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The role of psychological factors in the perpetuation of pain intensity and disability in people with chronic shoulder pain: a systematic review

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ABSTRACT

Introduction Chronic shoulder pain is a very complex syndrome, and the mechanisms involved in its perpetuation remain unclear. Psychological factors appear to play a role in the perpetuation of symptoms in people with shoulder chronicity. The purpose of this systematic review is to examine the role of psychological factors in the perpetuation of symptoms (pain intensity and disability) in people with chronic shoulder pain.

Methods and analysis A systematic search was performed on PubMed, AMED, CINAHL, PubPsych and EMBASE from inception to July 2017. Longitudinal studies with quantitative designs analysing the role of psychological factors on pain intensity, disability or both were included. The methodological quality of the included studies was evaluated with an adapted version of the Newcastle Ottawa Scale. The level of evidence per outcome was examined using the Grading of Recommendations Assessment, Development and Evaluation approach.

Results A total of 27 articles were included with a sample of 11 176 people with chronic shoulder pain. The risk of bias ranges from 7/21 to 13/21 across the studies. The quality of the evidence was very low. High levels of self-efficacy, resilience and expectations of recovery were significantly associated with low levels of pain intensity and disability. Inversely, high levels of emotional distress, depressive symptoms, anxiety, preoperative concerns, fear-avoidance beliefs, somatisation and pain catastrophising were significantly associated with high levels of pain intensity and disability.

Discussion Our results suggest that psychological factors may influence the perpetuation of pain intensity and disability, with very low evidence. A meta-analysis was not carried out due to the heterogeneity of the included studies so results should be interpreted with caution.

PROSPERO trial registration number CRD42016036366.

Strengths and limitations of this study

- The use of a prespecified protocol registered on the International Prospective Register of Systematic Reviews, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklist, the Grading of Recommendations Assessment, Development and Evaluation approach to evaluate the overall quality and the strength of the evidence, and the adapted Newcastle Ottawa Scale to determine the risk of bias in each study.
- It is possible that some studies were not identified even though both a comprehensive and a robust search strategy were carried out.
- Reported bias was found in several included studies.
- The quality of the evidence was very low.
- The results of the present study are not robust, and conclusions should be interpreted with caution.

INTRODUCTION

Chronic shoulder pain (CSP) is very common in both the general[1] and the working population.[2] The prevalence and the socioeconomic impact of CSP is high.[3] It ranges from 1% to 67% across different populations.[4] People with CSP report a broad variability in symptoms such as pain, insomnia and/or disability.[3] Personal, occupational, psychological, social and biological factors have been associated with the delay in recovery from CSP.[4 5] CSP is a very complex syndrome, and the mechanisms involved in its perpetuation remain unclear. Indeed, recovery rates are poor, with roughly 60% of patients with CSP reporting persistence of symptoms 12 months after onset.[6]

Contemporary approaches, from a biopsychosocial perspective, have emerged to analyse why many people do not recover after an acute episode of pain.[7–9] In this context, psychological factors seem to play a key role in the explanation as to why musculoskeletal pain becomes chronic, once the tissue damage has healed.[10–13] Over the last decades, the fear-avoidance (FA) model of pain has been largely explored.[14–16] When it is specifically applied to musculoskeletal pain,[15] it proposes that people who have musculoskeletal pain and a trait tendency to have

fearful and catastrophic thoughts, have a greater likelihood of developing chronic pain. The model conveys how people who perceive pain as a threat, often exhibit protective behaviours (eg, hypervigilance) in order to prevent a potential new injury/re-injury.[15] In the acute stage of the recovery process, these behaviours can be adaptive.[17] However, they become maladaptive once pain remains for a long time.[18] This unsuitable confrontation of the pain experience leads to a greater disuse of the affected area, causing physical and psychological consequences which provoke more pain and disability.[18 19] In this stage, all aspects involving fear (pain-related fear, kinesiophobia, hypervigilance and pain catastrophising) are intensified. This vicious cycle directly interferes in the person's recovery, which reduces treatment adherence and preserves the negative pain experience.[14] Inversely, people with musculoskeletal pain who report high levels of psychological factors, which are thought to be protective (eg, self-efficacy), are presumed to manage their pain better and, therefore, have a greater chance for recovery.[11]

The role of psychological factors on pain intensity and disability in people with CSP has been evaluated.[20–25] The findings of these studies have shown a possible relationship between the factors and the outcomes previously mentioned. People with CSP who mismanage their pain experience may create a negative spiral of pain perception, which could mean healing delays, brain alterations[26] and cognitive-behavioural changes.[27] Therefore, research efforts need to be focused on obtaining more knowledge and understanding about how psychological factors are associated with a poor or better prognosis in people with CSP. This understanding is crucial to acquire a clear picture of the process involved in CSP. This may aid in improving the current poor prognosis of this condition. To our knowledge, this is the first synthesis of evidence that explores the role of psychological factors on pain intensity and disability in people with CSP. A systematic review may help to diminish the uncertainty caused by the heterogeneity of particular studies, and may permit the formation of firm conclusions through an exhaustive synthesis of data.[28] Hence, the aim of this study was to answer the following PECOS (P, participant; E, exposure; C, comparator; O, outcome; S, study design) question through a systematic review of the literature on longitudinal studies (S): which is the role of psychological factors (E) on pain intensity and disability (O) in people with CSP (P)?

MATERIALS AND METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[29] The abstract was carried out using the PRISMA reporting guidelines for abstracts (http://www.prisma-statement.org/Extensions/Abstracts.aspx). The systematic review protocol was registered at the International Prospective Register of Systematic Reviews (PROSPERO: CRD42016036366).

Patient and public involvement

Patients and or public were not involved.

Data sources and search strategy

A systematic search was performed by two independent reviewers (JM-C and AL-S) from inception to August 2016 using optimised search strategies in the following electronic databases: PubMed, AMED, CINAHL, PubPsych and EMBASE. An update of the search strategy was carried out on July 2017. A manual search of relevant eligible studies, to select any studies missed during the electronic search, was also carried out using cross-references identified both in journals associated with the topic of this review, and in reference lists within both original and review articles. A sensitive search strategy using relevant search terms that were developed from Medical Subject Headings (MeSH), and keywords generated from the subject headings, as follows: 'chronic pain' (MeSH Terms), 'surgery' (MeSH Terms), 'arthroscopy' (MeSH Terms), 'shoulder pain' (MeSH Terms), 'rotator cuff' (MeSH Terms), 'fear' (MeSH Terms), 'catastrophization' (MeSH Terms), 'depression' (MeSH Terms), 'anxiety' (MeSH Terms), 'self-efficacy' (MeSH Terms), adhesive capsulitis, frozen shoulder, psychological factors, kinesiophobia, coping, expectations, were used. The complete search strategy report is shown in online supplementary appendix A. The grey literature, such as NHS Evidence, New York Academy of Medicine Grey Literature Report, Grey Source, Open Grey and Google Scholar[30] were explored to detect any relevant unpublished work. To gather any other non-published data, researchers were contacted directly. References were exported, and duplicates were removed using citation management software (Mendeley desktop V.1.17.4).

Eligibility criteria

The aforementioned PECOS framework was followed to determine which studies were included in the present systematic review. Each study had to meet the following inclusion criteria:

i. Longitudinal studies (prospective and retrospective) (S) examining the role of psychological factors (E) on pain intensity, disability or both (O) in people with CSP (P). Studies with a non-exposed cohort (C) in order to satisfy all the PECOS criteria. However, no included study reported a non-exposed cohort.
ii. Studies whose participants were adults diagnosed with CSP (>3 months).
iii. Studies written in English.
iv. No restriction was applied on the participants' gender or ethnicity.
v. Studies that reported a follow-up at least 6 weeks after intervention.
vi. Studies recruiting participants from any setting (general population, primary, secondary or tertiary care).

vii. Studies providing at minimum an association between psychological factors and pain intensity, disability or both through a quantitative design.

The exclusion criteria were as follows:

i. All studies that did not include a longitudinal design (eg, cross-sectional studies).
ii. Studies exploring psychological factors in people with acute or subacute shoulder pain.
iii. Studies evaluating psychological factors in people with CSP due to spinal cord injury, stroke, rheumatoid arthritis or cancer.
iv. Studies aimed at modifying levels of psychological factors through any therapy.
v. Studies investigating the psychometric properties of psychological factor assessment measures.

