

Review Article

Determinants and predictors of absenteeism and return-to-work in workers with shoulder disorders

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Abstract.

BACKGROUND: Shoulder disorders lead to substantial productivity loss and determinants and predictors of sick leave are poorly known.

OBJECTIVE: To perform a systematic review on determinants and predictors of sick leave and delayed return-to-work (RTW) in workers with shoulder disorders.

METHODS: A systematic literature search was conducted and we included studies on workers with shoulder disorders that contained information on determinants or predictors for sick leave or RTW. The risk of bias of included studies was evaluated with a validated tool.

RESULTS: Eight studies were included and four had a high risk of bias. The only determinants that were found significantly associated with delayed RTW or sickness absence in more than one study were an atraumatic history, disease severity and previous sickness absence. A clinical prediction rule was developed to predict sick leave in one study and included the following predictors: a longer duration of sick leave prior to consultation, higher shoulder pain, strain/overuse in usual activities and psychological complaints.

CONCLUSION: Several determinants or predictors were identified in the present review, but there is currently inconsistent evidence on the role of any determinants or predictors of work absence or delayed RTW for workers with a shoulder disorder. More methodologically sound studies are needed.

Keywords: Upper extremity, occupational diseases, review

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1. Introduction

Work-related upper extremity disorders (WRUEDs) constitute altogether a major problem in modern societies (point prevalence ranging from 30% to 47%) [1] as they represent a primary cause of absenteeism from work [2, 3] and lead to substantial productivity loss (presenteeism) and economic costs [4–6]. Workers' compensation claims have dramatically increased in the last decades for WRUEDs [7] with certain industries or occupations entailing greater hazards of WRUED [8, 9]. Although only a small fraction of workers with WRUEDs are absent from work for long periods of time, these workers are associated with the highest proportion of cases with work absence exceeding 31 days [10].

The shoulder is the region most frequently reported as symptomatic by workers suffering from a WRUED, followed by the wrist/hand and the elbow [11]. As the shoulder is involved in most upper extremity activity, pain in this region can adversely affect daily living and result in substantial utilisation of health care resources, absenteeism from work and disability at work and outside the workplace [12]. Workers are especially at risk of developing shoulder problems and it is estimated that as much as 33% of workers with shoulder disorders are at risk of prolonged absence from work [13]. For example, a 10% to 23% risk of permanent work disability has been reported within two to five years after subacromial decompression [14, 15]. In the Canadian province of Quebec, the average length of a worker compensation claim was 150 days following a shoulder disorder in 2005–2007 [13]. Patients receiving workers' compensation benefits have also been shown to have inferior results following medical or rehabilitation intervention compared to patients not receiving these type of compensations [15]. Return to work (RTW) of workers with shoulder disorders is a complex issue and evidence shows that usual medical and rehabilitation interventions may not be enough to allow a durable RTW, and that other multimodal interventions may be needed to address the physical and psychosocial demands of the workplace [3, 8]. It is therefore important to better understand the natural history of work-related shoulder disorders, and to identify the role of clinical, psychosocial and occupational determinants on related sick leave and return to work (RTW).

Systematic reviews help synthesize information on a given topic and appraise the quality of available studies in order to answer specific questions. Several

systematic reviews are available on determinants of shoulder disorders in the general population. Kuijpers et al. [16] who were the first to systematically review the literature on potential prognostic factors of shoulder disorders, concluded that there was strong evidence that high pain intensity predicts a poorer outcome in primary care populations and that middle age was associated with poor outcome in occupational populations. They also concluded that there is moderate evidence that a long duration of complaints, and a high disability score at baseline predict a poorer outcome in primary care. Fermont et al. [17] completed a systematic review of determinants for successful recovery after rotator cuff tear arthroscopic repair and identified 12 factors associated with better recovery: younger age, male gender, higher bone mineral density, absence of diabetes mellitus, higher level of sports activity, greater preoperative range of motion, absence of obesity, smaller sagittal size of the cuff lesion, less retraction of the cuff, less muscle fatty infiltration, no multiple tendon involvement and no concomitant biceps or acromioclavicular joint procedures. However, none of these systematic reviews were specific to work-related shoulder disorders, nor to sick leave or RTW. In fact, no attempts have yet been made to conduct a systematic search of the literature and to summarise the available evidence regarding determinants or predictors of sick leave and successful RTW following work-related shoulder disorders. The aim of the present study was therefore to perform a systematic review on determinants of sick leave for work-related shoulder disorders and successful RTW in workers with shoulder disorders.

