disorders.[35,45,46]

4. Recovery Expectations will be measured by asking the participants to rate the likelihood that they would resume some form of recovery at 3, 6 and 12 months follow-up ("How likely is it that within the next 3 months you will have resumed some form of recovery?"). Participants will indicate their response on a scale with the endpoints (0%) not at all likely to (100%) extremely likely. [47]

Age, gender, shoulder problems, educational level, treatments received and co-morbidities

1. Information of gender and age will be collected by self-administrated questionnaire.

2. Recurrence of shoulder problem was dichotomized to those patients who had a recurrent episode within the past 12 weeks and those who had a recurrent episode more than 12 weeks.

3. The Numerical Rating Scale (NRS) was used to assess each patient's pain intensity at baseline and follow-ups. The NRS scores ranges from 0 to 10, with 0 representing no pain and 10 representing the worst pain imaginable. The NRS has been shown to have good same-day test-retest reliability.[48]

4. Educational level will be coded into five educational levels: group 1: university/college ≥4 years; group 2: university/college 4 years; group 3: upper secondary; group 4: incomplete upper secondary; group 5: elementary secondary.[49]

5. Current treatment will be evaluated through a checklist divided in 5 groups (no treatment, pharmacological treatment, injections, physical therapy and other treatments (massage, reflexology, acupuncture)).

6. Previous treatments of this pathology will be tested with the question: Have you been

convinced of this pathology? With a simple answer: Yes/No.

7. Co-morbidities will be tested with the Self-Administered Comorbidity Questionnaire (SCQ). [50] Patients will be asked if they had one or more medical conditions (from a list of 15 diagnoses). If they gave a positive response, they will be asked whether the condition limited their activity.

8. Current/most recent job title and nature of work, work status (unemployed/active/sick leave/ retirement) will be collected by self-administered questionnaire.

The summary of potential prognostic factors and outcome measures will be presented in **table 1**.

Construct	Type	Staff Member	Baseline (T1)	3 months (T2)	6 months (T3)	12 months (T4)
Outcome Measures						
Pain and Function	SPADI	Interviewer	X	X	X	X
Self-efficacy	PSEQ	Interviewer	X	X	X	X
Shoulder Problems						
Side of shoulder problem and dominance (right, left, both)	Self-questionnaire	Interviewer	X			
History of previous shoulder problems	Self-questionnaire	Interviewer	X			
What modality of treatment? (Pharmacological/Physical therapy/Injections/No treatment/Other treatments)	Self-questionnaire	Interviewer	X	X	X	X
Have you been convinced of this pathology?	Self-questionnaire	Interviewer	X	X	X	X

Potential Prognostic Factors						
Pain-related Fear-avoidance and kinesiophobia	FACS	Interviewer	X	X	X	X
Pain Catastrophizing	PSC	Interviewer	X	X	X	X
Active shoulder ROM-free of pain		Interviewer	X	X	X	X
Anxiety and Depression	HADS	Interviewer	X	X	X	X
Recovery Expectations	Self-questionnaire	Interviewer	X	X	X	X
Co-morbidities	SCQ	Interviewer	X	X	X	X
Recurrence of shoulder pain	Self-questionnaire	Interviewer	X			
Intensity of pain	NRS	Interviewer	X	X	X	X
Current/most recent job title and nature of work	Self-questionnaire	Interviewer	X	X	X	X
Work status including alteration in hours/duties	Self-questionnaire	Interviewer	X	X	X	X
Work absence	Self-questionnaire	Interviewer	X	X	X	X
Work performance	Self-questionnaire	Interviewer	X	X	X	X
Age, gender	Self-questionnaire	Interviewer	X			
Height, weight	Self-questionnaire	Interviewer	X			
Educational Level	Self-questionnaire	Interviewer	X			

Table 1. Overview of measurement instruments and time of assessment

Sample size estimation

To achieve a power of 0.9 to detect differences in the contrast of the null hypothesis, six potential prognostic factors (Kinesiophobia, fear avoidance, pain catastrophizing,

anxiety-depression, age and gender) included in the estimation does not explain the primary outcome. Hence, using a ANOVA-test in a multiple linear regression model, considering a significance level of 0.05, assuming that one variable (Anxiety-depression[51]) provides a coefficient of determination of 0.31, and being expected a higher coefficient of 0.36, a sample of 230 patients will be needed. Considering an expected drop-out rate of 25% , a total number of 307 patients will be needed.

Statistical Analysis

Dataset will be carried out using SPSS for Windows (version 22, SPSS Inc. Chicago, IL) There will be 4 measurements in the study, T1= at baseline, T2= 3 months T3= 6 months, T4= 12 months follow-up. Kolmogorov-Smirnov test will analyze the normal distribution of the variables ($P > 0.05$). Continuous variables will be presented in mean, median, standard deviation and 25-75% percentile and categorical variables in frequencies and percentages. Rank sums and Wilcoxon signed Rank will be used in case the distribution will be no normal. For identification of potential prognostic factors, the variables will be divided in domains, such as: psychological (Kinesiophobia, fear avoidance, pain catastrophizing, anxiety, depression and recovery expectancies) and sociodemographic (age, gender, shoulder problems, educational level, treatments received and co-morbidities), and multiple linear regression analysis will be carried out taking SPADI as continuous dependent variable.

Finally, analysis through COX regression will be conducted to determine the hazard ratios of the aforementioned factors with the SPADI through proportional risk models. A p-value < 0.05 will be considered statistically significant.

Data collection and management

To ensure accurate, complete and reliable data, all study-related information will be stored securely at the study site. All participant information will be stored in locked file cabinets in areas with limited access. Reports, data collection, process, and administrative forms will be identified by a coded ID number only to maintain participant confidentiality.

Modification of the Protocol

Any modifications to the protocol that may affect the conduct of the study, potential benefit of the patient or may affect patient safety, including changes of study objectives,

study design, patient population, sample sizes, study procedures, or significant administrative aspects will require a formal amendment to the protocol.

Such amendment will be agreed upon this research group**,** and approved by Costa del Sol Ethics Committee, Malaga, Spain, prior to implementation and notified to the health authorities in accordance with local regulations.

Ethical considerations and dissemination

Ethics approval of the study was obtained from the Costa del Sol Ethics Committee, Malaga (reference no. 28042016). The trial is registered in Clinicaltrials.gov: NCT02738372.

Informed Consent

All the authors declare to have no conflict of interests.

The results of the study will be disseminated at several research conferences and as published articles in peer-reviewed journals.

DISCUSSION

The present study will be the largest cohort study that prospectively will analyze the influence of psychosocial factors in the prognosis of CSP. The main research question will be to determine which of these psychosocial factors are more underlying to predict a better and/or poorer prognosis in patients with CSP at 3, 6 and 12 months. The inclusion of a multi-center design will increase the external validity of the study findings because of a long list of GPs (recruiters) implicated and a large geographical area for patient recruitment.

Justification for selection of psychosocial variables

Pain related self-efficacy is a construct that describes a person's perceived confidence in their ability of successfully carrying out daily and/or work activities or behavior despite their pain. [52] This concept is associated with expectancy and behavior [52] and the mediation of developing disability in several musculoskeletal areas.[53] It has also been shown to play an important role in the prognosis of shoulder pain.[33]

Kinesiophobia is a major construct that could be probably involved in many chronic musculoskeletal conditions.[54] Some evidence in low back pain suggests that people feel fear to make some movements because of pain, to avoid worsening their condition or avoid causing a new problem,[55,56] carrying out to two responses: confront (reducing gradually their fear of that movement) or avoid the activity (leading to

physical disability in a middle-long term).

Fear avoidance is referred to the avoidance of movements or activities based on fear.[57] This pain-related fear can induce avoidance behavior meant to avert the perceived danger.[58,59] It could seem to be associated with an increase of disability and shoulder complaints at baseline.[60] Moreover, as a consequence of pain is typically no longer a sign of actual danger (e.g., the injury has healed, despite persistent pain) avoidance behavior loses its adaptive function as a protective strategy and may initiate a pathway towards functional disability [61] a middle-long term in chronic pain. Nevertheless, there is not much information about fear-avoidance as a prognostic factor of CSP.

Pain catastrophizing is a multidimensional construct that describes a person's irrational and exaggerated interpretation of their present situation about the pain and the likely outcome.[41,62] Higher levels of pain catastrophizing are associated with higher levels of pain intensity, pain behavior, and disability [63] which has been described previously in shoulder disorders.[33]

Depression is a multimodal construct extremely connected with pain catastrophizing and anxiety in chronic pain conditions.[64][65] It is often associated with a complex set of overlapping symptoms, including emotional and physical complaints.[62] Depressive symptoms commonly occur with painful symptoms, causing a worse prognosis,[62] specifically in shoulder pain.[33,34]

Anxiety is a construct that commonly occur with pain catastrophizing and depression in chronic pain disorders.[64] It is a feeling or emotion of dread, apprehension, and impending disaster but not disabling, often associated with a worse prognosis on shoulder pain conditions.[34,35]

Therefore, identifying what prognosis factors are involved in a better and/or poorer prognosis of CSP might allow to GPs and physiotherapists a better understanding of the awareness of the relationship between disability, pain intensity and to the patient`s cognitive-behavioral profile, which may supply valuable information to predict the prognosis and to steer treatments. Nevertheless, information bias could be an important limitation of this study. Some participants may have problems to deal with the questionnaires and remember any situation associated with their pain and disability at 3, 6 and 12 months follow-up. Even so, some participants might be more likely to deny participation or abort follow-up. However, adding a drop-out rate of 20% in sample size calculation should alleviate this risk.