Study selection

All studies identified by the search strategy were screened using our eligibility criteria. Two independent reviewers (JM-C and AL-S) carried out the first stage, which involved the screening of articles by title and abstract. The same reviewers undertook the second stage, screening the full text. In cases of disagreement, a decision was made by consensus or, when necessary, a third reviewer (JMM-A) was consulted. A short checklist was adapted to the present review in order to guide the selection of relevant studies (see online supplementary appendix B).[31]

Data extraction

Two independent reviewers (JM-C and AL-S) extracted the following relevant data from each study: study details (first author, year of publication), sample size, characteristics of participants (mean age, mean duration of symptoms), metric of psychological factor measures, metric of outcome (pain intensity and disability) measures, duration of follow-up and study design. If there was any discrepancy between reviewers, a third reviewer was consulted (JMM-A). When necessary, an email was sent to the original authors to provide further information on participants' data.

Quality assessment

Two independent reviewers (JM-C and AL-S) assessed the risk of bias of the included studies using the Newcastle Ottawa Scale (NOS).[32] The NOS is a reliable and valid tool for assessing the quality of non-randomised studies.[32] Due to none of the included studies used as non-exposed cohort, we decided to use an adapted version of the NOS, which was developed to evaluate the quality of any observational design.[33] This adapted version has been used for previous systematic reviews[33] and includes four domains of risk or bias assessment: methods for selecting study participants (selection bias), methods to control for confounding (performance bias), statistical methods (detection bias) and methods for exposure and outcome assessment (information bias). Seven items compose the four domains. Each item is scored from 0 (high risk) to 3 (low risk) points. Therefore, the maximum score for each study could be 21 points. To assess the overall quality and the strength of the evidence per outcome, the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was used.[34] In brief, the GRADE classification was carry out according to the presence, or not, of the following identified factors: (i) risk of bias, (ii) inconsistency of results, (iii) indirectness, (iv) imprecision and (v) other considerations (eg, reporting bias). Two reviewers (JM-C and AL-S) judged whether these factors were present for each outcome. The GRADE approach was only applied when at least the three studies informed of every outcome.

Statistical analysis

For the primary analysis, studies were grouped per outcome (pain intensity and disability). A meta-analysis could not be carried out as the heterogeneity was too high in terms of participant characteristics (mean age and duration of symptoms), sample size, metric of outcome measures, metric of psychological factor measures and statistical methods used in most of the potentially eligible studies. Consequently, a descriptive quantitative analysis (the most relevant summary measure with a precise estimate) was provided for every study. For the studies that reported results with several degrees of adjustment for confounders, in different models, the estimate was extracted from the model that showed the best adjustment. GRADEpro software,[35] and Review Manager (RevMan) V.5.3 (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014) software were used to process data during the review.

RESULTS

Study characteristics

A total of 2697 citations were identified through electronic databases, with 17 additional studies identified through reference screening. The authors screened 896 titles and abstracts, with 128 full-text articles finally being evaluated. The number of studies retrieved from each database and the number of studies excluded in each screening phase are shown in figure 1. The full reference of excluded studies in the last screening (n=101) is reported in online supplementary appendix C. The conflict of interests of included studies is reported in online supplementary appendix D. A total of 27 longitudinal studies (18 prospective cohort studies; 6 retrospective cohort studies and 3 secondary data analyses) with a total of 11 176 participants with CSP satisfied our inclusion criteria and were included in this review. Seventeen studies explored the role of psychological factors in people with CSP presurgery and postsurgery.[20 21 36–50] Ten studies evaluated this role in people with CSP without surgery.[22–25 51–56] The outcome measures included in this review were pain intensity[20 22 23 25 36–44 46–56] and disability.[20–25 38–54 56] The psychological factors were: depressive symptoms,[22 23 25 37–41 43 48–50 52 55] anxiety,[22 25 36 37 39–41 43 50 52 55] emotional distress,[25 43 44 51 52 54 56]

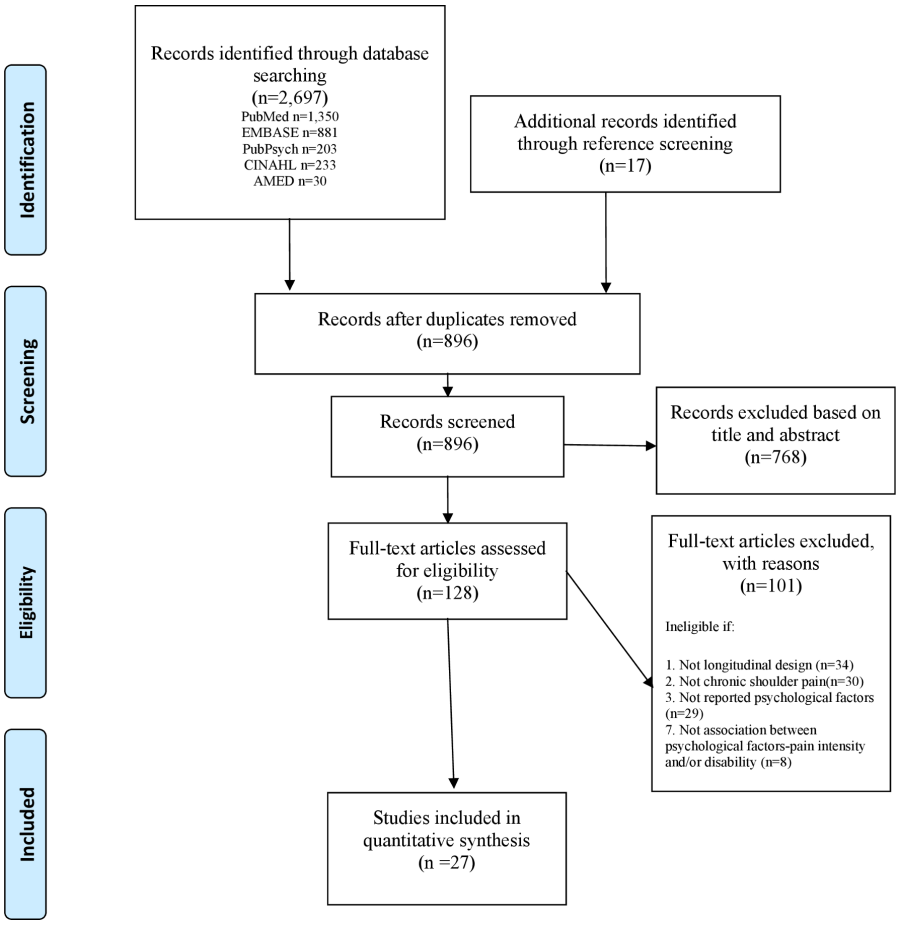

Figure 1 Flow diagram of review process. Adapted from Moher D, Liberati A, Tetzlaff J, *et al*. Preferred reporting items for systematic review and meta-analyses: the PRISMA Statement. *PLoS Med* 2009;6:e1000097. For more information, visit www.prisma-statement.org

self-efficacy,[22 51 54 55] expectations of recovery,[20–22 42 45 46 51] pain catastrophising,[24 25 36–38 53 55] FA beliefs,[24 53 55] somatisation,[25 43] fear of pain,[36] kinesiophobia,[36] optimism,[53] pain acceptance,[55] preoperative concerns,[21] sleep disturbances,[39] coping with pain,[25] internal and external locus of control[25] and resilience.[47] The characteristics of the included studies are reported in table 1.

Methodological quality

The degree to which studies met the quality criteria varied considerably, ranging from 7/21 to 13/21. The risk of bias assessment for the included studies is presented in table 2.

The role of psychological factors in the perpetuation of symptoms (pain intensity and disability) in people with CSP

After analysing the risk of bias for the included studies, the strength and the quality of the evidence for each outcome was determined using the GRADE approach. Since observational studies were included and methodological limitations, inconsistencies, indirectness of evidence, imprecisions of results and other issues were presented, a very low level of evidence was found for each outcome (table 3). A description of the statistical results is reported in table 4 for pain intensity and in table 5 for disability.