2. Methods

2.1. Literature search and study selection

A literature search for studies that identified determinants for return to work for workers with shoulder disorders was conducted in CINAHL, PUBMED and EMBASE using a combination of keywords and MESH terms (Fig. 1). All databases were searched from their date of inception to December 2014. Reference lists of all retrieved studies were searched for further relevant studies. This systematic review followed the PRISMA guidelines [18].

After removing duplicates, the titles and abstracts of each article were reviewed independently by two raters (FD and JSR) and were included for full review if they met the following criteria: 1) included

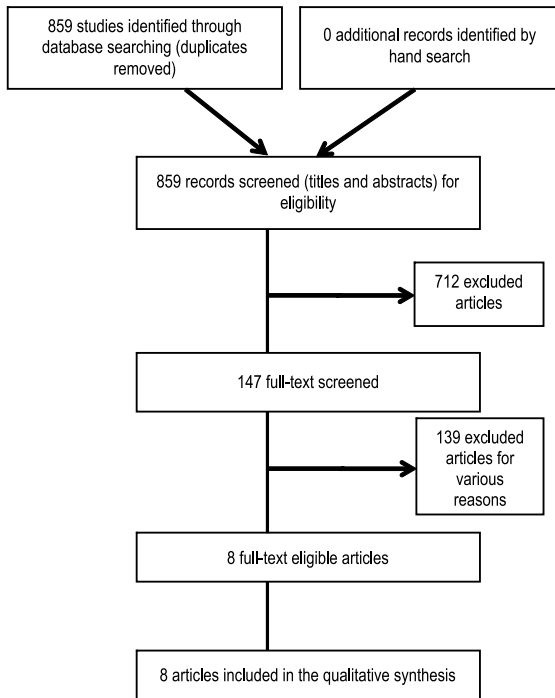


Fig. 1. Flow diagram of the bibliographic search.

workers with shoulder pain, 2) written in French or English, and 3) contained information on determinants or predictors (often presented in clinical prediction rules) for sickness absence from work or return to work. Prospective as well as retrospective study designs were included. Studies that included workers with diagnoses such as non-specific regional neck-shoulder pain or cervical radiculopathy were excluded, as well as traumatic disorders such as dislocation or fracture. Any definition of sickness leave from work or return to work outcomes was considered for this review.

2.2. Risk of bias/Methodological quality appraisal tool

Two raters independently assessed the risk of bias and the methodological quality of the included studies using the “methodology checklist for prognostic studies” [19]. This tool includes six methodological domains: study sampling, loss to follow-up, prognostic factors, outcome, confounders, and statistical analysis [19]. Each item is appraised regarding its risk of potential bias: ‘yes’ indicates low risk of bias, ‘no’ indicates high risk of bias, and ‘unclear’ indicates an unclear or unknown risk of bias with the information

presented in the study. A priori, it was established that studies with four or more yes responses on the six main items had a low risk of bias, while the other studies had a high risk of bias.

After the independent evaluation of each study by the two independent evaluators, the pair of raters met to compare ratings and resolve differences. There was no formal mechanism to exclude studies on the basis of quality.

2.3. Data extraction

The study characteristics of the included studies were systematically extracted using a standardized data-extraction sheet developed a priori that included: study design and settings, number and characteristics of the participants (diagnosis, age, sex, types of treatment or surgery, employment characteristics), length of follow-up, definition of sickness leave, definite on return to work, determinants or predictors, outcome measures, results and statistical analyses (type of analysis and adjustments). A first rater extracted the data. Then a second rater corroborated the extracted data and added data if missing.

2.4. Data synthesis

Given the nature of the study designs and the heterogeneity of included studies in terms of participants included, measurements of outcomes and different follow-up periods, only a qualitative synthesis of results was performed [20].

3. Results

3.1. Study selection

In total, 859 studies were identified. Based on the review of the titles and abstracts, 712 papers were excluded. After reviewing the full text of the remaining 147 studies, 139 of them were excluded, as they did not satisfy our inclusion criteria. At the end of the selection process, 8 studies were retained for evaluation of the methodological quality and risk of bias (See Fig. 1 for the flow diagram of literature search) [21–27].