In summary, despite the neuroanatomical and biomechanical basis of shoulder pain are interminable and not completely understood, this prospective cohort study may contribute to a new vision about the role played by psychosocial factors on the prognosis of CSP and, hence, to increase the body of knowledge in this field. Therefore, detailed knowledge about these factors could permit a better understanding of this pathology and help to detect global changes that could be produced in maintaining CSP (reduced function, avoidance of a movement or activity) and elicit a large amount of information to establish new treatment strategies that could avoid the shoulder chronicity.

Current study status

The recruiting patients will begin in August 2016.

Author's Contribution

ALS conceived the study. ALS and JMC initiated the study design and FS and MM helped with the final version of this protocol. ALS and FS provided statistical expertise in longitudinal trial design and JMA will be conducting the primary statistical analysis. All authors contributed to the refinement of the study protocol and approved the final manuscript.

Funding statement

This study is supported by University of Malaga, Spain. The funding source has no role in study design, in data collection, analysis and interpretation, in the writing of the report, or in the decision to submit the paper for publication.

Competing Interest Statement

None authors have any conflicts of interest to declare.

Ethics Approval: The Costa del Sol Ethics Committee approved the study 28th April 2016

REFERENCES

1 Klintberg IH, Cools AMJ, Holmgren TM, *et al.* Consensus for physiotherapy for shoulder pain. *Int Orthop* 2015;**39**:715–20. doi:10.1007/s00264-014-2639-9

2 Urwin M, Symmons D, Allison T, *et al.* Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Ann Rheum Dis* 1998;**57**:649–55. doi:10.1136/ard.57.11.649

3 Green S, Buchbinder R, Hetrick S. Physiotherapy interventions for shoulder pain. *Cochrane Database Syst Rev* 2003;:CD004258. doi:10.1016/S0031-9406(05)60024-7

4 House J, Mooradian A. Evaluation and management of shoulder pain in primary care clinics. *South Med J* 2010;**103**:1129-35-7. doi:10.1097/SMJ.0b013e3181f5e85f

5 Eriksen W. The prevalence of musculoskeletal pain in Norwegian nurses' aides. *Int Arch Occup Environ Health* 2003;**76**:625–30. doi:10.1007/s00420-003-0453-6

6 Roquelaure Y, Ha C, Leclerc A, *et al.* Epidemiologic surveillance of upper-extremity musculoskeletal disorders in the working population. *Arthritis Care Res* 2006;**55**:765–78. doi:10.1002/art.22222

7 Chard MD, Hazelman R, HAzelman BL, *et al.* Brief Report Shoulder Disorders in the Elderly : a Community Survey. *Arthritis Rheum* 1991;**34**:766–9.

8 Walker-Bone K, Palmer KT, Reading I, *et al.* Prevalence and impact of musculoskeletal disorders of the upper limb in the general population. *Arthritis Rheum* 2004;**51**:642–51. doi:10.1002/art.20535

9 Van der Heijden GJ. Shoulder disorders: a state-of-the-art review. *Baillieres Best Pract Res Clin Rheumatol* 1999;**13**:287–309. doi:10.1053/berh.1999.0021

10 Picavet HSJ, Schouten JS a G. Musculoskeletal pain in the Netherlands: Prevalences, consequences and risk groups, the DMC3-study. *Pain* 2003;**102**:167–78. doi:10.1016/s0304-3959(02)00372-x

11 van der Windt DA, Koes BW, Boeke AJ, *et al.* Shoulder disorders in general practice: prognostic indicators of outcome. *Br J Gen Pract* 1996;**46**:519–23.

12 Bot SDM. Incidence and prevalence of complaints of the neck and upper extremity in general practice. *Ann Rheum Dis* 2005;**64**:118–23. doi:10.1136/ard.2003.019349

13 A. Feleusa, S.M.A. Bierma-Zeinstraa, H.S. Miedema, R.M.D. Bernsen, J.A.N. Verhaar BWK. Incidence of non-traumatic complaints of arm, neck and shoulder in general practice. *Man Ther* 2008;**13**:426–33. doi:10.1016/j.math.2007.05.010

14 Linsell L, Dawson J, Zondervan K, *et al.* Prevalence and incidence of adults consulting for shoulder conditions in UK primary care; patterns of diagnosis and referral. *Rheumatology* 2006;**45**:215–21. doi:10.1093/rheumatology/kei139

15 Luime J, Koes B, Hendriksen I, *et al.* Prevalence and incidence of shoulder pain in the general population; a systematic review. *Scand J Rheumatol* 2004;**33**:73–81. doi:16167509

16 Greving K, Dorrestijn O, Winters JC, *et al.* Incidence, prevalence, and consultation rates of shoulder complaints in general practice. *Scand J Rheumatol* 2012;**41**:150–5. doi:10.3109/03009742.2011.605390

17 Bergman S, Herrström PER, Högström K, *et al.* Chronic Musculoskeletal Pain , Prevalence Rates , and Sociodemographic Associations in a Swedish Population Study. 2001;**28**.

18 McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. *Best Pract Res Clin Rheumatol* 2007;**21**:403–25. doi:10.1016/j.berh.2007.03.003

19 Croft P, Pope D, Silman A. The clinical course of shoulder pain: prospective cohort study in primary care. Primary Care Rheumatology Society Shoulder Study Group. *BMJ* 1996;**313**:601–2.

20 Luime JJ, Koes BW, Miedem HS, *et al.* High incidence and recurrence of shoulder and neck pain in nursing home employees was demonstrated during a 2-year follow-up. *J Clin Epidemiol* 2005;**58**:407–13. doi:10.1016/j.jclinepi.2004.01.022

21 Smith KL, Harryman DT, Antoniou J, *et al.* A prospective, multipractice study of shoulder function and health status in patients with documented rotator cuff tears. *J Shoulder Elb Surg* 2000;**9**:395–402. doi:10.1067/mse.2000.108962

22 Roquelaure Y, Mariel J, Fanello S, *et al.* Active epidemiological surveillance of musculoskeletal disorders in a shoe factory. *Occup Environ Med* 2002;**59**:452–8. doi:10.1136/oem.59.7.452

23 Greenberg DL. Evaluation and Treatment of Shoulder Pain. *Med Clin North Am* 2014;**98**:487–504. doi:10.1016/j.mcna.2014.01.016

24 van den Dolder PA, Ferreira PH, Refshauge KM. Effectiveness of soft tissue massage and exercise for the treatment of non-specific shoulder pain: a

systematic review with meta-analysis. *Br J Sports Med* 2014;**48**:1216–26. doi:10.1136/bjsports-2011-090553

25 Gwilym SE, Oag HCL, Tracey I, *et al.* Evidence that central sensitisation is present in patients with shoulder impingement syndrome and influences the outcome after surgery. *J Bone Joint Surg Br* 2011;**93**:498–502. doi:10.1302/0301-620X.93B4.25054

26 Struyf F, Lluch E, Falla D, *et al.* Influence of shoulder pain on muscle function: implications for the assessment and therapy of shoulder disorders. *Eur J Appl Physiol* 2015;**115**:225–34. doi:10.1007/s00421-014-3059-7

27 Turk DC, Okifuji A. Psychological factors in chronic pain: evolution and revolution. *J Consult Clin Psychol* 2002;**70**:678–90. doi:10.1037//0022-006X.70.3.678

28 Diatchenko L, Fillingim RB, Smith SB, *et al.* The phenotypic and genetic signatures of common musculoskeletal pain conditions. *Nat Rev Rheumatol* 2013;**9**:340–50. doi:10.1038/nrrheum.2013.43

29 Thompson E, Broadbent J, Bertino MD, *et al.* Do Pain-related Beliefs Influence Treatment adherence? A Systematic Review. *Clin J Pain* 2015;**32**:1. doi:10.1097/AJP.0000000000000235

30 Rajapakse D, Liossi C, Howard RF. Presentation and management of chronic pain. *Arch Dis Child* 2014;**99**:474–80. doi:10.1136/archdischild-2013-304207

31 Lotze M, Moseley GL. Theoretical Considerations for Chronic Pain Rehabilitation. *Phys Ther* 2015;**95**:1–5. doi:10.2522/ptj.20140581

32 George SZ, Wallace MR, Wu SS, *et al.* Biopsychosocial influence on shoulder pain: risk subgroups translated across preclinical and clinical prospective cohorts. *Pain* 2015;**156**:148–56. doi:10.1016/j.pain.0000000000000012

33 Menendez ME, Baker DK, Oladeji LO. Psychological Distress Is Associated with Greater Perceived Disability and Pain in. *J Bone Jt Surg* 2015;**97**:1999–2003. doi:10.2106/JBJS.O.00387

34 Roh YH, Lee BK, Noh JH, Oh JH, Gong HS BG. Effect of depressive symptoms on perceived disability in patients with chronic shoulder pain. *Arch Orthop Trauma Surg* 2012;**132**:1251–7.