The role of psychological factors on pain intensity in people with CSP without surgery

The role of psychological factors on pain intensity in people with CSP without surgery was explored in 10 studies.[22 23 25 51–56] High levels of self-efficacy[22 54] and expectations of recovery[22] were significantly associated with low levels of pain intensity. High levels of emotional distress,[54] depressive symptoms,[22 23] anxiety,[22] FA beliefs[55] and pain catastrophising[25] were significantly associated with high levels of pain intensity. There was no statistical relationship between optimism, somatisation, coping with pain, internal and external locus of control or pain acceptance and pain intensity in people with CSP without surgery.

The role of psychological factors on pain intensity in people with CSP presurgery and postsurgery

The role of psychological factors on pain intensity in people with CSP presurgery and postsurgery was analysed in 15 studies.[20 36–44 46–50] High levels of resilience[47] and preoperative expectations[20 46] were significantly associated with low levels of pain intensity. High levels of

Table 1 Characteristics of included studies

First author	Year	No. of participants	Mean age (years)	Duration of symptoms	Psychological factor	Outcome measure: pain intensity	Outcome measure: disability	Data collection (follow-up)	Study design
Badcock *et al*[52]	2002	4002 (304 with unilateral shoulder pain) (142 completed the follow-up)	47.7	≥1 year to ≤3 years	Anxiety (HADS-A); depressive symptoms (HADS-D); emotional distress (HADS)	Pain intensity (5-point Likert scale)	Disability (disability questionnaire)	(T1) at baseline; (T2) 24 months	L (prospective cohort study)
Chester *et al*[22]	2016	1030 (772 completed all follow-ups)	57 (SD 15)	14 months (SD 28)	Pain self-efficacy (PSEQ); expectations of recovery (not reported); anxiety (not reported); depressive symptoms (not reported)	Pain intensity (SPADI and QuickDASH)	Disability (SPADI and QuickDASH)	(T1) at baseline; (T2) 6 weeks; (T3) 6 months	L (prospective cohort study)
Cho *et al*[39]	2015	58 (47 completed all follow-ups)	57 (SD 8)	25 months (SD 36)	Anxiety (HADS-A); depressive symptoms (HADS-D); sleep disturbances (PSQI)	Pain intensity (VAS)	Disability (ASES)	(T1) at baseline (before surgery); (T2) 3 months; (T3) 6 months; (T4) 12 months after surgery	L (prospective cohort study)
Cho *et al*[40]	2017	60 (46 completed the follow-up)	65.7 (SD 10.1)	8.0 years (SD 9.8 years)	Anxiety (HADS-A); depressive symptoms (HADS-D)	Pain intensity (VAS)	Disability (ASES)	(T1) at baseline (before surgery); (T2) 3 months; (T3) 6 months; (T4) 12 months after surgery	L (prospective cohort study)
Coronado *et al*[53]	2017	78 (63 completed the follow-up)	38.8 (SD 14.9)	<6 months	Pain catastrophising (PCS); fear-avoidance beliefs (FABQ); optimism (LOT-R)	Pain intensity (BPI)	Disability (Penn-F)	(T1) at baseline; (T2) 3 months	L (secondary data analysis)
Dekker *et al*[41]	2016	86 (44 completed all follow-ups)	53.6 (depressed group); 56.2 (non-depressed group)	>3 months	Anxiety (HADS-A); depressive symptoms (HADS-D)	Pain intensity (VAS and OSS)	Disability (OSS)	(T1) at baseline; (T2) 6 weeks; (T3) 6 months after surgery	L (retrospective cohort study)
Ekeberg *et al*[51]	2010	106 (104 completed the follow-up)	52 (SD 12)	Between 6 months and >24 months	Emotional distress (HSCL); self-efficacy for pain (7-point ordinal scale); expectations of recovery (7-point ordinal scale)	Pain intensity (SPADI)	Disability (SPADI)	(T1) at baseline; (T2) 6 weeks after intervention	L (secondary data analysis)
Engebretsen *et al*[54]	2010	104 (94 completed the follow-up)	48 (SD 10.7)	3 months ->12 months	Emotional distress (HSCL); pain self-efficacy (four items from ASES)	Pain intensity (SPADI)	Disability (SPADI)	(T1) at baseline; (T2) 12 months	L (prospective cohort study)
George *et al*[36]	2008	59 (47 completed the follow-up)	50.3 (SD 15.0)	>3 months	Fear of pain (FPQ-III); kinesiophobia (TSK-11); pain catastrophising (PCS); anxiety (STAI)	Pain intensity (BPI)	-	(T1) at baseline (presurgery); (T2) 3–5 months after surgery	L (prospective cohort study)
Gill *et al*[23]	2013	2337 (206 with CSP completed all follow-ups)	51.1 (SD 3.0)	>3 months	Depressive symptoms (CES-D)	Pain intensity (SPADI)	Disability (SPADI)	(T1) at baseline; (T2) median 48 months	Longitudinal (prospective cohort study)
Henn *et al*[20]	2007	125	56.2 (SD 11.4)	16.0 months (SD 25.9)	Preoperative expectations (MODEMS)	Pain intensity (VAS and DASH)	Disability (SST, VAS and DASH)	(T1) at baseline; (T2) 12 months after surgery	Longitudinal (retrospective cohort study)

Continued

Table 1 Continued

First author	Year	No. of participants	Mean age (years)	Duration of symptoms	Psychological factor	Outcome measure: pain intensity	Outcome measure: disability	Data collection (follow-up)	Study design
Jawa *et al*[42]	2016	74	60.8	>3 months	Preoperative expectations (list of 10 items)	Pain intensity (VAS)	Disability (ASES)	(T1) at baseline; (T2) minimum of 36 months after surgery	Longitudinal (retrospective cohort study)
Karlsson *et al*[55]	2016	57	43 (SD 8.5)	8.5 years	Anxiety (HADS-A); depressive symptoms (HADS-D); pain catastrophising (PCS); fear-avoidance beliefs (FABQ); general self-efficacy (GSES); pain self-efficacy (PSEQ); pain acceptance (CPAQ)	Pain intensity (NRS)	–	(T1) at baseline; (T2) 46 months; (T3) 12 months after intervention	Longitudinal (secondary data analysis)
Koorevaar *et al*[43]	2016	315	52 (SD 16)	32 months (SD 40)	Emotional distress, anxiety, depressive symptoms and somatisation (4DSQ)	Pain intensity (DASH and 7-point Likert scale)	Disability (DASH and 7-point Likert scale)	(T1) at baseline; (T2) 12 months after surgery	Longitudinal (prospective cohort study)
Kromer *et al*[24]	2014	90 (88 completed the follow-up)	51.8 (SD 11.2)	84.7% >3 months	Pain catastrophising (PCS); fear-avoidance beliefs (FABQ)	–	Disability (SPADI)	(T1) at baseline; (T2) 3 months after intervention	Longitudinal (prospective cohort study)
Macfarlane *et al*[56]	1998	135 (92 completed the follow-up)	18–74	>3 months	Emotional distress (GHQ)	Pain intensity (one item: "Do you have shoulder pain today?")	Disability (disability questionnaire)	(T1) at baseline; (T2) 36 months	Longitudinal (prospective cohort study)
Oh *et al*[21]	2012	128	58.8	>3 months	Preoperative expectations (MODEMS); preoperative concerns (64 items with a 4-point Likert scale)	–	Disability (SST and Constant-Murley score)	(T1) at baseline; (T2) mean 13.7 months (ranging 12–37 months) after surgery	L (prospective cohort study)
Potter *et al*[44]	2015	89 (70 completed the follow-up)	60 (SD 2)	>3 months	Emotional distress (DRAM divided in: ZUNG questionnaire and MSPQ)	Pain intensity (VAS)	Disability (ASES)	(T1) at baseline; (T2) 12 months after surgery	L (prospective cohort study)
Razmjou *et al*[45]	2011	185 (160 completed the follow-up)	57 (SD 11)	Mean 43.42–46.48 months	Preoperative expectations (MODEMS)	–	Disability (WORC, ASES and QuickDASH)	(T1) at baseline; (T2) 6 months after surgery	L (prospective cohort study)
Reilingh *et al*[25]	2008	587 (242 with chronic shoulder pain at baseline)	52.9 (SD 13.3)	>3 months	Pain catastrophising, coping with pain, internal and external locus of control (PCCL); anxiety, depressive symptoms, somatisation, and emotional distress (4DSQ)	Pain intensity (NRS)	Disability (SDQ)	(T1) at baseline; (T2) 6 weeks; (T3) 3 months; (T4) 6 months	L (prospective cohort study)
Styron *et al*[46]	2015	467 (436 complete the follow-up)	66.6 (SD 10.3)	20.9 months	Expectations of recovery (10-point Likert scale);	Pain intensity (PSS pain subscore)	Disability (PSS function subscore and SF-12-PCS score)	(T1) at baseline; (T2) 6 months after surgery	L (prospective cohort study)
Tokish *et al*[47]	2017	70	65 (SD 10)	>3 months	Resilience (BRS)	Pain intensity (ASES)	Disability (ASES, SANE and Penn)	(T1) at baseline; (T2) 24 months (minimum) after surgery	L (retrospective cohort study)