3.2. Characteristics of included studies

Of the eight included studies (total of 3660 workers), four were prospective and four were retro-

spective cohort studies (Table 1). Seven studies using explanatory modeling, investigated determinants of sickness absence or return to work and only one study used predictive modeling to build a clinical prediction rule. Three studies looked at determinants of sickness leave, while five looked at determinants or predictors of return to work. At baseline, 39% of the workers were male and 61% female. The mean age of the workers was 47 years, and it varied from 20 to 73 years. Three studies only included workers with a full-thickness tear [21, 23, 26], one study included workers with rotator cuff (RC) tendinopathy [24], one study included workers with upper extremity MSK disorders (18% with only shoulder disorders, 49% with upper extremity MSK disorders including shoulder disorders) [22]. One study included patients with neck and shoulder pain [27], one study included new employees from a metropolitan public school district (not necessarily with shoulder pain) [25], and one study included workers with a new episode of shoulder pain [28]. The duration of postoperative follow-up varied from one to seven years.

Determinants or predictors of interest varied between studies, but could be categorized as follows: sociodemographic variables (for example: age, sex, education), disease characteristics (for example: nature of injury, dominant arm involvement, recurrence, onset, duration, pain intensity, shoulder related disability, treatment, medication, surgical technique, comorbidities, general health status), clinical measures (for example: range of motion, muscle strength), and work-related measures (for example: working status, work level, workers' compensation claim, psychosocial work environment, employment status, type of work, physical work load) (Table 2). The definition of RTW varied between studies. It ranged from RTW to a capacity equal to the preoperative level [21] to return to the same position [26]. Others studies did not define RTW.

3.3. Risk of bias across studies

Four studies had a low risk of bias according to the consensus between raters on the *Methodology Checklist for Prognostic Studies*, and four studies had a high risk of bias (Table 3). The methodological items that had the most risk of bias across studies were the attrition bias (five studies) and the statistical analysis that was not always appropriate for the study design (five studies).

3.4. Description of included studies evaluating determinants of sickness absence or return to work

The retrospective study by Bhatia et al. [21] had for objective to identify functional determinants that are associated with RTW in a cohort of workers' compensation patients ($n = 78$) that underwent arthroscopic repair of a full-thickness RC tear [21]. This study was appraised as having a high risk of bias. For this cohort of workers with work related physical demands ranging from light to very heavy, successful RTW was defined as RTW capacity equal to the preoperative level. At a mean follow-up of 33.6 months (SD: ± 13.9), bivariate analysis revealed that only a history of preoperative alcohol use (>6 drinks per week) was significantly associated with failure to RTW ($p = 0.011$). Other personal, clinical or surgical determinants were not significantly associated with the ability to RTW ($p \geq 0.05$) [21].

Descatha and colleagues [22] evaluated the clinical outcomes of workers with upper-extremity musculoskeletal symptoms or disorders, including shoulder problems ($n = 549$, of which only 74 had shoulder problems without other upper extremity symptoms), over a three-year period in a population highly exposed to repetitive work in a prospective epidemiological study appraised as having a high risk of bias [22]. The three-year recovery rate was low for shoulder disorders, as only 17/74 workers (23%) recovered. The recovery rate was however lower when more than one upper extremity disorders were present (25/207 or 12%). Intensity of pain and pain duration at baseline were highly associated with multiple upper extremity problems ($p < 0.001$). Older age and pain intensity were also associated with a poorer outcome: nine of the workers older than 45 years at baseline had no symptom at the three year follow-up compared with 21 of those younger than 30 years of age ($p < 0.001$). No significant differences were observed in resolution of symptoms between workers with an upper-extremity musculoskeletal symptoms or disorders who reported a change in job assignment in the past three years and those who did not ($p \geq 0.05$). Likewise, job satisfaction, measured with a yes or no question, was not significantly associated with the resolution of symptoms during the three-year study for all included workers [22].

The retrospective study by Didden et al. [23] appraised as having a high risk of bias, examined the association between workers' compensation status and time to return to work after RC repair in