35 Cho CH, Jung SW, Park JY, Song KS YK. Is shoulder pain for three months or longer correlated with depression, anxiety, and sleep disturbance? *J Shoulder Elb Surg* 2013;**22**:222–8.

36 Gill TK, Shanahan EM, Taylor AW, Buchbinder R HC. Shoulder pain in the community: an examination of associative factors using a longitudinal cohort study. *Arthritis Care Res* 2013;**65**:2000–7.

37 Struyf F, Meeus M, Nijs J. A Multivariable Prediction Model for the Chronification of Non-traumatic Shoulder Pain : A Systematic Review A Multivariable Prediction Model for the Chronification of Non-traumatic Shoulder Pain : 2016;:1–10.

38 Chester R, Shepstone L, Daniell H, *et al.* Predicting response to physiotherapy treatment for musculoskeletal shoulder pain: a systematic review. *BMC Musculoskelet Disord* 2013;**14**:1. doi:10.1186/1471-2474-14-203

39 Kuijpers T, Van Der Windt DAWM, Van Der Heijden GJMG, *et al.* Systematic review of prognostic cohort studies on shoulder disorders. Pain. 2004;**109**:420–31. doi:10.1016/j.pain.2004.02.017

40 Luque-Suarez A, Rondon-Ramos A, Fernandez-Sanchez M, *et al.* Spanish version of SPADI (shoulder pain and disability index) in musculoskeletal shoulder pain: a new 10-items version after confirmatory factor analysis. *Health Qual Life Outcomes* 2016;**14**:32. doi:10.1186/s12955-016-0436-4

41 Nicholas MK. The pain self-efficacy questionnaire: Taking pain into account. *Eur J Pain* 2007;**11**:153–63. doi:10.1016/j.ejpain.2005.12.008

42 Neblett R, Mayer TG, Hartzell MM, *et al.* The Fear-avoidance Components Scale (FACS): Development and Psychometric Evaluation of a New Measure of Pain-related Fear Avoidance. *Pain Pract* 2015;**16**:435–50. doi:10.1111/papr.12333

43 Sullivan MJ, Bishop SR PJ. The Pain Catastrophizing Scale: Development and validation. *Psychol Assess* 1995;**7**:524–32.

44 Kori SH, Miller RP TD. Kinesiophobia: A new view of chronic pain behavior. *Pain Manag* 1990;**3**:35–43.

45 Pallant JF BC. Assessment of the structure of the Hospital Anxiety and Depression Scale in musculoskeletal patients. *Heal Qual Life Outcomes* 2005;**3**:82.

46 Härter M, Reuter K, Gross-Hardt K BJ. Screening for anxiety, depressive and somatoform disorders in rehabilitation--validity of HADS and GHQ-12 in patients with musculoskeletal disease. *Disabil Rehabil* 2001;**23**:737–44.

47 Carriere JS, Thibault P, Milioto M, *et al.* Expectancies Mediate the Relations among Pain Catastrophizing, Fear of Movement, and Return to Work Outcomes

after Whiplash Injury. *J Pain* 2015;**16**:1280–7. doi:10.1016/j.jpain.2015.09.001

48 Downie WW, Leatham P a, Rhind VM, *et al.* Studies with pain rating scales. *Ann Rheum Dis* 1978;**37**:378–81. doi:10.1136/ard.37.4.378

49 Sterud T, Johannessen HA, Tynes T. Do Work-Related Mechanical and Psychosocial Factors Contribute to the Social Gradient in Low Back Pain?: A 3-Year Follow-Up Study of the General Working Population in Norway. *Spine (Phila Pa 1976)* 2016;**41**:1089–95. doi:10.1097/BRS.0000000000001451

50 Sangha O, Stucki G, Liang MH, *et al.* The Self-Administered Comorbidity Questionnaire: a new method to assess comorbidity for clinical and health services research. *Arthritis Rheum* 2003;**49**:156–63. doi:10.1002/art.10993

51 Chester R, Jerosch-herold C, Lewis J, *et al.* Psychological factors are associated with the outcome of physiotherapy for people with shoulder pain : a multicentre longitudinal cohort study. 2016;:1–8. doi:10.1136/bjsports-2016-096084

52 A B. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev* 1977;**84**:191.

53 Lee H, Hübscher M, Moseley GL, *et al.* How does pain lead to disability? A systematic review and meta-analysis of mediation studies in people with back and neck pain. *Pain* 2015;**156**:988–97. doi:10.1097/j.pain.0000000000000146

54 Das De S, Vranceanu AM RD. . Contribution of kinesophobia and catastrophic thinking to upper-extremity-specific disability. *J Bone Jt Surg Am* 2013;**95**:76–81.

55 Trocoli TO BR. Prevalence of anxiety, depression and kinesiophobia in patients with low back pain and their association with the symptoms of low back spinal pain. *Rev Bras Reum* 2016;**S0482-5004**.

56 de Moraes Vieira EB, de Góes Salvetti M, Damiani LP de MPC. Self-efficacy and fear avoidance beliefs in chronic low back pain patients: coexistence and associated factors. *Pain Manag Nurs* 2014;**15**:593–602.

57 Vlaeyen JW LS. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain* 2000;**85**:317–32.

58 Trost Z, France CR TJ. Pain-related fear and avoidance of physical exertion following delayed-onset muscle soreness. *Pain* 2011;**152**:1540–7.

59 Vlaeyen JW, Kole-Snijders AM, Boeren RG van EH. Fear of movement/(re)injury in chronic low back pain and its relation to behavioral performance. *Pain* 1995;**62**:363–72.

60 Kromer TO, Sieben JM, de Bie RA BC. Influence of fear-avoidance beliefs on disability in patients with subacromial shoulder pain in primary care: a secondary analysis. *Phys Ther* 2014;**94**:1775–84.

61 Zale EL, Lange KL, Fields SA DJ. The relation between pain-related fear and disability: a meta-analysis. *J Pain* 2013;**14**:1019–30.

62 Osman A, Barrios FX, Gutierrez PM, Kopper BA, Merrifield T GL. The Pain Catastrophizing Scale: further psychometric evaluation with adult samples. *J Behav Med* 2000;**23**:351–65.

63 Sullivan MJ, Thorn B, Haythornthwaite JA, Keefe F, Martin M, Bradley LA LJ. Theoretical perspectives on the relation between catastrophizing and pain. *Clin J Pain* 2001;**17**:52–64.

64 Scott EL, Kroenke K, Wu J YZ. Beneficial Effects of Improvement in Depression, Pain Catastrophizing, and Anxiety on Pain Outcomes: A 12-Month Longitudinal Analysis. *J Pain* 2016;**17**:215–22.

65 Bair MJ, Robinson RL, Katon W KK. Depression and pain comorbidity: a literature review. *Arch Intern Med* 2003;**163**:2433–45.

SPIRIT 2013 Checklist: Recommended items to address in a clinical trial protocol and related documents*

Section/item	Item No	Description	Page Number
Administrative information			
Title	1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	**(Page 1)**
Trial registration	2a	Trial identifier and registry name. If not yet registered, name of intended Registry	**(Page 2)**
	2b	All items from the World Health Organization Trial Registration Data Set	**(N/A)**
Protocol version	3	Date and version identifier	**(N/A)**
Funding	4	Sources and types of financial, material, and other support	**(Page 13)**
Roles and responsibilities	5a	Names, affiliations, and roles of protocol contributors	**(Page 1, 13)**
	5b	Name and contact information for the trial sponsor	**(N/A)**
	5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	**(Page 13)**
	5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)	**(Page 10)**
Introduction			
Background and rationale	6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention	**(Page 3-4)**
	6b	Explanation for choice of comparators	**(N/A)**
Objectives	7	Specific objectives or hypotheses	**(Page 4)**

Trial design	8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, noninferiority, exploratory) **(Page 4)**

Methods: Participants, interventions, and outcomes

Study setting	9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained. **(Page 4)**
Eligibility criteria	10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists) **(Page 5)**
Interventions	11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered **(Page 5)**
	11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving/worsening disease) **(N/A)**
	11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return, laboratory tests) **(Page 5)**
	11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial **(N/A)**
Outcomes	12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended **(Page 6-7)**
Participant timeline	13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure) **(Page 7-9)**
Sample size	14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations **(Page 9)**
Recruitment	15	Strategies for achieving adequate participant enrolment to reach target sample size **(Page 5)**

Methods: Assignment of interventions (for controlled trials)

Allocation:

Sequence generation	16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions **(N/A)**
Allocation concealment mechanism	16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned **(N/A)**
Implementation	16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions **(N/A)**
Blinding (masking)	17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how **(N/A)**
	17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial **(N/A)**

Methods: Data collection, management, and analysis

Data collection methods	18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol **(Page 6-7)**
	18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols **(Page 5)**
Data management	19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol **(Page 10)**

Statistical methods	20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol **(Page 9-10)**
	20b	Methods for any additional analyses (eg, subgroup and adjusted analyses) **(Page 9-10)**
	20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation) **(Page 9-10)**
Methods: Monitoring		
Data monitoring	21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed **(N/A)**
	21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial **(N/A)**
Harms	22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct **(N/A)**
Auditing	23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor **(N/A)**
Ethics and dissemination		
Research ethics approval	24	Plans for seeking research ethics committee/institutional review board (REC/IRB) approval **(Page 11)**
Protocol amendments	25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC/IRBs, trial participants, trial registries, journals, regulators) **(Page 10-11)**
Consent or assent	26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32) **(Page 5,11)**
	26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable **(N/A)**
Confidentiality	27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial **(Page 10)**
Declaration of interests	28	Financial and other competing interests for principal investigators for the overall trial and each study site **(13)**

Access to data	29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators **(Page 10)**
Ancillary and post-trial care	30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation **(N/A)**
Dissemination policy	31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions **(Page 11)**
	31b	Authorship eligibility guidelines and any intended use of professional Writers **(N/A)**
	31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code **(N/A)**
Appendices		
Informed consent materials	32	Model consent form and other related documentation given to participants and authorised surrogates **(N/A)**
Biological specimens	33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable **(N/A)**

*It is strongly recommended that this checklist be read in conjunction with the SPIRIT 2013 Explanation & Elaboration for important clarification on the items. Amendments to the protocol should be tracked and dated. The SPIRIT checklist is copyrighted by the SPIRIT Group under the Creative Commons "Attribution-NonCommercial-NoDerivs 3.0 Unported" license.

BMJ Open

The influence of psychological factors in the prognosis of chronic shoulder pain: protocol for a prospective cohort study.

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2016-012822.R2
Article Type:	Protocol
Date Submitted by the Author:	25-Jan-2017
Complete List of Authors:	MARTINEZ-CALDERON, JAVIER; UNIVERSITY OF MALAGA, Department of Physiotherapy STRUYF, FILIP; Universiteit Antwerpen Campus Drie Eiken, Rehabilitation Sciences and Physiotherapy MEEUS, MIRA; Universiteit Antwerpen Campus Drie Eiken, Rehabilitation Sciences and Physiotherapy Miguel Morales-Asencio, Jose; Univ Malaga, Department of Nursing LUQUE-SUAREZ, ALEJANDRO; UNIVERSITY OF MALAGA, Department of Physiotherapy
Primary Subject Heading:	Rehabilitation medicine
Secondary Subject Heading:	Epidemiology
Keywords:	shoulder pain, chronic pain, psychological factors, prognosis

The influence of psychological factors on the prognosis of chronic shoulder pain: protocol for a prospective cohort study.

Javier Martinez-Calderon [1], Filip Struyf [2], Mira Meeus [2,3,4], Jose Miguel Morales-Asencio [5], Alejandro Luque-Suarez [1*]

*Corresponding author. Address: Faculty of Health Science, University of Malaga, Arquitecto Francisco Penalosa, 3, 29071 Malaga, Spain. Tel.: + 00 34 951 952 853 Email address: aluques@uma.es

Javier Martínez-Calderon (1) Department of Physiotherapy, University of Malaga, Malaga, Spain. Email address: calderonjmc@uma.es

Filip Struyf (2) Rehabilitation Sciences and Physiotherapy Department, University of Antwerp, Antwerp, Belgium Email address: filip.struyf@uantwerpen.be

Mira Meeus (2,3,4) Rehabilitation Sciences and Physiotherapy Department, University of Antwerp, Antwerp, Belgium; (3) Rehabilitation Sciences and Physiotherapy Department, Ghent University, Ghent, Belgium; (4) Pain in Motion International Research Group, www.paininmotion.be Email address: mira.meeus@uantwerpen.be

Jose Miguel Morales-Asencio (5) Department of Nursing, University of Malaga, Spain Email address: jmmasen@uma.es

Alejandro Luque-Suarez (1) Department of Physiotherapy, University of Malaga, Malaga, Spain. Email address: aluques@uma.es

Word count: 3.771

ABSTRACT

Introduction: Shoulder pain is a highly prevalent condition. Psychological factors could play an essential role on the prognosis of CSP. The aims will be to analyse the level of association between psychological factors and pain-disability at baseline, and prospectively to assess their prognostic role; to evaluate the association of pain catastrophizing and kinesiophobia at baseline and prospectively in the relationship between pain intensity and disability, or between self-efficacy and disability in patients with CSP; to explore the association of self-efficacy at baseline and prospectively in the relationship between pain intensity and disability, in comparison with kinesiophobia and pain catastrophizing.

Methods and analysis: The study is a longitudinal, prospective cohort study with a 12-month follow-up. It will be conducted in four primary-care centres and one hospital of the province of Malaga, Spain. 307 participants aged between 18 and 70 years, suffering from chronic shoulder pain (3 months or more) will be included. Primary outcomes will include pain, disability, and self-efficacy, whereas kinesiophobia, pain-related fear, pain catastrophizing, anxiety, depression, patient expectations of recovery, age, gender, duration/intensity of symptoms, educational level, and other factors will be predictive measures. Follow-up: baseline, 3, 6, and 12 months.

Ethics and dissemination: The local ethics committee (The Costa del Sol Ethics Committee, Malaga 28042016), has approved this protocol. Dissemination will occur through presentations at National and International conferences and publications in international peer-reviewed journals.

Trial registration number: NCT02738372

Keywords: Shoulder pain; chronic pain; prognosis; psychological factors

Strengths and limitations:

- The inclusion of a long battery of psychological factors evaluating their role on the prognosis of chronic shoulder pain.
- The exploration of the mediating power of self-efficacy, kinesiophobia, and pain catastrophizing in chronic shoulder pain.
- The inclusion of self-efficacy as an outcome measure.
- The use of the SPIRIT checklist to give more quality to the study.
- Information bias could be an important limitation of this study.
- Some psychological factors such as pain acceptance, or psychological distress will be not included in this study.
- Another limitation could be that some psychological factors are quite broad in definition, increasing the risk on finding conflicting evidence on their relationship with outcomes.

Contribution of the manuscript

- To determine which psychological factors are involved on the prognosis of chronic shoulder pain.
- To evaluate whether kinesiophobia and/or pain catastrophizing mediate the relationship between pain intensity and disability, or between self-efficacy and disability.
- To explore if self-efficacy is the strongest mediator in the relationship between pain intensity and disability in chronic shoulder pain.

INTRODUCTION

Shoulder pain is the third most common musculoskeletal condition presenting to physicians or physiotherapists [1] in primary healthcare after low back and neck pain, [2,3] being a significant cause of morbidity, [4] and functional disability in both working, [5,6] and general population. [6–8] It affects one in three adults, [7,9,10] accounting 1% of general practitioners (GPs) consultations in primary care. [11]

Incidence rates range from 11.2 to 29.5 per 1000 person-years, [11–14] and the reported prevalence rates range from 4.7 to 46.7 per 1000 person-years. [10,14,15] Both incidence and prevalence rates tend to increase with age, [16] in women, [10,16,17] in subjects from lower socioeconomic groups, and in psychologically stressed populations. [18]

Despite the large group of individuals seeking for primary care services, about 50% of patients with shoulder pain still report persistent pain after 12 months. [9,16,18,19] As a result, socio-economic burdens are considerable due to extensive use of heath care services, sickness absence, disability pension, and loss of productivity, [20–24] as well as, patient´s suffering.

That's why there is a consensus in the field that research efforts need to be focused on obtaining insight into which prognostic factors play the most important roles in chronic shoulder pain (CSP), and how those factors impact on pain and function, as this understanding is crucial to acquire a clear comprehension of all the process involved in CSP, and to underline pain treatment effects in seeking to improve the poor prognosis of this entity.