Continued

Table 1 Continued

First author	Year	No. of participants	Mean age (years)	Duration of symptoms	Psychological factor	Outcome measure: pain intensity	Outcome measure: disability	Data collection (follow-up)	Study design
Valencia *et al*[37]	2011	59 (48 completed the follow-up)	50.39 (SD 14.92)	>3 months	Depressive symptoms (BDI); anxiety (STAI); pain catastrophising (PCS)	Pain intensity (BPI)	–	(T1) at baseline; (T2) 3 months after surgery	L (prospective cohort study)
Valencia *et al*[38]	2014	78 (73 completed all follow-ups)	43.25 (SD) to 51.35 (SD 20.73)	68.98 (SD 68.59) to 88.78 (SD 137.13) weeks	Depressive symptoms (PHQ-9); pain catastrophising (PCS)	Pain intensity (BPI)	Disability (DASH)	(T1) at baseline; (T2) 3 months (T2) 6 months after surgery	L (prospective cohort study)
Werner *et al*[48]	2016	150	71.6 (SD 8.8)	>3 months	Depressive symptoms (from database registry)	Pain intensity (ASES)	Disability (ASES)	(T1) at baseline; (T2) 24 months (minimum) after surgery	L (retrospective cohort study)
Werner *et al*[49]	2017	616	67.0 (SD 7.4)	>3 months	Depressive symptoms (measurement instrument not reported)	Pain intensity (ASES)	Disability (ASES, SF-12-PCS)	(T1) at baseline; (T2) 24 months after surgery	L (retrospective cohort study)
Yeoman et al[50]	2012	31	54.6	26 months	Depressive symptom (HADS-D); anxiety (HADS-A)	Pain intensity (VAS)	Disability (OSS)	(T1) at baseline; (T2) 2 weeks; (T3) 3 weeks; (T4) 6 weeks after surgery	L (prospective cohort study)

4DSQ, the 50-item Four-Dimensional Symptoms Questionnaire; ASES, Arthritis Self-Efficacy Scale; BDI, the Beck Depression Inventory; BPI, Brief Pain Inventory; BRS, the Brief Resilience Scale; CPAQ, the Chronic Pain Acceptance Questionnaire; DASH, the Quick Disability of the Arm, Shoulder and Hand Questionnaire; DRAM, the Distress Risk Assessment Method Questionnaire; FABQ, the Fear-Avoidance Beliefs Questionnaire; FPQ-III, the Fear of Pain Questionnaire; GHQ, the General Health Questionnaire; GSES, the General Self-Efficacy Scale; HADS, the Hospital Anxiety and Depression Scale; HSCL, the Hopkins Symptoms Checklist; LOT-R, Life Orientation Test-Revised; L , longitudinal; MODEMS, the Musculoskeletal Outcomes Data Evaluation and Management System Questionnaire; MSPQ, Modified Somatic Perceptions Questionnaire; OSS, the Oxford Shoulder Score; PCCL, the 43-item Pain Coping and Cognition List; PCS, the Pain Catastrophising Scale; Penn-F, Pennsylvania Shoulder Score function subscale; PHQ-9: the Patient Health Questionnaire; PSEQ, the Pain Self-Efficacy Scale; PSQI, the Pittsburgh Sleep Quality Index; PSS, the Penn Shoulder Score; SANE, Single Assessment Numeric Evaluation; SDQ, Shoulder Disability Questionnaire; SF-12, the General Health-Related Quality of life Physical Component Summary (PCS) Score; SPADI, the Shoulder Pain and Disability Index; SST, the Simple Shoulder Test; STAI, the State Trait-Anxiety Index; TSK, the Tampa Scale for Kinesiophobia; WORC, the Western Ontario Rotator Cuff index; ZUNG questionnaire: modified Zung Depression Scale.

Table 2 Methodological quality of included studies (the Newcastle Ottawa Scale (NOS) adapted version)

		Selection bias	Performance bias		Detection bias		Information bias		
First author	Year	A	B	C	D	E	F	G	Total score
Badcock *et al*[52]	2002	1	0	2	1	0	2	2	8/21
Chester *et al*[22]	2016	3	3	2	2	0	0	2	12/21
Cho *et al*[39]	2015	2	3	0	1	0	2	2	10/21
Cho *et al*[40]	2017	2	3	0	1	0	2	2	10/21
Coronado *et al*[53]	2017	1	0	2	2	2	3	2	12/21
Dekker *et al*[41]	2016	2	3	0	1	0	2	2	10/21
Ekeberg *et al*[51]	2010	1	0	2	2	3	2	2	12/21
Engebretsen *et al*[54]	2010	1	0	3	2	3	2	2	13/21
George *et al*[36]	2008	1	0	1	2	0	2	2	8/21
Gill *et al*[23]	2013	1	0	3	2	3	2	2	13/21
Henn III *et al*[20]	2007	1	0	2	2	3	2	2	12/21
Jawa *et al*[42]	2016	1	0	0	0	3	1	2	7/21
Karlsson *et al*[55]	2016	0	0	2	2	3	3	2	12/21
Koorevaar *et al*[43]	2016	1	0	2	2	3	3	2	13/21
Kromer *et al*[24]	2014	1	0	2	2	3	3	2	13/21
Macfarlane *et al*[56]	1998	1	0	2	0	0	2	2	7/21
Oh *et al*[21]	2012	1	0	0	1	3	2	2	9/21
Potter *et al*[44]	2015	1	0	0	2	0	3	2	8/21
Razmjou *et al*[45]	2011	2	1	1	2	1	3	2	12/21
Reilingh *et al*[25]	2008	1	0	3	2	0	2	2	10/21
Styron *et al*[46]	2015	1	0	2	1	1	1	2	8/21
Tokish *et al*[47]	2017	1	0	0	0	3	1	2	7/21
Valencia *et al*[37]	2011	1	0	0	1	0	3	2	7/21
Valencia *et al*[38]	2014	1	0	2	2	3	3	2	13/21
Werner *et al*[48]	2016	1	0	1	1	3	1	2	9/21
Werner *et al*[49]	2017	2	3	1	1	3	1	2	13/21
Yeoman et al [50]	2012	2	3	0	0	3	3	2	13/21

A, Is the source population (cases, controls, cohorts) appropriate and representative of the population of interest? B, Is the sample size adequate and is there sufficient power to detect a meaningful difference in the outcome of interest? C, Did the study identify and adjust for any variables or confounders that may influence the outcome? D, Did the study use appropriate statistical analysis methods relative to the outcome of interest? E, Is there little missing data and did the study handle it accordingly? F, Is the methodology of the outcome measurement explicitly stated and is it appropriate? G, Is there an objective assessment of the outcome of interest?

depressive symptoms,[37 41 43 48 49] anxiety,[41 43 50] pain catastrophising,[36 37] emotional distress[43] and somatisation[43] were significantly associated with high levels of pain intensity. There was no statistical relationship between sleep disturbances, fear of pain, kinesiophobia and pain intensity in people with CSP presurgery and postsurgery.

The role of psychological factors on disability in people with CSP without surgery

The role of psychological factors on disability in people with CSP without surgery was evaluated by nine studies.[22–25 51–54 56] High levels of self-efficacy[22 54] and expectations of recovery[22] were significantly associated with low levels of disability. High levels of depressive symptoms,[22 23 52] anxiety,[22 52] emotional distress[52 54] and pain catastrophising[53] were significantly associated with high levels of disability. There was no statistical relationship between coping with pain, internal and external locus of control, optimism, FA beliefs or somatisation and disability in people with CSP without surgery.