Table 1
Characteristics of the included studies

Studies	Study design	Participants		Follow-up period	Outcomes	
		Diagnosis	Type of surgery or treatment			
<i>Explanatory studies evaluating determinants of sickness absence or return to work</i>						
Bhatia et al. [21]	Retrospective cohort study	Full-thickness RC tear	Arthroscopic repair	Number of participants (N), mean age (SD) & sex (%/female)	Return to preoperative work level (Yes or No)	
Descatha et al. [22]	Case-control	Upper-extremity musculoskeletal (UEMS) symptoms or disorders (Shoulder : 74, elbow : 21, hand or wrist : 119, multiple UEMS : 207)	Surgery (n = 23), physiotherapy (n = 64), steroids injection (n = 32)	Workers' compensation patients: Sedentary: 0 Light work: 21.8% Medium work: 16.7% Heavy work: 51.3% Very strong work: 10.3% Workers highly exposed to repetitive work (assembly-line manufacturing of small electrical appliances, motor vehicle accessories, or ski accessories; clothing or shoe industry; food industry; packaging; supermarkets (cashiers) population (18-55) Highest compensation (Gr1 n = 9), lower compensation (Gr2 n = 55), self-employed lowest compensation (Gr3 n = 9) Work level : Sedentary (n = 9), light (n = 25), medium (n = 18), heavy (n = 21).	33.6 +/- 13.9 months	UEMS symptoms or disorders in workers exposed to repetitive work (measured with Nordic-style questionnaire, self-assessment questionnaire and clinical examination)
Didden et al. [23]	Retrospective cohort study	Unilateral primary rotator cuff repair	Open (n = 34) or arthroscopic (n = 39) repair	N = 549 (baseline) N = 464 (follow-up) Age: 38.5 (range: 20-59) Sex: 73.1% F	3 years	Time to return to full-duty work after surgery (measured with questionnaire, Iannotti classification work level)
Engelbretsen et al. [24]	Prospective cohort study	Subacromial shoulder pain	Supervised exercises or Radial extracorporeal shockwave therapy	N = 93 (baseline), N = 73 (follow-up) Age: 49 (range: 36-55)	1 year	Shoulder Pain and Disability Index (SPADI) Work status (yes/no)

(Continued)

Table 1
(Continued)

Studies	Study design	Diagnosis	Participants		Follow-up period	Outcomes
			Type of surgery or treatment	Worker's characteristics		
Grooten et al. [27]	Prospective cohort study	Neck-shoulder pain		Blue-collar workers ($n = 738$), White collar ($n = 471$), Other (Employers, self-employed and subjects in labour-market programmes) ($n = 262$)	5-6 years	Symptoms and clinical signs that predict future neck/shoulder pain and sickness absence (measured with Nordic questionnaire); medical care-seeking (yes/no); Sickness absence financially compensated (yes/no, longer than 14 days OR 28 days)
Harbin et al. [25]	Historical cohort study	New episode of shoulder pain	Post-offer physical capacity testing protocol	Custodian: demonstrated the physical capacity for Heavy work (Level 4). Historical control groups (did not underwent post-offer physical capacity test)	Comparison of 2 consecutive 3 year time intervals for injury	Incidence of work injuries
Nove-Josserand et al. [26]	Retrospective cohort study	Surgery for RC tears due to work-related injury (67%) or occupational disease (33%)	RC repair. Open surgery ($n = 185$), mini-open surgery ($n = 24$), arthroscopic repair ($n = 53$)	Private sector employees (75.2%), Self-employed (12.6%), Government employees (11.8%), Non-manual work (6.1%), manual labour (25.5%), heavy manual labour (68.3%)	2 to 7 years	Return to work in the same position (or different position)
<i>Predictive studies for predictors of sickness absence or return to work</i>						
Kujipers et al. [28]	Prospective cohort study	New episode of shoulder pain	Paracetamol or NSAIDs ($n = 253$) Corticosteroid injection ($n = 35$) Physiotherapy ($n = 41$) Other therapies ($n = 17$)	Workers (all sectors) with a new episode of shoulder pain	6 weeks, 3 and 6 months	Sick leave due to shoulder pain (yes/no), Shoulder Disability Questionnaire (SDQ 0-100), Shoulder pain (0-10 numeric rating scale), Severity of the main complaint (0-10 numeric rating scale)

Table 2
Overview of the significant determinants of the included explanatory studies for return to work or sickness absence

