Optimizing Care Approaches for Work-Related Shoulder Conditions: A Multifaceted Investigation

by

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Abstract

Shoulder pain represents a significant challenge for workers, workplaces, and healthcare systems, necessitating a multifaceted approach to understand its impact and improve outcomes. This doctoral project investigated the most effective care approaches for work-related shoulder conditions. It focused on evaluating the effectiveness of exercise therapy with/without adjunct therapies, analyzing how care delivery impacts return-to-work (RTW) outcomes, and identifying the determinants of claim duration on an aging workforce within the Workers' Compensation Board in Alberta.

Exercise therapy (ET) is frequently an early treatment of choice when managing shoulder pain, yet evidence on its efficacy to expedite recovery is inconsistent. Moreover, the value of adding adjunct therapies (i.e. injections, manual therapy, electro-physical agents) to ET is currently unclear. The first plan of work of this doctoral work determined the effectiveness of ET with or without adjunct therapies compared to usual medical care through a network meta-analysis. Analysis of 54 studies with 3,893 participants showed that ET targeting shoulder muscles significantly reduces pain (Mean Difference (MD)= -2.1; 95% confidence interval (CI)= -0.7, -3.5) compared to usual care. Additional adjunct therapies like electro-physical agents (MD= -2.5; 95% CI= -0.7, -4.2), injections (MD= -2.4; 95% CI= -1.04 to -3.9), or manual therapy (MD= -2.3; 95% CI= -0.8, -3.7) added little value in reducing pain compared to ET alone. Given that pain is a primary reason for seeking treatment among patients with shoulder injuries, healthcare professionals may consider ET as a first-line treatment, exercising caution when considering adjunct therapies.

Global evidence on the impact of care pathways for workers is limited. Effective care for shoulder injuries is essential for improving efficiency, reducing costs, and optimizing RTW outcomes. In this thesis, the second plan of work focuses on assessing the effect of care delivery—comparing usual care with a care pathway—on RTW among workers with shoulder injuries. The primary distinction between the two groups lies in their diagnostic and treatment coordination approach. In the usual care cohort, initial consultations and decisions regarding diagnosis and treatment were made by a general family physician, including requests for diagnostic imaging and surgical referrals. Conversely, the care pathway model involved specialized assessments by both physicians and physical therapists, who collaboratively reached a consensus on diagnosis and treatment. Moreover, the care pathway used streamlined collaborative team meetings to develop and execute RTW plans involving all relevant stakeholders. Multinomial logistic regression determined the effect of delivery of care on RTW levels (primary objective) and identified determinants associated with RTW levels (secondary objective). While the usual care cohort had a higher likelihood of RTW at pre-accident levels (Relative Risk Ration (RRR):1.8. 95%CI=1.4, 2.3), the relationship between cohorts and RTW levels was impacted by claim duration. For claims exceeding 12-months, the care pathway cohort had higher likelihood of returning to pre-accident (RRR=2, 95%CI=1.3, 3.3). Number of days receiving wage-replacement benefits one-year post-claim closure is similar between cohorts (P-value>0.05), reinforcing that RTW at modified duties in a shorter period of time is not detrimental and implementing a care pathway seems beneficial. This underscores the importance of proactive intervention strategies like care pathways in optimizing workplace rehabilitation outcomes and minimizing long-term disability.

The third plan of work determined the impact of age on claim duration among workers with work-related shoulder injuries treated under a standardized care pathway. Through a Cox proportional hazards regression with time-varying covariates (TVC), we were able to show that early treatment for work-related shoulder injuries is a large determinant of claim duration. Expedited treatment start decreased claim duration significantly (Hazard Ratio (HR): 0.005, 95%CI: 0.002, 0.01). While age wasn't a large determinant of claim duration, workers aged 50 and above often experienced delayed treatment compared to younger workers ($p<0.0001$) despite being under an equitable care pathway, possibly due to age-related biases.

Through a comprehensive research framework encompassing synthesis and modeling, this doctoral project contributes to advancing understanding and optimizing care approaches for work-related shoulder conditions. By addressing distinct aspects of treatment, care delivery, and age-related considerations, this study aims to inform evidence-based practice, policy development, and employer interventions, ultimately enhancing workforce productivity and promoting the wellbeing of workers affected by shoulder injuries.