The role of psychological factors on disability in people with CSP presurgery and postsurgery

The role of psychological factors on disability in people with CSP presurgery and postsurgery was reported by 15 studies.[20 21 38–50] High levels of resilience[47] and preoperative expectations[20 21 46] were significantly associated with low levels of disability. High levels of depressive symptoms,[41 43 48 49] anxiety,[41 43] emotional distress,[43] preoperative concerns[21] and somatisation[43] were significantly

Table 3 Summary of findings and quality of evidence assessment

Summary of findings			Quality of evidence assessment (GRADE)						
Outcome	No. of studies	No. of participants	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Level of evidence	Importance
Depressive symptoms									
Pain intensity	14	9466	Very serious*	Very serious†	Very serious‡	Very serious§	Reporting bias detected¶	Very low	Critical
Disability	12	9350	Very serious*	Very serious†	Very serious‡	Very serious§	Reporting bias detected¶	Very low	Critical
Anxiety									
Pain intensity	11	6344	Very serious*	Very serious†	Very serious‡	Very serious§	Reporting bias detected¶	Very low	Critical
Disability	8	6169	Very serious*	Very serious†	Very serious‡	Very serious§	Reporting bias detected¶	Very low	Critical
Emotional distress									
Pain intensity	7	5336	Very serious*	Very serious†	Very serious‡	Very serious§	Reporting bias detected¶	Very low	Critical
Disability	7	5336	Very serious*	Serious†	Very serious‡	Very serious§	Reporting bias detected¶	Very low	Critical
Self-efficacy									
Pain intensity	4	1297	Serious*	Serious†	Very serious‡	Serious§	N/A	Very low	Critical
Disability	3	1240	Serious*	Serious†	Very serious‡	Serious§	N/A	Very low	Critical
Expectations of recovery									
Pain intensity	5	1802	Very serious*	Very serious†	Very serious‡	Very serious§	Reporting bias detected¶	Very low	Critical
Disability	7	2115	Very serious*	Very serious†	Very serious‡	Very serious§	Reporting bias detected¶	Very low	Critical
Pain catastrophising									
Pain intensity	6	918	Very serious*	Serious†	Serious‡	Very serious§	N/A	Very low	Critical
Disability	4	833	Serious*	Very serious†	Very serious‡	Serious§	Reporting bias detected¶	Very low	Critical

*Randomised trials (lack of allocation concealment; lack of blinding; incomplete accounting of patients and outcomes events; selective outcome reporting bias; other limitations; observational studies (failure to develop and apply appropriate eligibility criteria; flawed measurement of both exposure and outcome; failure to adequate control confounding; incomplete follow-up; non-presence of an unexposed cohort).
†Point estimates vary widely across studies; CIs show minimal or no overlap.
‡ Differences in population, differences in intervention, differences in outcome, indirect comparison.
§ Optimal information size (OIS) criterion is not met and the sample size is small; OIS criterion is met but the 95% CI around an effect does not exclude 1.0 (wide CIs); 95% CI is not reported.
¶ Outcome data not included in the predictive model.
N/A, not available.

associated with high levels of disability. There was no statistical relationship between sleep disturbances and disability in people with CSP presurgery and postsurgery.

DISCUSSION

Statement of principal findings

The objective of this systematic review was to explore the role of psychological factors in the perpetuation of symptoms (pain intensity and disability) in people with CSP, based on the analysis of longitudinal studies. Our results suggest that there is a relationship between high levels of self-efficacy, resilience and expectations of recovery with low levels of pain intensity and disability. Inversely, there is also a relationship between high levels of emotional distress, depressive symptoms, anxiety, preoperative concerns, FA beliefs, somatisation or pain catastrophising and high levels of pain intensity and disability in people with CSP. Nevertheless, the quality and the strength of evidence was very low, and the risk of bias was substantial so firm conclusions could not be drawn.

Comparison with other studies

Our findings suggest that people with CSP who present certain psychological features (eg, depressive symptoms or fear) are prone to develop greater levels of pain intensity and disability. This statement is in accordance with previous systematic reviews in chronic pain conditions[57–60]

Table 4 Summary of the statistical results about the association between psychological factors and pain intensity (longitudinal analysis)

The role of psychological factors in the perpetuation of pain intensity in people with chronic shoulder pain	
The association between fear-avoidance and pain intensity	Baseline fear-avoidance beliefs (physical activity subscale)-pain intensity at 3 months: B (95% CI)=−0.01 (−0.20 to 0.19), P=0.090[53] Baseline fear-avoidance beliefs-pain intensity at baseline: r=0.04, P=0.75; **at 4–6 months: r=−0.33, P=0.029;** at 12 months: r=−0.29, P=0.08[55]
The association between fear of pain and pain intensity	Baseline fear of pain-pain intensity at 3–5 months: standardised B=0.08, P=0.584[36]
The association between kinesiophobia and pain intensity	Baseline kinesiophobia-pain intensity at 3–5 months: standardised B=−0.15, P=0.329[36]
The association between pain catastrophising and pain intensity	Baseline pain catastrophising-pain intensity at 3 months: B (95% CI)=0.11 (−0.11 to 0.32), P=0.213[53] **Baseline pain catastrophising-pain intensity at 3 months after surgery: standardised B=0.34, SE=0.04, P=0.04**[37] **Baseline pain catastrophising-pain intensity at 3– 5 months: standardised B=0.53, P=0.001**[36] **Baseline pain catastrophising-pain intensity at 6 months: mean (95% CI)=−0.62 (−1.03 to −0.20), P=0.001**[25] Baseline pain catastrophising-pain intensity at 6 months after surgery: standardised B=0.05, SE=0.03, P=0.70[38] Baseline pain catastrophising-pain intensity at baseline: r=0.02, P=0.88; at 4–6 months: r=−0.20, P=0.21; at 12 months: r=−0.06, P=0.73[55]
The association between self-efficacy and pain intensity	Baseline pain self-efficacy-pain intensity at 6 weeks after intervention: B (95% CI)=0.9 (−0.2 to 1.9), P=0.1[51] **Baseline pain self-efficacy-pain intensity at 6 months: B (95% CI)=−0.36 (−0.50 to −0.22), P<0.001**[22] **Baseline pain self-efficacy-pain intensity at 12 months: B (95% CI)=6.0 (2.0 to 9.9), P=0.004**[54] Baseline pain self-efficacy-pain intensity at baseline: r=−0.10, P=0.45; at 4–6 months: r=0.10, P=0.51; at 12 months: r=−0.20, P=0.23[55] Baseline general self-efficacy-pain intensity at baseline: r=0.12, P=0.37; at 4–6 months: r=0.21, P=0.18; at 12 months: r=0.19, P=0.27[55]
The association between expectations of recovery and pain intensity	Baseline expectations of recovery-pain intensity at 6 weeks after intervention: B (95% CI)=2.3 (−8.0 to 12.6), P=0.66[51] **Baseline expectations of recovery-pain intensity at 6 months:** much improved: B (95% CI)=−5.21 (−1.80 to 8.61), P=0.003**; slightly improved: B (95% CI)=−12.43 (−8.20 to −16.67), P<0.001;** no changes/worse: B (95% CI)=−0.94 (−8.53 to 6.66), P=0.809[22] **Baseline expectations of recovery-pain intensity at 6 months (PSS pain subscore): mean (95% CI)=1.99 (0.17 to 3.82), P=0.033**[46] **Preoperative expectations-pain intensity at 12 months: VAS B=9.91, P=0.005; DASH: B=11.93, P<0.001**[20] Association between preoperative expectations and pain intensity at a minimum of 3 years was not reported[42]
The association between optimism and pain intensity	Baseline optimism (in the model with pain catastrophising)-pain intensity at 3 months: B (95% CI)=−0.01 (−0.20 to 0.19)[53] Baseline optimism (in the model with fear-avoidance beliefs)-pain intensity at 3 months: B (95% CI)=−0.04 (−0.22 to 0.15)[53]
The association between internal and external locus of control and pain intensity	Baseline external locus of control-pain intensity at 6 months: 3–4: mean (95% CI)=−0.79 (−1.60 to 0.02), P=0.06; >4: mean (95% CI)=0.21 (−0.92 to 1.35), P=0.71[25]
The association between pain acceptance and pain intensity	Baseline pain acceptance-pain intensity at baseline: r=−0.14, P=0.32; at 4–6 months: r=0.14, P=0.40; at 12 months: r=−0.00, P=0.99[55]
The association between coping and pain intensity	Association between coping and pain intensity at 6 months was not reported[25]
The association between resilience and pain intensity	**Postoperative resilience-pain intensity (ASES): r=0.41–0.44, P<0.004**[47]
The association between sleep disturbances and pain intensity	Baseline sleep disturbances-pain intensity at 12 months after surgery: coefficient (95% CI)=0.040 (−0.082 to 0.163), P=0.664[39]
The association between somatisation and pain intensity	Baseline somatisation-pain intensity at 6 months: mean (95% CI)=−0.16 (−1.01 to 0.68), P=0.71[25] Baseline somatisation-pain intensity (DASH) at 12 months: coefficient (95% CI)=−3.00 (−10.53 to 4.52), P=0.43; pain intensity at 12 months (Likert scale): coefficient (95% CI)=−0.12 (−0.62 to 0.37), P=0.63[43] Somatisation at 12 months-pain intensity (DASH) at 12 months: **coefficient (95% CI)=−14.37 (−21.23 to −7.51), P<0.001**; pain intensity at 12 months (Likert scale): coefficient (95% CI)=−0.37 (−0.82 to −0.83), P=0.11[43]