CSP is a complex syndrome, and pain chronicity often cannot be explained (solely) by an obvious anatomic defect or tissue damage. [25] A recent review, [26] exposed that the effective management of shoulder pain relies, not only upon a detailed knowledge of peripheral pathology (i.e. adhesive capsulitis, SLAP lesion or rotator cuff tendinopathy), but also on a comprehensive understanding of how pain can be generated, propagated, and modified. In this sense, there has been a growing recognition that the degree of chronic pain is influenced by the beliefs, attitudes, and expectations of individuals. [27–29] Given the importance of pain as a mechanism of

survival, it is perhaps unsurprising that pain perception is clearly influenced by conscious and unconscious memory, cognitive, and emotional functioning, and contextual factors that are explicitly included in a biopsychosocial formulation of pain. [30] Inside of the biopsychosocial understanding of chronic pain, there is a growing interest, and acceptance in hypothesizing that the association between physical impairment, pain intensity, and pain-related disability is only moderate, and that psychological factors may influence the experience of pain and its impact, and hence, may play a crucial role in the maintenance of pain-related problems. [27,31] Currently, some evidence have shown how psychological factors could be associated with the prognosis of CSP. [32–34] Reilingh et al. [32] investigated the course and prognosis of shoulder pain in the 6 first months after presentation to the general practitioner. Predictors of a better outcome for CSP were lower scores on pain catastrophizing and higher baseline pain intensity (explained variance 21%). Gill et al. [33] examined which factors are predictive of incident, recurrent, or resolved shoulder pain in a community based sample from the general population. Findings showed how recurrent shoulder pain was associated with depressive symptoms. Chester et al. [34] aimed to identify which baseline patient and clinical characteristics are associated with a better outcome, 6 weeks and 6 months after starting a course of physiotherapy for shoulder pain. In this study, higher patient expectation of complete recovery compared to slight improvement because of physiotherapy, and higher pain self-efficacy were associated with patient-rated outcomes.

Therefore, it seems presumable that psychological factors could play a role in people with shoulder pain, and favour the perpetuation of CSP. Self-efficacy has been proposed to predict pain, pain behaviour, physical functioning, and disability in chronic musculoskeletal pain. [35,36] Furthermore, self-efficacy is considered as a stronger mediator of the relationship between pain behaviour, pain intensity and disability, than psychological factors such as kinesiophobia and pain catastrophizing. [37–39]. However, the role of self-efficacy as an outcome measure and as mediator on CSP has not studied yet. Knowing and understanding

which psychological factors are specifically involved on the prognosis of CSP is challenging, to facilitate clinical decision-making and, if necessary, timely, and specific consultation with -or referral to- other health care providers. [40]

There are four hypotheses in the present study. Firstly, higher levels of psychological factors at baseline and prospectively, such as kinesiophobia, pain-related fear, depression, anxiety, patient expectations of recovery and pain catastrophizing are associated with a higher level of pain intensity, and disability, and lower level of self-efficacy. Secondly, pain catastrophizing and/or kinesiophobia mediate the relationship between pain intensity and disability, or between self-efficacy and disability at baseline. Thirdly, changes in pain catastrophizing and/or changes in kinesiophobia mediate the relationship between changes in pain intensity and changes in disability, or changes in self-efficacy and changes in disability after 12 months' follow-ups. Fourthly, self-efficacy is the strongest mediator in the relationship between pain intensity and disability at baseline and prospectively. Hence, the aims of the present study will be: (i) to analyse the level of association between psychological factors and pain-disability at baseline, and prospectively to assess their prognostic role; (ii) to evaluate the association of pain catastrophizing and kinesiophobia at baseline and prospectively in the relationship between pain intensity and disability, or between self-efficacy and disability in patients with CSP; (iii) to explore the association of self-efficacy at baseline and prospectively in the relationship between pain intensity and disability, in comparison with kinesiophobia and pain catastrophizing.

METHODS AND ANALYSIS

Study design and setting

The present study will be a 12 months' multi-centre, prospective, cohort study that will be carried out between May 2016 and April 2018 in four primary care centres and one hospital of the province of Malaga, Spain. Several questionnaires assessing different psychological factors will be administrated to these participants. The outcomes will be assessed at baseline (t1) and at

3 follow-ups times (after 3 (t2), 6 (t3) and 12 months (t4)). Ethical approval has been obtained from Costal del Sol Ethics Committee, Malaga, Spain (28042016). The study will be implemented and reported in line with the SPIRIT statement.

Participants

A consecutive sample comprised of participants with CSP will be recruited. General practitioners (GPs) will carry out the recruitment. Then, research assistants who previously will be instructed by the research team will assess participants for eligibility. If participants satisfy the eligibility criteria, they will be invited to participate in this study, and then they will be evaluated at baseline and 3, 6, and 12 months' follow-up. The inclusion criteria as follows: (i) men/women aged over 18 years; (ii) participants suffering from shoulder pain (pain intensity of 3 or more on a 0-10 numerical pain rating scale), will be included in this study, among all these following shoulder pain conditions: non-specific shoulder pain, subacromial pain syndrome, rotator cuff tendinopathy, adhesive capsulitis, instability without trauma, SLAP lesion, acromioclavicular pathology and/or shoulder osteoarthritis. Diagnosis will be carried out by clinical testing based on the recommendations of McClure et al. [41], and radiological test through MRI and/or ultrasound imaging; (iii) duration of symptoms: more than 3 months. The exclusion criteria as follows: (i) recent shoulder dislocation (1 year prior) and/or systemic diseases such as rheumatoid arthritis, fibromyalgia and/or polymyalgia rheumatic; (ii) shoulder pain considered to be originated from the cervical region, and other traumas, or if there is a neurological dysfunction (i.e. multiple sclerosis or stroke), osteoporosis, haemophilia, and / or cancer; (iii) participants receiving shoulder surgery; (iv) participants with shoulder pain after post fracture; (v) inability to provide informed consent and/or complete written questionnaires.

Procedures

Recruitment

Anonymized age and gender will be collected for those participants who decline to take part in the project, to assess the external validity of the recruited sample of participants.

Eligible participants who will be interested in the study will be asked to provide written informed consent to participate. Participants will then complete several questionnaires at baseline, 3, 6 and 12 months after the beginning of the study.

Participant data files will be stored in numerical order and in a secure and accessible place and manner. Participant files will be maintained in storage for a period of 3 years after completion of the study.

Outcomes Measures

Outcome measures and some of the potential prognostic factors will be measured at baseline and prospectively, with the aim of observing possible associations between potential prognostic factors and pain-disability, and self-efficacy at baseline, and prospectively to assess their prognostic role, and if some of them appear as confounding factors.

Primary outcome

Pain and function

1. The Shoulder Pain and Disability Index (SPADI) is a self-administered index consisting of 13 items divided into two subscales: pain and disability. [42] It grades a normal shoulder as 0 and maximally affected as 130, and a 11-point numerical pain rating scale with 0 as normal and 10 as maximal pain.

Secondary outcome

Self-Efficacy

2. Pain Self-Efficacy Questionnaire (PSEQ) contains 10 questions that will measure the patient's confidence in performing certain activities despite pain. Items are scored on a scale from 0 to 6,

with a maximum possible score of 60 points. Lower scores indicate less self-efficacy. [43]

Potential Prognostic Factors

Psychological factors will be assessed through four questionnaires at baseline, 3,6,12 months follow-up.

Kinesiophobia, pain-related fear, pain catastrophizing, anxiety, depression, and patient expectations of recovery

1. The Fear-avoidance Components Scale (FACS) is a new patient-reported measure designed to evaluate pain-related fear and kinesiophobia in patients with painful medical conditions. It consists of 20 items that are scored on a 5-point scale. [44]

2. The Pain Catastrophizing Scale (PCS) will be included to assess catastrophic thinking about pain. It consists of 13 items describing different thoughts and feelings that individuals may have when experiencing pain. Items are scored on a 5-point scale. A general score and scores on 3 subscales (i.e., helplessness, magnification, and rumination) will be obtained; higher scores indicate more severe catastrophic thoughts about pain. [45]

3. The Hospital Anxiety and Depression Scale (HADS) is a 14-item scale designed to detect anxiety and depression, independent of somatic symptoms. It consists of two 7-item subscales measuring depression (HADS-D) and anxiety (HADS-A). It uses a 4-point response scale that ranges from 0 (absence of symptoms) to 3 (maximum symptoms), with possible scores for each subscale ranging from 0 to 21.[46] Higher scores indicate higher levels of disorder. The HADS has been widely used as a screening instrument for the detection of comorbid depressive and anxiety disorders in patients with musculoskeletal disorders. [47–49]

4. Patient expectations of recovery will be measured by asking the participants to rate the likelihood that they would resume some form of recovery at 3, 6 and 12 months' follow-up

("How likely is it that within the next 3 months you will have resumed some form of recovery?"). Participants will indicate their response on a scale with the endpoints (0%) not at all likely to (100%) extremely likely. [50]

Other potential prognostic factors

1. Side of shoulder problem (right, left, both) will be coded into three levels: (i) right; (ii) left; (iii) both.

2. Shoulder dominance (right, left, ambidexterity) will be coded into three levels: (i) right; (ii) left; (iii) ambidexterity.

3. History of previous shoulder problems will be measured with a Yes/No question.

4. Current treatment will be evaluated through a checklist divided in 5 groups: (i) no treatment; (ii) pharmacological treatment; (iii) injections; (iv) physical therapy; (v) other treatments (massage, reflexology, acupuncture.