Preface

This thesis represents original research conducted by Anelise Silveira under the supervision of Drs. Allyson Jones, Lauren Beaupre, and Donald Voaklander. The cohort studies included in this doctoral work received research ethics approval from the University of Alberta Research Ethics Board under Project Name "The Impact of Using a Specific Shoulder Clinical Pathway Among WCB Patients with Rotator Cuff Related Pathology: A Cohort Study" (Project Number: Pro00096157), dated November 26, 2019. Additionally, authorization for data access was granted by the Workers Compensation Board Alberta (WCB-AB).

Chapter 2 of this doctoral work is accepted for publication by PLOS ONE journal as, "Anelise Silveira, Camila Lima, Lauren Beaupre, Judy Chepeha, Allyson Jones. "**Shoulder specific exercise therapy is effective in reducing chronic shoulder pain: A network meta-analysis**". Each author has contributed to the design, conduct, and interpretation of the analyses, and writing of the paper. A research health sciences librarian developed and conducted the systematic literature search. Camila Lima and I performed the data collection, extraction and risk of bias assessments. Liza Bialy from Alberta Strategy for Patient-Oriented Research (SPOR) SUPPORT Unit Knowledge Translation Platform at University of Alberta provided support with methodological design and data collection. I performed the data analysis with support from Ben Vandermeer, a statistician specialized in systematic reviews and network meta-analysis from SPOR. All authors critically revised the manuscript and provided final approval of the version to be published. This work has also been presented as, "Silveira A, Lima C, Beaupre L, Chepeha J, Jones A. Exercise Therapy for Chronic Shoulder Pain: A Network Meta-Analysis. World Physiotherapy Congress 2023, June 2-4, Dubai, United Arab Emirates. Podium Presentation".

Chapter 3 of this doctoral work has been prepared for submission at the **Scandinavian Journal of Work, Environment & Health as, "**Anelise Silveira, Lauren Beaupre, Donald Voaklander, Riikka Niemelainen, Allyson Jones. A **care pathway is effective in reducing claim duration among workers with time lost shoulder injuries: a retrospective cohort study."** Each author has contributed to the design, conduct, and interpretation of the analyses, and writing of the paper. I performed data cleaning and data analysis under the supervision of Drs. Allyson Jones, Lauren Beaupre, and Donald Voaklander. Dr. Sentil Senthilselvan, a professor and statistician at the School of Public Health at the University of Alberta, provided guidance throughout the data analysis of this study. This study was financially supported by WCB-AB, but the funder had no influence on the study design, data collection, analysis and interpretation of the data, writing of the report, or the decision to submit the paper for publication. This study has been submitted for a podium presentation at the 2024 European Society for Surgery of the Shoulder and the Elbow (SECEC) and the European Society for Surgery of the Shoulder and the Elbow (ESSSE): SECEC/ESSSE Congress in Munich, as, "Anelise Silveira, Lauren Beaupre, Donald Voaklander, Riikka Niemelainen, Allyson Jones. **A Shoulder Care Pathway Reduces Claim Duration Among Workers with Shoulder Injuries: A Cohort Study."** This work has been funded by Workers' Compensation Board in Alberta.

Chapter 4 has been prepared for submission at the **Journal of Work, Aging and Retirement, "**Anelise Silveira, Lauren Beaupre, Donald Voaklander, Riikka Niemelainen, Allyson Jones. **Age-related differences in characteristics and predictive factors of shoulder injury claim duration: a retrospective cohort study**." Each author has contributed to the conceptualization, methodology, and interpretation of the analyses, as well as the drafting of the manuscript. Data cleaning and analysis were conducted under the supervision of Drs. Allyson Jones, Lauren

Beaupre, and Donald Voaklander. Guidance throughout the data analysis was provided by Dr. Sentil Senthilselvan, a professor and statistician at the School of Public Health, University of Alberta. The study received financial support from WCB-AB, which had no involvement in the study's design, data collection, analysis, interpretation, manuscript preparation, or decision to publish. This work has been funded by Workers' Compensation Board in Alberta.

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To my parents, Hilario and Berenice, I owe everything to your never-ending support, even from afar. I am who I am today because of you. To Berenice Mourao, my mother-in-law who has become like a second mother to me, your love, support, and care for my daughters have been indispensable. To my friends, you have been my second family in Canada. Your unwavering belief in me and your support for my family and myself every step of the way have made me feel incredibly lucky. I am immensely grateful to have you in my life, and I love you all.

And now, it's time for us to celebrate because I am finally DONE!