Category/Prognostic factor	Study	Results
<i>Sociodemographic</i>		
Education	Engelbretsen et al.	Higher education has a positive effect on working after 1 year in patients with subacromial shoulder pain (OR = 4.3 [95%CI 1.3 to 14.9]). Thus, the odds of return are 4.3 times higher for those with more than 12 years of education.
Age	Nové-Joserand et al.	Age has a negative effect on return to work (returned to work: 82.8% of workers \leq 50 years old, 64% for workers 50–55 years old, and 21% for workers \geq 55 years old) and on return to the same position (different position: 20.7% of workers \leq 50 years old, 5.3% for workers 50–55 years old, and 0% for workers \geq 55 years old) after rotator cuff repair ($P < 0.0001$).
Alcohol use	Bhatia et al.	History of preoperative alcohol use (>6 drinks per week) is associated with the inability to RTW after arthroscopic rotator cuff repair ($p = 0.011$).
<i>Disease characteristics</i>		
Onset	Grooten et al.	A traumatic onset is associated with a lower risk for sickness absence in workers with persistent neck/shoulder pain (RR = 0.71 [95%CI 0.59–0.86])
	Nové-Joserand et al.	A diagnosis of occupational disease (compared to work-related injury) has a negative effect on return to work ($P = 0.0005$; returned to work: 63.7% for workers with a work-related injury, 43.6% for workers with occupational disease) and return to the same position ($P < 0.0001$; returned to the same position: 52% for workers with a work-related injury, 28% for workers with occupational disease) after rotator cuff repair.
Pain	Grooten et al.	Long lasting pain (≥ 3 months) is associated with a lower risk for sickness absence in workers with persistent neck/shoulder pain (RR = 0.65 [95%CI 0.51–0.82])
Health status	Engelbretsen et al.	Better self-reported health status has a positive effect on working after 1 year in patients with subacromial shoulder pain (OR = 1.06 [95%CI 1.0 to 1.1]). Thus, a one point higher score on EQ-VAS increase the probability of working by 6%.
	Grooten et al.	Previously sought medical care due to neck/shoulder pain is associated with a lower risk for sickness absence in workers with persistent neck/shoulder pain (RR = 0.67 [95%CI 0.56–0.80])
Surgical technique	Nové-Joserand et al.	The use of an open procedure for rotator cuff repair has a positive effect on return to work (returned to work: 66% for open, 41.6% for mini-open, 45.3% for arthroscopy).
<i>Work-related measures</i>		
Monetary compensation	Didden et al.	Higher monetary compensation has a negative effect on time off work ($P < 0.05$) after rotator cuff repair (mean time to RTW of 7 months in patients receiving workers' compensation after a rotator cuff tear caused by a work-related accident, 4 months for patients receiving workers' compensation after a non work-related accident and 2 months for the self-employed workers).
Type of work	Didden et al.	Higher preoperative physical work demands has a negative effect on time off work ($P < 0.05$) after rotator cuff repair (mean time to RTW of less than one month in Iannotti work demand level I [sedentary], three months in Iannotti level II [light physical demand], four months in level III [medium physical demand], and six months in Iannotti level IV [heavy physical demand]).
Sickness absence	Grooten et al.	Sickness absence during the year of enrolment has a negative effect on the risk for sickness absence during the study period in workers with persistent neck/shoulder pain (RR = 2.58 [95%CI 2.01–3.19]).
Employment status	Nové-Joserand et al.	Working as a private sector employee has a negative effect on return to work ($P = 0.0015$; returned to work: 53% for private sector employee, 78.8% for self-employed, 80.6% for government employee) and return to the same position ($P = 0.0004$; returned to work: 39% for private sector employee, 70% for self-employed, 68% for government employee) after rotator cuff repair.

Table 3
Risk of bias of the included studies

Study	Patient Selection	Follow-up	Prognostic Factor	Outcome of Interest	Potential Cofounders	Statistical Analysis
Bhatia et al. [21]	+	-	+	+	?	-
Descatha et al. [22]	+	-	+	?	-	-
Didden et al. [23]	+	-	?	+	-	-
Engelbrechtsen et al. [24]	+	-	+	+	+	+
Grooten et al. [27]	?	+	+	+	+	+
Harbin et al. [25]	+	+	+	+	?	-
Kuijpers et al. [28]	+	-	+	+	+	+
Nove-Josserand et al. [26]	-	+	-	-	-	?

+Low Risk, -High Risk, ?Unclear Risk.

a cohort of Belgian workers ($n=73$) [23]. A significantly longer postoperative time off work was reported in the group that received the highest monetary compensation: 7.2 months versus 2.4 months for the lowest compensation group ($p<0.05$). Using the Lanotti classification for physical work demands (four categories defined with the combination of the carried weight and the frequency of working above shoulder level), a significantly longer postoperative time to RTW was observed in the higher demand group ($p<0.05$) [23].