5. Being convinced of this pathology will be measured with a Yes/No question.

6. Active shoulder ROM-free of pain will be measured with a manual inclinometer placing in the affected shoulder.

7. Co-morbidities will be tested with the Self-Administered Comorbidity Questionnaire (SCQ). [51] Patients will be asked if they had one or more medical conditions (from a list of 15 diagnoses). If they gave a positive response, they will be asked whether the condition limited their activity.

8. Recurrence of shoulder problem was dichotomized to those patients who had a recurrent episode within the past 12 weeks and those who had a recurrent episode more than 12 weeks. With a simple answer: Yes/No.

9. The Numerical Rating Scale (NRS) was used to assess each patient's pain intensity at baseline and follow-ups. The NRS scores ranges from 0 to 10, with 0 representing no pain and 10 representing the worst pain imaginable. The NRS has been shown to have good same-day test-retest reliability. [52]

10. Work status will be coded into five categories of work: (i) unemployment; (ii) sick leave; (iii) retirement; (iv) housewife; (v) active worker.

11. Work Absenteeism will be measured by the following sentence: how many days (if any) within the previous 4 weeks' care workers had not attended work due to feeling ill and unfit for work. Respondents answered by number of days. Numbers were then grouped into three categories (0 = 0 days, 1 = 1–2 days, 2 = 3 or more days). [53]

12. Work performance will be measured by the Word Health Organization Health and Work Performance Questionnaire (HPQ) through the following sentence: How would you rate your overall job performance on the days you worked during the past 4 weeks (28 days)?; responses used a scale ranging from 0 to 10, with higher scores indicating higher work performance in the previous 4 weeks. [54]

13. Educational level will be coded into five educational levels: (i) university/college ≥4 years; (ii) university/college 4 years; (iii) upper secondary; (iv) elementary secondary; (v) no studies. [55]

14. Gender, age, height, and weight will be reported by self-reported questionnaire.

The summary of potential prognostic factors and outcome measures will be presented in **table 1**.

Construct	Type	Staff Member	Baseline (T1)	3 months (T2)	6 months (T3)	12 months (T4)
Outcome Measures						
Pain and Function	SPADI	Interviewer	X	X	X	X
Self-efficacy	PSEQ	Interviewer	X	X	X	X
Shoulder Problems						
Side of shoulder problem (i) right; (ii) left; (iii) both.	Self-reported questionnaire	Interviewer	X			
Shoulder dominance (i) right; (ii) left; (iii) ambidexterity.	Self-reported questionnaire	Interviewer	X			
History of previous shoulder problems	Self-reported questionnaire (Yes/No)	Interviewer	X			
What modality of treatment? ((i) no treatment;(ii) pharmacological treatment; (iii) injections; (iv) physical therapy; (v) other treatments (massage, reflexology, acupuncture.)	Self-reported questionnaire	Interviewer	X	X	X	X
Have you been convinced of this pathology?	Self-reported questionnaire (Yes/No)	Interviewer	X	X	X	X

Potential Prognostic Factors						
Pain-related fear and kinesiophobia	FACS	Interviewer	X	X	X	X
Pain Catastrophizing	PSC	Interviewer	X	X	X	X
Active shoulder ROM-free of pain	Manual Inclinometer	Interviewer	X	X	X	X
Anxiety and Depression	HADS	Interviewer	X	X	X	X
Patient expectations of recovery	Self-reported question (0-100)	Interviewer	X	X	X	X
Co-morbidities	SCQ	Interviewer	X	X	X	X
Recurrence of shoulder pain	Self-reported questionnaire (Yes/No)	Interviewer	X			
Intensity of pain	NRS	Interviewer	X	X	X	X
Work status ((i) unemployment; (ii) sick leave; (iii) retirement; (iv) housewife; (v) active worker.)	Self-reported questionnaire	Interviewer	X	X	X	X
Work absenteeism	Self-reported questionnaire	Interviewer	X	X	X	X
Work performance	Question obtaining of	Interviewer	X	X	X	X

	HPQ		
Age, gender	Self-reported questionnaire	Interviewer	X
Height, weight	Self-reported questionnaire	Interviewer	X
Educational Level: (i) university/college ≥4 years; (ii) university/college 4 years; (iii) upper secondary; (iv) elementary secondary; (v) no studies.	Self-reported questionnaire	Interviewer	X

Table 1. Overview of measurement instruments and time of assessment

Sample size estimation

To contrast the null hypothesis that six potential prognostic factors (Kinesiophobia, pain-related fear, pain catastrophizing, anxiety-depression, age and gender) included in the estimation does not explain the primary outcome, ANOVA-test in a multiple linear regression model will be used, considering a significance level of 0.05, and a statistical power of 0.9, assuming that one variable (Anxiety-depression [34]) provides a coefficient of determination of 0.31, and being expected a higher coefficient of 0.36, a sample of 230 patients will be needed. Assuming an expected drop-out rate of 25%, a total number of 307 patients will be needed.

Statistical Analysis

Dataset will be carried out using SPSS for Windows (version 22, SPSS Inc. Chicago, IL). There will be 4 measurements in the study, T1= at baseline, T2= 3 months T3= 6 months, T4= 12 months' follow-up. Kolmogorov-Smirnov test will be used to analyse the normal distribution of the variables ($P > 0.05$). Continuous variables will be presented through centrality measures

(mean, median), and dispersion (standard deviation, and interquartile range), and categorical variables through frequencies and percentages. Rank sums, Wilcoxon signed Rank test, Mann-Whitney's U, and Friedman's test will be used depending on the comparisons to be made, in case of non-normal distribution of variables. For the identification of potential prognostic factors, the psychological variables (kinesiophobia, pain-related fear, pain catastrophizing, anxiety, depression, and patient expectations of recovery), and sociodemographic characteristics (age, gender, height, weight, shoulder problems, work status, work absenteeism, work performance, intensity of pain, active shoulder ROM-free of pain, educational level, treatments received, and co-morbidities), will be introduced as predictors in a multiple linear regression analysis, taking SPADI as continuous dependent variable.

Finally, analysis through COX regression will be conducted to determine the hazard ratios of the aforementioned factors with the presence of pain and disability (using SPADI values to determine this state), through proportional hazard models. A p-value < 0.05 will be considered statistically significant.

Data collection and management

To ensure accurate, complete, and reliable data, all study-related information will be stored securely at the study site. All participant information will be stored in locked file cabinets in areas with limited access. A coded ID number will identify reports, data collection, process, and administrative forms only to maintain participant confidentiality.

Modification of the Protocol

Any modifications to the protocol that may affect the conduct of the study, potential benefit of the patient or may affect patient safety, including changes of study objectives, study design, patient population, sample sizes, study procedures, or significant administrative aspects will require a formal amendment to the protocol.

Such amendment will be agreed upon this research group**,** and approved by Costa del Sol Ethics Committee, Malaga, Spain, prior to implementation and notified to the health authorities in

accordance with local regulations.

Ethical considerations and dissemination

Ethics approval of the study was obtained from the Costa del Sol Ethics Committee, Malaga (reference no. 28042016). The trial is registered in Clinicaltrials.gov: NCT02738372.

Informed Consent

All the authors declare to have no conflict of interests.

The results of the study will be disseminated at several research conferences and as published articles in peer-reviewed journals.

DISCUSSION

The present study will be the first study analysing the role of a long battery of psychological factors (pain-related fear, kinesiophobia, anxiety, depression, patient expectations of recovery, and pain catastrophizing) on the prognosis of CSP. Previous work [32–34,56,57] have evaluated the influence of several psychological factors on the prognosis of CSP. Macfarlane et al. [56] showed how higher levels of psychological distress predicted perpetuation of CSP. Badcock et al. [57] reported association between disability and psychological distress after controlling for possible confounders. Reilingh et al. [32] exposed how higher levels of pain catastrophizing predicted recurrence of symptoms in CSP. Gill et al. [33] showed how recurrent shoulder pain was associated with depressive symptoms. Chester et al. [34] reported how higher patient expectation of complete recovery compared to slight improvement as a result of physiotherapy, and higher pain self-efficacy were associated with patient-rated outcomes. These previous studies support the necessity of carrying out the present study, but also, the inclusion of several psychological factors, which have not already evaluated on the prognosis of CSP, such as: pain-related fear, kinesiophobia, and anxiety, justifying the development of this cohort study, due to it seems presumable that psychological factors may play an essential role along with biomedical and/or biomechanical factors in the perpetuation of chronicity in patients with CSP. Besides that,

this will be the first study evaluating self-efficacy as an outcome measure in shoulder region. Previous studies have explored how psychological factors influence self-efficacy in chronic musculoskeletal conditions, [58] and how several therapeutic strategies could improve this psychological construct. [59,60] Therefore, the inclusion of self-efficacy as an outcome in this study could be reasonable, due to this construct are based on how a person's perceived confidence in their ability of successfully carrying out daily and/or work activities or behaviour despite their pain, [61] and people with CSP usually have to do many task that implicate the movement of their shoulders. That's why, detecting possible factors who contribute to improve or reducing effects of self-efficacy in people with CSP may give rise to benefits for this population.