Continued

Table 4 Continued

The role of psychological factors in the perpetuation of pain intensity in people with chronic shoulder pain	
The association between emotional distress and pain intensity	Emotional distress-pain intensity at 6 weeks after intervention: B (95% CI)=7.4 (−3.0 to 17.8), P=0.16[51] **Baseline emotional distress-pain intensity at 12 months: B (95% CI)=10.3 (−1 to 21.6), P=0.073**[54] Baseline emotional distress-pain intensity (DASH) at 12 months: coefficient (95% CI)=0.30 (−6.09 to 6.7), P=0.93; pain intensity at 12 months (Likert scale): coefficient (95% CI)=0.31 (−0.12 to 0.74), P=0.16[43] Emotional distress at 12 months-pain intensity (DASH) at 12 months: **coefficient (95% CI)=−20.63 (−27.25 to −14.00), P<0.001**; pain intensity at 12 months (Likert scale): **coefficient (95% CI)=−0.95 (−1.39 to −0.51), P<0.001**[43] Baseline emotional distress (ZUNG questionnaire)-pain intensity at 12 months: B=−0.18, P=0.084 Baseline emotional distress (MSPQ)-pain intensity at 12 months: B=−0.10, P=0.658[44] Baseline emotional distress-pain intensity at 3 years: GHQ score 0–1: OR (95% IC)=1.0; GHQ score 2–4: OR (95% CI)=0.8 (0.3 to 2.7); GHQ score≥5: OR (95% CI)=2.6 (0.8 to 7.7)[56] Changes in emotional distress and changes in pain intensity at 24 months were not reported[52] Association between emotional distress and pain intensity was not reported[25]
The association between depressive symptoms and pain intensity	Baseline depressive symptoms-pain intensity 2 weeks postsurgery: r=0.463; 3 weeks: r=0.261; 6 weeks; r=0.191[50] **Baseline depressive symptoms-pain intensity at 3 months after surgery: standardised B=0.33, SE=0.06, P=0.04**[37] Baseline depressive symptoms-pain intensity at 6 months after surgery: standardised B=0.18, SE=0.05, P=0.15[38] **Baseline depressive symptoms-pain intensity at baseline (r=0.309, P<0.05); 6 weeks (r=0.376, P<0.01); 6 months after surgery (r=0.508, P<0.01)**[41] **Baseline depressive symptoms-pain intensity (OSS) at baseline (r=−0.319, P<0.01); 6 weeks (r=−0.490, P<0.01); 6 months after surgery (r=−0.626, P<0.01)**[41] **Baseline depressive symptoms-pain intensity at 48 months (median): no depression: OR=1; depressive symptoms: OR (95% CI)=1.96 (1.07 to 3.58), P=0.029**[23] Baseline depressive symptoms-pain intensity at 12 months after surgery: coefficient (95% CI)=−0.073 (−0.298 to 0.152), P=0.515[39] Baseline depressive symptoms-pain intensity at 12 months after surgery: coefficient (95% CI)=−0.016 (−0.276 to 0.244), P=0.899[40] Baseline depressive symptoms-pain intensity at baseline: r=0.14, P=0.29; at 4–6 months: r=−0.19, P=0.22; at 12 months: r=−0.11, P=0.95[55] Baseline depressive symptoms-pain intensity (DASH) at 12 months: coefficient (95% CI)=−4.68 (−14.72 to −5.36), P=0.36; pain intensity at 12 months (Likert scale): coefficient (95% CI)=0.09 (−0.56 to 0.74), P=0.78[43] Depressive symptoms at 12 months-pain intensity (DASH) at 12 months: **coefficient (95% CI)=−16.59 (−23.86 to −9.32), P<0.001**; pain intensity at 12 months (Likert scale): **coefficient (95% CI)=−0.79 (−1.26 to −0.32), P=0.001**[43] **Baseline depressive symptoms-pain intensity at a minimum of 24 months: OR (95% CI)=11.2 (2.0 to 61.3), P=0.005**[48] **Baseline depressive symptoms-pain intensity (ASES) at 24 months: P=0.018**[49] Changes in depressive symptoms and changes in pain intensity at 24 months were not reported[52] Association between depressive symptoms and pain intensity was not reported[25]
The association between anxiety and pain intensity	Baseline anxiety-pain intensity **2 weeks postsurgery: r=0.026, P<0.05**; 3 weeks: r=0.364; 6 weeks: r=0.301[50] Baseline anxiety-pain intensity at 3 months after surgery: standardised B=−0.22, SE=0.04, P=0.26[37] Baseline anxiety-pain intensity at 3–5 months: standardised B=0.07, P=0.646[36] **Baseline anxiety-pain intensity at baseline (r=0.309, P<0.05); 6 weeks (r=0.376, P<0.01); 6 months after surgery (r=0.508, P<0.01)**[41] **Baseline anxiety-pain intensity (OSS) at baseline (r=−0.319, P<0.01); 6 weeks (r=−0.490, P<0.01); 6 months after surgery (r=−0.626, P<0.01)**[41] Baseline anxiety-pain intensity at 12 months after surgery: coefficient (95% CI)=0.115 (−0.053 to 0.283), P=0.174[39] Baseline anxiety-pain intensity at 12 months after surgery: coefficient (95% CI)=−0.010 (−0.363 to 0.142), P=0.382[40] Baseline anxiety-pain intensity at baseline: r=0.16, P=0.26; at 4–6 months: r=−0.18, P=0.22; at 12 months: r=−0.26, P=0.13[55] Baseline anxiety-pain intensity (DASH) at 12 months: coefficient (95% CI)=−6.25 (−13.84 to 1.30), P=0.10; pain intensity at 12 months (Likert scale): coefficient (95% CI)=−0.27 (−0.75 to 0.21), P=0.27[43] Anxiety at 12 months-pain intensity (DASH) at 12 months: **coefficient (95% CI)=−11.62 (−19.15 to −4.10), P=0.003**; pain intensity at 12 months (Likert scale): coefficient (95% CI)=−0.46 (−0.94 to 0.19), P=0.06[43] Changes in anxiety and changes in pain intensity at 24 months were not reported[52] Association between anxiety and pain intensity was not reported[25]

*Significant results are shown in bold.
ASES, Arthritis Self-Efficacy Scale; B, beta-coefficient; DASH, the Quick Disability of the Arm, Shoulder and Hand Questionnaire; GHQ, the General Health Questionnaire; MSPQ, Modified Somatic Perceptions Questionnaire; OSS, the Oxford Shoulder Score; PSS, the Penn Shoulder Score; r, Pearson's coefficient of correlation; VAS, Visual Analogue Scale; ZUNG questionnaire: modified Zung Depression Scale.