The prospective study by Engelbrechtsen et al. [24] (appraised as having a low risk of bias) evaluated the one-year predictors of work status in a cohort of participants suffering from RC tendinopathy ($n=104$). This study was a secondary analysis of data from a randomized controlled trial that compared therapeutic exercises to radial extracorporeal shockwave therapy. At the beginning of the study, 41 (40%) participants were not working and one year after treatment, 25 (25%) of participants were still on sick leave, disability pension or vocational rehabilitation. A comprehensive set of potential predictors including socio-demographic and clinical characteristics such as baseline pain and disability levels, symptoms duration, psychological distress, previous treatments and medication use as well as shoulder range of motion, were considered in a multivariate analysis. Low education (<12 years in school) and poor self-reported health status predicted a work status of not working at 1 year; odds ratio (OR) = 4.3; 95% confidence interval (CI): 1.3 to 14.9 for education, and OR = 1.06; 95% CI : 1.0 to 1.1 for self-reported health status, respectively. Adjustments for potential confounders such as age, gender, and treatment group were performed, but did not change the results.

In a prospective population based Swedish cohort study by Grooten et al. [27], appraised as having

a low risk of bias, 1471 participants were followed over a six-year period. At baseline, 124 participants reported suffering from shoulder pain and 38 reported having sickness absence during that period. Baseline shoulder pain was not considered a significant determinant of sickness absence during the follow-up period when compared to participants not suffering from shoulder pain (relative risk, RR = 0.91; 95% CI 0.64 to 1.23). A multivariate analysis combining participants suffering from shoulder pain or neck pain or both, revealed that a previous sickness absence before enrollment was a significant determinant for sickness absence during the follow-up period (RR = 2.58; 95% CI 2.01 to 3.19). Previously sought medical care due to neck/shoulder pain was also found to be a protective significant factor for sickness absence during the follow-up period (RR = 0.67; 95% CI 0.56 to 0.80). Also initial traumatic onset was found to be related to less sickness absence (RR = 0.71; 95% CI 0.59 to 0.86).

The historical cohort study by Harbin et al. [25] is an interventional study on the effect of a post-offer employment testing on injury rate to the shoulder and absence from work in custodial staff ($n=745$) from a public school district in the USA (appraised as having a low risk of bias). The post-offer employment testing aimed at evaluating if a future employee had the required strength to perform expected work tasks. If candidates were deemed unfit following evaluation, the public school district did not hire them. In the previous three years before the implementation of the employment testing, 19 shoulder injuries were reported and the incidence of shoulder injuries per 100 worked hours was 0.022. After implementation of the post-offer testing, no shoulder injuries were reported during the 3-year follow-up ($p<0.05$).

In a retrospective study by Nové-Josserand and colleagues [26] looking at factors and conditions

affecting RTW following a surgical repair for RC tears due to a work-related injury or occupational disease, 290 patients completed a questionnaire at least two years after surgery (two to seven years) to determine the occupational outcome and subjective results [26]. This study was appraised as having a high risk of bias and no definition of RTW was given. Sixty percent of the cases returned to work and shoulder injury was the reason for the other 40% of the cases not returning to work. Age ($P < 0.0001$), diagnosis of a work-related injury vs. an occupational disease ($P < 0.0001$; worst for occupational disease), employment status ($p = 0.0015$; worst for private sector employees compared to self-employed and government employees), and surgical technique ($p = 0.004$; better with open procedure compared to arthroscopic) had a significant effect on RTW. Type of work and nature of the tendon injury did not affect RTW ($p < 0.05$); however the nature of the tendon injury had an effect on time away from work ($p = 0.04$; worst with two or three tendons injured) [26]. The only other factor affecting time away from full-time work was the type of work ($p = 0.05$; directly related to the requirement for manual labor).

3.5. *Description of included studies for predictors of sickness absence or return to work*

The study by Kuijpers et al. [28] appraised as having a low risk of bias, used a prospective design to develop a clinical prediction rule for calculating the risk of shoulder pain related sick leave for individual worker. They included 350 workers from the Netherlands that had a new episode of shoulder pain. At six months, sick leave was measured using a yes (≥ 1 day) or no (0 day) question for the 298 workers who returned the postal questionnaire. Thirty percent of the workers reported at least one day of sick leave because of their shoulder pain during the past six months, while 16% reported sick leave during at least 10 days. A longer duration of sick leave prior to consultation (≤ 1 week OR = 1.7 [0.8–3.6]; > 1 week OR = 2.2 [1.0–4.7]), higher shoulder pain intensity on a visual analog scale (VAS) (4–6 points OR = 1.7 [0.9–3.2]; 7–10 points OR = 1.9 [0.9–3.9], strain (overuse) as a result of usual activities (OR = 1.9 [1.1–3.5]) and co-existing psychological complaints (OR = 4.0 [1.5–10.8]) were associated with a higher risk of sick leave during six months [28].