Strengths and weaknesses of the study

The strengths of this study will include a long battery of psychological factors evaluating their role on the prognosis of CSP, the exploration of the mediating power of self-efficacy, kinesiophobia, and pain catastrophizing in CSP, the inclusion of self-efficacy as an outcome measure, and the use of the SPIRIT checklist to give more quality to the study. The limitations associated with this study must be acknowledged when interpreting the results. Firstly, information bias could be an important limitation of this study. Some participants may have problems to deal with the questionnaires and remember any situation associated with their pain and disability at 3, 6 and 12 months' follow-up. Even so, some participants might be more likely to deny participation or abort follow-up. However, adding a drop-out rate of 20% in sample size calculation should alleviate this risk. Furthermore, some psychological factors such as pain acceptance, or psychological distress will be not included in this study, due to implicate too much time to carry out all the self-reported questionnaires, and participants may not respond clarifying. Another limitation could be that some psychological factors are quite broad in definition, increasing the risk on finding conflicting evidence on their relationship with outcomes.

Clinical and research implications of study findings

The early identification of which psychological factors have higher predictive value in people with CSP, may assist to clinicians in clinical decision-making, and timely and specific consultations with -or referral to- other health care providers, but also to researchers in exploring which psychological factors could be the most predictive power in shoulder region, giving rise to the possibility to steer treatments. That's why, clinicians should be encouraged to identify patients with CSP who show psychological symptoms in the preliminary assessment, as this approach might increase the possibility of consider other therapeutic interventions rather than physical therapies for CSP, e.g., pain neuroscience education.

Future Research

Further studies analysing prospectively the influence of psychological factors on the prognosis of CSP, including several factors such as pain acceptance, psychological distress and/or coping with pain are needed. As CSP is a complex multifactorial condition, future investigations should consider the combination, and interaction of a cluster of factors to increase their predictive value, and to determine the importance of each factor. Even though the effect caused by psychological factors on the prognosis of CSP could be relevant, further research evaluating the effects of these factors on the prognosis of CSP, and the possible mediating power of these factors in this entity, as well as their clinical usefulness is required.

Conclusion

Despite the neuroanatomical and biomechanical basis of shoulder pain are interminable and not completely understood, this prospective cohort study may contribute to a new vision about the role played by pain-related fear, kinesiophobia, anxiety, depression, and pain catastrophizing on the prognosis of CSP, and how self-efficacy, kinesiophobia and pain catastrophizing mediate the relationship between symptoms, increasing the body of knowledge in this field.

Current study status

The recruiting patients will begin in August 2016.

Author's Contribution

ALS conceived the study. ALS and JMC initiated the study design and FS and MM helped with the final version of this protocol. ALS and FS provided statistical expertise in longitudinal trial design and JMA will be conducting the primary statistical analysis. All authors contributed to the refinement of the study protocol and approved the final manuscript.

Funding statement

This study is supported by University of Malaga, Spain. The funding source has no role in study design, in data collection, analysis, and interpretation, in the writing of the report, or in the decision to submit the paper for publication.

Competing Interest Statement

None authors have any conflicts of interest to declare.

Ethics Approval: The Costa del Sol Ethics Committee approved the study 28th April 2016

REFERENCES

1 Klintberg IH, Cools AM, Holmgren TM, *et al.* Consensus for physiotherapy for shoulder pain. *Int Orthop* 2015;**39**:715–20. doi:10.1007/s00264-014-2639-9

2 Urwin M, Symmons D, Allison T, *et al*. Estimating the burden of musculoskeletal disorders in the community: the comparative prevalence of symptoms at different anatomical sites, and the relation to social deprivation. *Ann Rheum Dis* 1998;**57**:649–55. doi:10.1136/ard.57.11.649

3 Green S, Buchbinder R, Hetrick S. Physiotherapy interventions for shoulder pain. *Cochrane Database Syst Rev* 2003;**2**:CD004258. doi:10.1002/14651858.CD004258

4 House J, Mooradian A. Evaluation and management of shoulder pain in primary care clinics. *South Med J* 2010;**103**:1129-35-7. doi:10.1097/SMJ.0b013e3181f5e85f

5 Eriksen W. The prevalence of musculoskeletal pain in Norwegian nurses' aides. *Int Arch Occup Environ Health* 2003;**76**:625–30. doi:10.1007/s00420-003-0453-6

6 Roquelaure Y, Ha C, Leclerc A, *et al.* Epidemiologic surveillance of upper-extremity musculoskeletal disorders in the working population. *Arthritis Care Res* 2006;**55**:765–78. doi:10.1002/art.22222

7 Chard MD, Hazleman R, Hazleman BL, *et al.* Shoulder Disorders in the Elderly : a Community Survey. *Arthritis Rheum* 1991;**34**:766–9. doi: 10.1002/art.1780340619

8 Walker-Bone K, Palmer KT, Reading I, *et al.* Prevalence and impact of musculoskeletal disorders of the upper limb in the general population. *Arthritis Rheum* 2004;**51**:642–51.

doi:10.1002/art.20535

9 Van der Heijden GJ. Shoulder disorders: a state-of-the-art review. *Baillieres Best Pract Res Clin Rheumatol* 1999;**13**:287–309. doi:10.1053/berh.1999.0021

10 Picavet HS, Schouten JS. Musculoskeletal pain in the Netherlands: Prevalences, consequences and risk groups, the DMC3-study. *Pain* 2003;**102**:167–78. doi:10.1016/s0304-3959(02)00372-x

11 van der Windt DA, Koes BW, Boeke AJ, *et al*. Shoulder disorders in general practice: prognostic indicators of outcome. *Br J Gen Pr* 1996;**46**:519–23.

12 Bot SD, van der Waal JM, Terwee CB, *et al*. Incidence and prevalence of complaints of the neck and upper extremity in general practice. *Ann Rheum Dis* 2005;**64**:118–23. doi:10.1136/ard.2003.019349

13 Feleus A, Bierma-Zeinstra SM, Miedema HS, *et al*. Incidence of non-traumatic complaints of arm, neck and shoulder in general practice. *Man Ther* 2008;**13**:426–33. doi:10.1016/j.math.2007.05.010

14 Linsell L, Dawson J, Zondervan K, *et al*. Prevalence and incidence of adults consulting for shoulder conditions in UK primary care; patterns of diagnosis and referral. *Rheumatology (Oxford)* 2006;**45**:215–21. doi:10.1093/rheumatology/kei139

15 Luime JJ, Koes BW, Hendriksen IJ, *et al*. Prevalence and incidence of shoulder pain in the general population; a systematic review. *Scand J Rheumatol* 2004;**33**:73–81. doi:16167509

16 Greving K, Dorrestijn O, Winters JC, *et al*. Incidence, prevalence, and consultation rates of shoulder complaints in general practice. *Scand J Rheumatol* 2012;**41**:150–5. doi:10.3109/03009742.2011.605390.

17 Bergman S, Herrström P, Högström K, *et al*. Chronic Musculoskeletal Pain , Prevalence Rates , and Sociodemographic Associations in a Swedish Population Study. *J Rheumatol* 2001;**28**: 1369-77.

18 McBeth J, Jones K. Epidemiology of chronic musculoskeletal pain. *Best Pract Res Clin Rheumatol* 2007;**21**:403–25. doi:10.1016/j.berh.2007.03.003

19 Croft P, Pope D, Silman A. The clinical course of shoulder pain: prospective cohort study in primary care. Primary Care Rheumatology Society Shoulder Study Group. *BMJ* 1996;**313**:601–2. doi: https://doi.org/10.1136/bmj.313.7057.601

20 Luime JJ, Koes BW, Miedem HS, *et al.* High incidence and recurrence of shoulder and neck pain in nursing home employees was demonstrated during a 2-year follow-up. *J Clin Epidemiol* 2005;**58**:407–13. doi:10.1016/j.jclinepi.2004.01.022

21 Smith KL, Harryman DT 2nd, Antoniou J, *et al.* A prospective, multipractice study of shoulder function and health status in patients with documented rotator cuff tears. *J Shoulder Elb Surg* 2000;**9**:395–402. doi:10.1067/mse.2000.108962

22 Roquelaure Y, Mariel J, Fanello S, *et al.* Active epidemiological surveillance of musculoskeletal disorders in a shoe factory. *Occup Environ Med* 2002;**59**:452–8. doi:10.1136/oem.59.7.452

23 Greenberg DL. Evaluation and Treatment of Shoulder Pain. *Med Clin North Am* 2014;**98**:487–504. doi:10.1016/j.mcna.2014.01.016

24 van den Dolder PA, Ferreira PH, Refshauge KM. Effectiveness of soft tissue massage and exercise for the treatment of non-specific shoulder pain: a systematic review with meta-analysis. *Br J Sports Med* 2014;**48**:1216–26. doi:10.1136/bjsports-2011-090553

25 Nijs J, Goubert D, Ickmans K. Recognition and Treatment of Central Sensitization in Chronic Pain Patients: Not Limited to Specialized Care. *J Orthop Sport Phys Ther* 2016;**46**:1024–8. doi:10.2519/jospt.2016.0612