Table 5 Summary of the statistical results for the association between psychological factors and disability (longitudinal analysis)

The role of psychological factors in the perpetuation of disability in people with chronic shoulder pain	
The association between fear-avoidance and disability	Baseline fear-avoidance (physical activity subscale)-disability (function) at 3 months: B (95% CI)=−0.13 (-0.31 to 0.05), P=0.092[53] Baseline fear-avoidance beliefs-disability at 3 months: B (95% CI)=−0.102 (-1.14 to −0.36), P=0.305, VIF=1.51[24]
The association between pain catastrophising and disability	**Baseline pain catastrophising-disability (function) at 3 months: B (95% CI)=−0.19 (−0.37 to −0.01), P<0.05**[53] Baseline pain catastrophising-disability at 3 months: B (95% CI)=0.083 (− 0.23 to 0.59), P=0.381, VIF=1.40[24] Baseline pain catastrophising-disability at 6 months after surgery: standardised B=0.23, SE=0.24, P=0.11[38] Association between baseline pain catastrophising-disability at 6 months was not reported[25]
The association between self-efficacy and disability	Baseline pain self-efficacy-disability at 6 weeks after intervention: B (95% CI)=0.9 (−0.2 to 1.9), P=0.1[51] **Baseline pain self-efficacy-disability at 6 months follow-up: B (95% CI) =−0.36 (−0.50 to −0.22), P<0.001** (statistical data of QuickDASH not reported)[22] **Baseline pain self-efficacy-disability at 12 months: B (95% CI)=6.0 (2.0 to 9.9), P=0.004**[54]
The association between expectations of recovery and disability	Baseline expectations of recovery-disability at 6 weeks after intervention: B (95% CI)=2.3 (−8.0 to 12.6), P=0.66[51] **Baseline expectations of recovery-disability at 6 months:** much improved: B (95% CI)=−5.21 (−1.80 to 8.61), P=0.003**; slightly improved: B (95% CI)=−12.43 (−8.20 to −16.67), P<0.001;** no changes/worse: B (95% CI)=−0.94 (−8.53 to 6.66), P=0.809 (statistical data of QuickDASH not reported)[22] Preoperative expectations-disability at 6 months: F value=1.89 df (R^2)=3, P=0.1349[45] **Baseline expectations of recovery-disability at 6 months (PSS-function subscore): mean (95% CI)=2.65 (0.14 to 5.16), P=0.039;** (SF-12-PCS score): mean (95% CI)=−0.06 (−0.78 to 0.65), P=0.858[46] **Preoperative expectations-disability at 12 months: VAS B=8.30, P=0.023; DASH: B=11.93, P<0.001; SST: B=15.34, P<0.001**[20] **High expectations at follow-up-disability Constant Murley at baseline: OR (95% CI)=0.868 (0.82 to 0.91), P<0.001, R^2=−0.142; SST: P=0.007**[21] Association preoperative expectations-disability at a minimum of 3 years was not reported[42]
The association between optimism and disability	Baseline optimism (in the model with pain catastrophising)-disability (function) at 3 months: B (95% CI)=0.05 (−0.12 to 0.22)[53] Baseline optimism (in the model with fear-avoidance beliefs)-disability (function) at 3 months: B (95% CI)=0.10 (-0.06 to 0.26)[53]
The association between internal and external locus of control and disability	Association between baseline locus of control-disability at 6 months was not reported[25]
The association between coping and disability	Association between coping and disability at 6 months was not reported[25]
The association between resilience and disability	**Postoperative resilience-disability (ASES and Penn): r=0.41–0.44, P<0.004**[47]
The association between sleep disturbances and disability	Baseline sleep disturbances-disability at 12 months after surgery: coefficient (95% CI)=0.386 (-− 1.330 to 0.558), P=0.415[39]
The association between preoperative concerns and disability	Preoperative concerns-disability Constant Murley: P=0.361; **SST: P=0.018**[21]
The association between somatisation and disability	Baseline somatisation-disability (DASH) at 12 months: coefficient (95% CI)=−3.00 (-10.53 to 4.52), P=0.43; disability at 12 months (Likert scale): coefficient (95% CI)=−0.12 (-0.68 to 0.45), P=0.69[43] Somatisation at 12 months-disability (DASH) at 12 months: **coefficient (95% CI)=−14.37 (-21.23 to −7.51), P<0.001**; disability at 12 months (Likert scale): **coefficient (95% CI)=−0.62 (−1.13 to −0.10), P=0.02**[43] Association between baseline somatisation-disability at 6 months was not reported[25]
The association between emotional distress and disability	Emotional distress-disability at 6 weeks after intervention: B (95% CI)=7.4 (-3.0 to 17.8), P=0.16[51] **Baseline emotional distress-disability at 12 months: B (95% CI)=10.3 (−1 to 21.6), P=0.073**[54] Baseline emotional distress-disability (DASH) at 12 months: coefficient (95% CI)=0.30 (-6.09 to 6.7), P=0.93; disability at 12 months (Likert scale): coefficient (95% CI)=0.19 (-0.31 to 0.69), P=0.45[43] Emotional distress at 12 months-disability (DASH) at 12 months: **coefficient (95% CI)=−20.63 (−27.25 to −14.00), P<0.001**; disability at 12 months (Likert scale): **coefficient (95% CI)=−0.98 (−1.49 to −0.47), P<0.001**[43] Baseline ZUNG questionnaire-disability at 12 months: B=0.44, P=0.262; baseline MSPQ-disability at 12 months: B=−0.40, P=0.645[44] **Changes emotional distress-changes disability at 24 months: r=0.341, P=0.002**[52] Association between baseline emotional distress-disability at 6 months was not reported[25] Association between baseline emotional distress-disability at 3 years was not reported[56]

Continued

Table 5 Continued

The role of psychological factors in the perpetuation of disability in people with chronic shoulder pain	
The association between depressive symptoms and disability	Baseline depressive symptoms-disability 2 weeks postsurgery: r=0.206; 3 weeks: r=0.947; 6 weeks: r=0.405[50] Baseline depressive symptoms-disability at 6 months: moderate: B (95% CI)=2.19 (-0.99 to 5.37), P=0.177; **extreme: B (95% CI)=12.02 (1.49 to 22.56), P=0.025** (statistical data of QuickDASH not reported)[22] **Baseline depressive symptoms-disability (OSS) at baseline (r=−0.319, P<0.01); 6 weeks (r=−0.490, P<0.01); 6 months after surgery (r=−0.626, P<0.01)**[41] Baseline depressive symptoms-disability at 6 months after surgery: standardised B=0.16, SE=0.39, P=0.24[38] Baseline depressive symptoms-disability at 12 months after surgery: coefficient (95% CI)=0.235 (−1.492 to 1.963), P=0.785[39] Baseline depressive symptoms-disability at 12 months after surgery: coefficient (95% CI)=0.140 (−2.030 to 2.309), P=0.897[40] Baseline depressive symptoms-disability (DASH) at 12 months: coefficient (95% CI)=−4.68 (−14.72 to −5.36), P=0.36; disability at 12 months (Likert scale): coefficient (95% CI)=0.07 (−0.68 to 0.82), P=0.85[43] Depressive symptoms at 12 months-disability (DASH) at 12 months: **coefficient (95% CI)=−16.59 (−23.86 to −9.32), P<0.001**; disability at 12 months (Likert scale): **coefficient (95% CI)=−0.93 (−1.47 to −0.38), P=0.001**[43] **Baseline depressive symptoms-disability at a minimum of 24 months: OR (95% CI)=11.2 (2.0 to 61.3), P=0.005**[48] **Baseline depressive symptoms-disability (ASES) at 24 months: P=0.018**[49] **Baseline depressive symptoms-SF-12-PCS at 24 months: P=0.006**[49] **Changes depressive symptoms-changes disability at 24 months: r=0.372, P=0.001**[52] **Baseline depressive symptoms-disability at 4 years (median): no depression: OR=1; depressive symptoms: OR (95% CI)=1.96 (1.07 to 3.58), P=0.029**[23] Association between baseline depressive symptoms-disability at 6 months was not reported[25]
The association between anxiety and disability	Baseline anxiety-disability 2 weeks postsurgery: r=0.087; 3 weeks: r=0.817; 6 weeks: r=0.341[50] Baseline anxiety-disability at 6 months: moderate: B (95% CI)=2.19 (-0.99 to 5.37), P=0.177**; extreme: B (95% CI)=12.02 (1.49 to 22.56), P=0.025** (statistical data of QuickDASH not reported)[22] **Baseline anxiety-disability (OSS) at baseline (r=−0.319, P<0.01); 6 weeks (r=−0.490, P<0.01); 6 months after surgery (r=−0.626, P<0.01)**[41] Baseline anxiety-disability at 12 months after surgery: coefficient (95% CI)=−0.624 (−1.913 to 0.665), P=0.335[39] Baseline anxiety-disability at 12 months after surgery: coefficient (95% CI)=0.787 (−1.318 to 2.893), P=0.454[40] Baseline anxiety-disability (DASH) at 12 months: coefficient (95% CI)=−6.25 (−13.84 to 1.30), P=0.10; disability at 12 months (Likert scale): coefficient (95% CI)=−0.33 (−0.89 to 0.23), P=0.24[43] Anxiety at 12 months-disability (DASH) at 12 months: **coefficient (95% CI)=−11.62 (−19.15 to −4.10), P=0.003**; disability at 12 months (Likert scale): coefficient (95% CI)=−0.47 (−1.03 to −0.08), P=0.10[43] **Changes anxiety-changes disability at 24 months: r=0.265, P=0.017**[52] Association between baseline anxiety-disability at 6 months was not reported[25]