4. Discussion

In the present systematic review, that aimed at identifying determinants and predictors of sickness absence or RTW for patients suffering from a shoulder disorder, eight studies were included and only four were considered as having a low risk of bias. Four studies focused on evaluating determinants in patients suffering from a shoulder disorder and three focused on determinants of RTW for patients after RC repair.

Only one study used predictive statistical modeling and identified the following predictors: a longer duration of sick leave prior to consultation, more shoulder pain, a strain or overuse during activities, and co-existing psychological complaints. The clinical prediction rule developed demonstrated adequate discriminative ability but further external validation is needed before the rule may be used by health care providers [28].

For explanatory studies on determinants of RTW or work absence, overall there is insufficient and inconsistent evidence for the role of any determinants of RTW or work absence for workers with a shoulder disorder or for workers after a RC repair. Various clinical, socio-demographic and work-related determinants were identified as significantly associated with sickness absence but very few determinants were identified in more than one study. The only determinants that were found significantly associated with RTW or sickness absence in more than one study for shoulder disorders were either traumatic or atraumatic history, disease severity and previous sickness absence. In three studies, an atraumatic onset also qualified as overuse or cumulative trauma was significantly related to an increased risk of sick leave or delayed RTW. The strength of the association was somewhat similar across the three studies ranging from a relative risk of 1.4 to 1.9. Other authors have also shown that the onset of upper-extremity disorders related to overuse might be related to sick leave or chronicity [29]. However, based on this evidence and from results of our review, it still remains unclear what is the strength of this association and how it may be altered by other clinical, psychosocial or work related factors [26–29]. Pain severity as well as general health status as measured with EQ-5D, were found to be significant determinants in two studies in the present review [24, 27]. Similar to other studies on related populations with musculoskeletal complaints, such as upper extremity disorders or low back pain,

disease severity may be associated with increased risk of sick leave and delayed or failed RTW [30, 31]. Surprisingly however, in the study by Grooten et al. [27], included in the present review, the authors observed that long lasting pain of three months or more was significantly associated with a lower risk of sickness absence during follow-up. The authors hypothesized that it was due to a coping strategy developed by these subjects where they have learned to control their pain in order to continue their work [27] and in another study from the present review, previous shoulder pain was not found to be a significant predictor of RTW [24]. It therefore remains unclear if disease severity is associated with work related outcomes such as RTW or sick leave. The difference found in the present review could be explained by the fact that the independent variables related to disease severity were not measuring the exact same construct, or more likely, methodological issues with the study design and difference in populations of workers under study could be responsible for the accounted differences. A previous sickness absence or a previous sickness absence of longer duration were associated with a higher risk of unsuccessful RTW or of a new sickness absence during follow-up in two other studies [27, 28]. These determinants have also been identified in workers with low back or neck pain [32], but a review on prognostic factors associated with shoulder complaints reported that there were inconclusive evidence for previous sick leave being a risk factor for future sickness absence [16]. It remains unclear how a history of previous sick leave or of longer duration may have an impact on RTW or future sickness absence in workers with shoulder disorders.

Sociodemographic personal factors found to be associated with (better) work status included higher education in workers with shoulder impingement syndrome in one study. Although, the authors did not adjust for potential confounding factors, workers with 12 years or more education had 4.3 more chances to be working at a one-year follow-up; no other study included in the review measured this variable. This study did find in multivariate analyses a significant association of higher education with lower shoulder pain and disability as measured with the SPADI shoulder score at a one-year follow-up [24]. Other authors have also concluded that higher education may be considered a significant determinant associated with shorter work absence in workers following acute orthopaedic trauma [33]. Co-existing psychological complaints such as distress, depression, or

anxiety, were also found significantly associated with future sickness absence in one study [28], but not in another study included in the present review [24]. These conflicting results for workers with shoulder pain appears surprising as a growing body of evidence indicate that psychosocial personal and work-related factors play an important role in the incidence of work related upper extremity disorders and may have a negative effect on RTW [31, 33].