26 Dean BJ, Gwilym SE, Carr AJ. Why does my shoulder hurt? A review of the neuroanatomical and biochemical basis of shoulder pain. *Br J Sports Med* 2013;**47**:1095–104. doi:10.1136/bjsports-2012-091492

27 Turk DC, Okifuji A. Psychological factors in chronic pain: evolution and revolution. *J*

Consult Clin Psychol 2002;**70**:678–90. doi:10.1037//0022-006X.70.3.678

28 Diatchenko L, Fillingim RB, Smith SB, et al. The phenotypic and genetic signatures of common musculoskeletal pain conditions. *Nat Rev Rheumatol* 2013;**9**:340–50. doi:10.1038/nrrheum.2013.43

29 Thompson E, Broadbent J, Bertino MD, *et al.* Do Pain-related Beliefs Influence Treatment adherence? A Systematic Review. *Clin J Pain* 2015;**32**:1. doi:10.1097/AJP.0000000000000235

30 Rajapakse D, Liossi C, Howard RF. Presentation and management of chronic pain. *Arch Dis Child* 2014;**99**:474–80. doi:10.1136/archdischild-2013-304207

31 Jensen MP, Ward LC, Thorn BE, *et al*. Measuring the Cognitions, Emotions, and Motivation Associated with Avoidance Behaviors in the Context of Pain: Preliminary Development of the Negative Responsivity to Pain Scales. *Clin J Pain* 2016;**[Epub ahead of print]**. doi:doi: 10.1097/AJP.0000000000000407

32 Reilingh ML, Kuijpers T, Tanja-Harfterkamp AM, *et al*. Course and prognosis of shoulder symptoms in general practice. *Rheumatology (Oxford)* 2008;**47**:724–30. doi:10.1093/rheumatology/ken044

33 Gill TK, Shanahan EM, Taylor AW, *et al*. Shoulder pain in the community: an examination of associative factors using a longitudinal cohort study. *Arthritis Care Res* 2013;**65**:2000–7. doi:10.1002/acr.22082

34 Chester R, Jerosch-Herold C, Lewis J, *et al*. Psychological factors are associated with the outcome of physiotherapy for people with shoulder pain: a multicentre longitudinal cohort study. *Br J Sport Med* 2016;**0**:1–8. doi:10.1136/bjsports-2016-096084.

35 Asghari A, Nicholas MK. Pain self-efficacy and pain behaviour. A prospective study. *Pain* 2001;**94**:85–100. doi: 10.1016/S0304-3959(01)00344-X

36 Van Liew C, Brown KC, Cronan TA, *et al*. Predictors of pain and functioning over time in fibromyalgia syndrome: an autoregressive path analysis. *Arthritis Care Res (Hoboken)*

2013;**65**:251–6. doi: 10.1002/acr.21792

37 Woby SR, Urmston M, Watson PJ. Self-efficacy mediates the relation between pain-related fear and outcome in chronic low back pain patients. *Eur J Pain* 2007;**11**:711–8. doi:10.1016/j.ejpain.2006.10.009

38 Costa Lda C, Maher CG, McAuley JH, *et al.* Self-efficacy is more important than fear of movement in mediating the relationship between pain and disability in chronic low back pain. *Eur J Pain* 2011;**15**:213–9. doi:10.1016/j.ejpain.2010.06.014

39 Skidmore JR, Koenig AL, Dyson SJ, *et al.* Pain self-efficacy mediates the relationship between depressive symptoms and pain severity. *Clin J Pain* 2015;**31**:137–44. doi: 10.1097/AJP.0000000000000094

40 Kooijman MK, Barten DJ, Swinkels IC, *et al.* Pain intensity, neck pain and longer duration of complaints predict poorer outcome in patients with shoulder pain - a systematic review. *BMC Musculoskelet Disord* 2015;**16**:288. doi:10.1186/s12891-015-0738-4.

41 McClure PW, Michener LA. Staged Approach for Rehabilitation Classification: Shoulder Disorders (STAR-Shoulder). *Phys Ther* 2015;**95**:791–800. doi:10.2522/ptj.20140156

42 Luque-Suarez A, Rondon-Ramos A, Fernandez-Sanchez M, *et al.* Spanish version of SPADI (shoulder pain and disability index) in musculoskeletal shoulder pain: a new 10-items version after confirmatory factor analysis. *Health Qual Life Outcomes* 2016;**14**:32. doi:10.1186/s12955-016-0436-4

43 Nicholas MK. The pain self-efficacy questionnaire: Taking pain into account. *Eur J Pain* 2007;**11**:153–63. doi:10.1016/j.ejpain.2005.12.008

44 Neblett R, Mayer TG, Hartzell MM, *et al.* The Fear-avoidance Components Scale (FACS): Development and Psychometric Evaluation of a New Measure of Pain-related Fear Avoidance. *Pain Pract* 2015;**16**:435–50. doi:10.1111/papr.12333

45 Sullivan MJL, Bishop SR, Pivik J. The pain catastrophizing scale: development and

validation. *Psychol Assess* 1995;**7**:524–532.

46 Kori SH, Miller RP, Todd DD. Kinesiophobia: a new view of chronic pain behaviour. *Pain Manag* 1990;**3**:35–43.

47 Pallant JF, Bailey CM. Assessment of the structure of the Hospital Anxiety and Depression Scale in musculoskeletal patients. *Heal Qual Life Outcomes* 2005;**3**:82. doi: 10.1186/1477-7525-3-82

48 Härter M, Reuter K, Gross-Hardt K, *et al*. Screening for anxiety, depressive and somatoform disorders in rehabilitation--validity of HADS and GHQ-12 in patients with musculoskeletal disease. *Disabil Rehabil* 2001;**23**:737–44. doi: http://dx.doi.org/10.1080/09638280110062176

49 Cho CH, Jung SW, Park JY, *et al*. Is shoulder pain for three months or longer correlated with depression, anxiety, and sleep disturbance?. *J Shoulder Elb Surg* 2013;**22**:222–8. doi:10.1016/j.jse.2012.04.001.

50 Carriere JS, Thibault P, Milioto M, *et al*. Expectancies Mediate the Relations among Pain Catastrophizing, Fear of Movement, and Return to Work Outcomes after Whiplash Injury. *J Pain* 2015;**16**:1280–7. doi:10.1016/j.jpain.2015.09.001

51 Sangha O, Stucki G, Liang MH, *et al.* The Self-Administered Comorbidity Questionnaire: a new method to assess comorbidity for clinical and health services research. *Arthritis Rheum* 2003;**49**:156–63. doi:10.1002/art.10993

52 Downie WW, Leatham PA, Rhind VM, *et al.* Studies with pain rating scales. *Ann Rheum Dis* 1978;**37**:378–81. doi:10.1136/ard.37.4.378

53 Aronsson G, Gustafsson K, Dallner M. Sick but yet at work. An empirical study of sickness presenteeism. *J Epidemiol Community Heal* 2000;**54**:502–9. doi:10.1136/jech.54.7.502

54 Kessler RC, Barber C, Beck A, *et al.* The World Health Organization Health and Work Performance Questionnaire (HPQ). *J Occup Env Med* 2003;**45**:156–74.

doi:10.1097/01.jom.0000052967.43131.51

55 Sterud T, Johannessen HA, Tynes T. Do Work-Related Mechanical and Psychosocial Factors Contribute to the Social Gradient in Low Back Pain?: A 3-Year Follow-Up Study of the General Working Population in Norway. *Spine (Phila Pa 1976)* 2016;**41**:1089–95. doi:10.1097/BRS.0000000000001451

56 Macfarlane GJ, Hunt IM, Silman AJ. Predictors of chronic shoulder pain: A population based prospective study. *J Rheumatol* 1998;**25**:1612–5.

57 Badcock LJ, Lewis M, Hay EM, *et al*. Chronic shoulder pain in the community: a syndrome of disability or distress?. *Ann Rheum Dis* 2002;**61**:128–31. doi:10.1136/ard.61.2.128

58 Rahman A, Reed E, Underwood M, *et al.* Factors affecting self-efficacy and pain intensity in patients with chronic musculoskeletal pain seen in a specialist rheumatology pain clinic. *Rheumatology (Oxford)* 2008;**47**:1803–8. doi:10.1093/rheumatology/ken377

59 Damush TM, Kroenke K, Bair MJ, *et al.* Pain self-management training increases self-efficacy, self-management behaviours and pain and depression outcomes. *Eur J Pain* 2016;**20**:1070–8. doi:10.1002/ejp.830

60 Ludvigsson ML, Peterson G, Dedering Å, *et al*. One- and two-year follow-up of a randomized trial of neck-specific exercise with or without a behavioural approach compared with prescription of physical activity in chronic whiplash disorder. *J Rehabil Med* 2016;**48**:56–64. doi:10.2340/16501977-2041

61 Bandura A. Self-efficacy: toward a unifying theory of behavioral change. *Psychol Rev* 1977;**84**:191-215.