*Significant results are shown in bold.
B, beta-coefficient; DASH, the Quick Disability of the Arm, Shoulder and Hand Questionnaire; F, F statistics; PSS, the Penn Shoulder Score; r, Pearson's coefficient of correlation; R^2, coefficient of determination; SF-12, the General Health-Related Quality of life Physical Component Summary (PCS) Score; SST, the Simple Shoulder Test; VAS, Visual Analogue Scale; VIF, variance inflation factor.

and with the FA model of pain.[14–16] In brief, this model argues that people with high levels of pain catastrophising or fear, perceive their pain as a threat. Interestingly, they develop avoidance behaviours in order to prevent this real or potential injury or re-injury. Defensive escape behaviours are an adaptive response when a real or potential aversive outcome is imminent.[61] However, in chronic stages, these behaviours become maladaptive, which facilitates the physical inactivity of the affected area.[15] In the case of people with CSP, the disuse of the affected shoulder could diminish the ability to carry out daily life activities such as driving a vehicle, holding an object and/or or sleeping properly. A vicious cycle starts to emerge, as people with CSP might not understand how to confront their pain in different situations, and why that pain is not disappearing, even after a conservative treatment or surgical procedure. This could increase the levels of depressive symptoms, anxiety and fear, which affects the way in which the individuals perceive their pain experience, and therefore may cause more pain intensity and disability.[15]

Inversely, our results also suggest that people with CSP who present high levels of self-efficacy and expectations of recovery, may be able to have both better control and management of their lives.[62] People with CSP may be able to confront any daily situation that minimises the potential impact of the negative psychological factors mentioned above (eg, pain catastrophising). Several systematic reviews have explored the role of self-efficacy[62 63] and expectations of recovery[64] in patients with chronic pain. Jackson *et al*[62] concluded after analysing 86 studies that self-efficacy has a significant reverse association with disability, emotional distress and pain severity. Martinez-Calderon *et al*[63] reported that high levels of self-efficacy predict greater physical functioning, physical activity participation, health status and low pain intensity, disability and depressive symptoms, in chronic musculoskeletal pain. Ellis *et al*[64] found a positive

short-term association between expectations of recovery and patient's satisfaction and functional outcomes, after lumbar spine surgery. Therefore, the findings reported by our study and previous reviews[57–60 62 64] seem to support the potential role of psychological factors, favouring the perpetuation of pain intensity and disability in people with CSP, and minimising these symptoms based on their potential protective factors, for example, self-efficacy or expectations of recovery.

However, despite these promising findings, a lack of uniformity in terms of significance still exists, and our conclusions should be taken with caution. Several reasons could explain this issue. First, contrary to the FA model of pain, pain intensity has been considered as a robust and unique predictor of disability,[65 66] with it itself being a threatening experience that drives escape and avoidance.[67] Second, the number and duration of episodes, fluctuations of symptoms, healthcare use and the biopsychosocial profile of every individual with CSP, can vary considerably. Therefore, these individual differences in the development and the course of symptoms in people with CSP should be kept in mind when interpreting the contribution of each psychological factor during different stages of pain in order to convey a more comprehensive picture of this entity.

Strengths and weaknesses of the study

The strengths of this systematic review included the use of a prespecified protocol registered on PROSPERO, the PRISMA checklist, the GRADE approach to evaluate the overall quality and strength of the evidence, and the adapted NOS to determine the risk of bias in each study. There are several limitations that should be mentioned, as follows: (i) despite this review having been designed to be comprehensive with a robust search strategy that used a long variety of MeSH terms, as well as a manual search and grey literature, it is possible that some studies were not identified; (ii) some psychological factors are quite broad in definition and may increase the risk of finding conflicting evidence in their association with outcomes; (iii) risk of bias was reported in most of the included studies (table 2). For instance, reporting bias was revealed in some included studies and this could limit the findings of the present systematic review; (iv) a meta-analysis was not carried out because the heterogeneity of the included studies was too high, consequently the results of the present study are not robust, and conclusions should be interpreted with caution; (v) the causality and the impact of psychological factors in pain intensity and disability in this population cannot be determined due to the observational nature of the included studies (cohort studies without a non-exposed cohort), as well as the very low evidence of the obtained findings, and hence, firm conclusions could not be drawn; (vi) some shoulder presentations (eg, traumatic) were not considered as criteria in our search strategy, giving rise to the possibility of missing potential articles; (vii) despite the post-traumatic stress disorder profile being considered a relevant factor in other musculoskeletal conditions, for example, whiplash, this profile was not considered as a criteria in our search strategy; (viii) understanding about how psychological factors influence the transition from acute to CSP could be very important in establishing preventive strategies; however, this review did not include longitudinal studies examining the transition from acute to CSP.

Implications for clinical practice

Many psychological factors included in this study are considered a barrier to the adherence to treatment in different pain conditions.[68 69] However, psychological factors such as self-efficacy or pain catastrophising are considered modifiable factors that may facilitate pain relief and function recovery.[70 71] Therefore, clinicians and surgeons should be encouraged to identify these factors, through an assessment of the psychological profile of each individual with CSP, in the first consultation. Obtaining this information may be relevant to assist health providers in clinical decision-making with the aim of targeting which interventions (eg, pharmacological and/or behavioural) could be appropriate in enhancing positive (eg, self-efficacy) or reducing negative (eg, pain catastrophising) psychological factors.

Implications for further research

Despite the promising results found in this systematic review, a clear gap seems to exist in the literature which should be filled. This is based mainly on the flaws observed in the majority of the included studies in this review. Hence, some recommendations to guide future research are: (i) further studies prospectively analysing the role of psychological factors on pain intensity and disability in people with CSP including a non-exposed cohort; (ii) studies examining the role of psychological factors on CSP standardising metrics to assess psychological factors and outcome measures; (iii) studies establishing specific definitions for each psychological factor construct (eg, a clear distinction between fear of pain, FA beliefs or kinesiophobia); (iv) studies targeting modifiable psychological factors through biopsychosocial approaches; (v) studies exploring the role of psychological factors on treatment adherence in people with CSP; (vi) as CSP is a complex entity, a long list of factors (biological, biomechanical, occupational, contextual, environmental) apart from the psychological ones should be kept in mind prior to developing observational and experimental studies. Cluster analysis and mediation analysis are examples that may help to determine the importance of each factor.

CONCLUSIONS

This systematic review provides information about the role of psychological factors on pain intensity and disability in people with CSP. The available evidence suggests that there is a relationship between high levels of self-efficacy, resilience or expectations of recovery and low levels of pain intensity and disability. Inversely, there is also a

relationship between high levels of emotional distress, depressive symptoms, anxiety, preoperative concerns, FA beliefs, somatisation or pain catastrophising and high levels of pain intensity and disability in people with CSP. Nevertheless, due to the very low quality of the evidence, firm conclusions cannot be drawn, and further research is needed.

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