Three studies evaluated factors affecting RTW specifically after RC repair [21, 23, 26]. Older workers were less likely to RTW: only 21% of workers aged over 55 years and older returned to work compared to 82,8% of workers aged 50 years old and younger after RC repair. Older age has been consistently associated with worst outcome in terms of tendon healing and patient function or quality of life in various studies investigating prognostic factors related to the outcome of RC repair [31, 33]. Alcohol use (6 drinks or more per week) was significantly associated with the inability to RTW in one study, but the author's conclusion was based on a univariate analysis and potential confounding sociodemographic factors were not considered. Therefore, the results of this study should be interpreted with caution [21]. Interestingly, the only clinical related determinant found positively associated with RTW, was an open surgical approach used to perform the RC repair compared to mini open or arthroscopic approaches [26], although this factor was not significantly associated with RTW in another study from the present review [23]. Other factors such as disease severity, associated shoulder disorders and comorbidities were not found significant factors associated with RTW after RC repair, although these factors have been reported significant prognostic factors associated with the outcome of this type of surgery [17]. Work-related factors were evaluated in two studies with workers having RC repair [23, 26]. Heavy physical work demands were associated with longer time off work. Not surprisingly, the difference in time away from work in heavy manual workers compared to sedentary workers was observed to be five months longer in both studies. Higher monetary compensation resulted in more time away from work in one study and working as a private sector employee had a negative impact on RTW compared to self-employed or government employed workers. These factors have also been associated with delayed or failed RTW in workers with upper extremity disorders [31, 33].

Although many determinants associated with RTW or sick leave were identified in the present review, it is difficult to draw firm conclusions on the effect of these factors for workers with shoulder disorders or undergoing RC repair. Although all factors identified in the present review have either been found associated with sick leave, RTW or other clinical outcomes in studies with workers with other musculoskeletal disorders and especially with upper extremity disorders [31, 33], in the present review, there is insufficient and inconsistent evidence due in part to the limited number of studies included to formally conclude on the role of these factors on RTW and sickness absence. The actual strength of the associations and the causal relationship of a determined factor on RTW or sickness absence cannot be determined at this point. Moreover because other authors have outlined that RTW and sick leave may be regarded as multicausal [34], the potential factors that could modify these relationships are also unclear. More methodologically sound studies focusing on workers with shoulder disorders are therefore needed. The methodological quality of the included studies was generally low; attrition bias was often present and adequate multivariate analyses where potential confounding factors are considered were often not performed. More over there is need to clarify the methodologic approach used, either explanatory where significant determinants are identified using only statistical considerations, contrary to predictive modeling (prediction rule) where relevant predictors included in a predictive model can be selected based on clinical consideration also while insuring adequate discriminative capability. Proper definition of the outcome, either sick leave or RTW, need to be also done in future studies [35]. Although sick leave and RTW are obvious relevant work outcomes, presenteeism and work disability need to be investigated as they are also of importance for workers and employers [34].

5. Strength and weakness of the present review

This systematic review was achieved by using a rigorous literature search and a validated appraisal tool for methodological quality of the studies. Still, there are some limitations. We only focused on studies with workers with shoulder disorders and this resulted in the inclusion of a limited number of studies. We believe that this approach has merit, as it is important

to identify precisely factors related to RTW and sickness absence related to shoulder disorders. Other authors have suggested that determinants for specific shoulder disorders will differ from those of other upper extremity disorders [36]. Moreover, because shoulder disorders in workers are highly prevalent, more research specific to this population is certainly warranted.

6. Conclusions

In conclusions, while several clinical, socio-demographic and work-related determinants or predictors associated with work absence and RTW were identified in the present review, there is currently insufficient and inconsistent evidence on the role of any factor related to work absence or RTW for workers with a shoulder disorder or for workers after a RC repair. The only determinants that were found significantly associated with work absence or RTW in more than one study were either traumatic or atraumatic history, disease severity and previous sickness absence. A clinical prediction rule using a set of relevant predictors was identified in the literature but further validation is needed before its use can be integrated in clinical practice. Therefore, more methodologically sound studies are needed to draw firm conclusions on determinants and predictors of sick leave and of successful RTW in workers with shoulder disorders.

Conflict of interest

The authors declare that they have no competing interests. Financial support has been provided by the Institut de Recherche Robert-Sauvé en Santé et Sécurité au Travail (IRSST) and the Réseau Provincial de Recherche en Adaptation-Réadaptation/Fonds de recherche du Québec-Santé (REPAR/FRQ-S).

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