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List of Abbreviations

RTW – Return-to-work

WCB-AB - Workers Compensation Board Alberta

ET – Exercise Therapy

ROM – Range of motion

HRQL - Health-related quality of life

CINeMA - Confidence In Network Meta-Analysis

NMA - Network meta-analysis

RoB2 - Revised Cochrane risk-of-bias tool for randomized trials

ROB-MEN - Risk of Bias due to Missing Evidence in Network meta-analysis

SPADI - Shoulder Pain and Disability Index

DASH - Disabilities of the Arm, Shoulder and Hand

RC+SCAP - Rotator Cuff and Scapula Exercise

RC – Rotator Cuff

EPA - Electro-physical agent

MT – Massage Therapy

ICD-9 - International Classification of Diseases

POB - Part of Body

NOI - Nature of Injury

N – Number of participants

MD – Mean difference

95% CI – 95% confidence interval

SD – Standard Deviation

MLR - Multinomial logistic regression

RR – Relative risk

HR – Hazard ratio

TVC - Time-variant covariates

SF-36 - Short Form 36 Health Survey

PCS- Physical Component Summary

MCS - Mental Component Summary

VAS - Visual Analogue Scale

Chapter 1: Introduction

Overview of Research Problem and Significance

Impact of shoulder conditions in the workforce

Shoulder pain is a global challenge with significant economic, societal and personal burden on patients, workplaces and health care systems.(1-3) Among the working population, more than half will experience nonspecific musculoskeletal symptoms within a one-year timeframe, with shoulder pain being one of the most prevalent conditions.(4) Reported prevalence rates of shoulder conditions vary (median of 16% (range 0.67 to 55.2%)), with a higher prevalence of shoulder pain in women and high-income countries.(1) Incidence rates range from 7.7 to 62 per 1000 persons per year among general population across different countries (median 37.8 per 1000 persons per year).(1) Noteworthy to mention that prevalence and incidence rates varied widely among high-, middle- and low-income countries, and variability in study populations, methodology and lack of data from low-income countries could be responsible for the wide range of reported rates.(1)

Shoulder conditions have deleterious impact on health status, since most symptomatic patients have physical symptoms (i.e. pain, stiffness, decreased function), psychological symptoms (i.e. frustration, concern), and work/social impairments (inability to perform regular duties, to participate in sports, to drive).(5-7) Lower health-related quality of life (HRQL) is associated with increased use of health care resources and work absenteeism.(8, 9) Health care resources include increased physician and rehabilitation visits, hospitalizations (impatient/outpatient), use of diagnostic imaging, surgeries, home care, and prescription drugs.(9) Between 2006-2008,

shoulder claims at WCB- Alberta accounted for Can$45.3 million in health care utilization costs and Can$90.1 million in total costs (excluding pensions) (Non-published data).

Treating Shoulder Conditions

Current practices to treat shoulder conditions are diverse and range from conservative (e.g., physical therapy, pharmaceutical management) to surgical management. Conservative treatment strategies appear effective in pain relief and improving function, increasing participation in activities of daily living (ADL) and work, preventing/delaying surgery, and improving HRQL among patients with shoulder conditions.(10-12) Surgical management is recommended for patients not responsive to conservative treatments.(13) Evidence suggests that surgical decompression techniques of the subacromial space and arthroscopy are effective for reducing pain and improving function in patients with shoulder conditions.(13-15)

Based on current evidence-based clinical guidelines for shoulder conditions, conservative management, in particular exercise therapy (ET) is a recommended treatment yet efficacy of exercise remains inconsistent.(16, 17) The value of adjunct therapies such as manual therapy, electro-physical agents, medications, and injections to augment ET is inconclusive.(17) Conservative management for shoulder conditions offers benefits, although the supporting evidence is not as robust. The available data relies on less rigorous methods, such as descriptive analysis or limited systematic reviews. This is primarily attributed to the inherent heterogeneity in data, encompassing variations in outcomes, timelines, treatment duration, follow-up protocols, and case definitions. A persuasive concern with current evidence is that ET was evaluated as one general approach,(11, 18-20) although ET consists of several different approaches including shoulder-specific strengthening and range of motion (ROM) exercises with/without scapular exercises to non-specific shoulder exercises such as postural and functional exercises. Within a

clinical context, ET is not always used alone but rather with adjunct therapy(17, 21, 22) and understanding the effectiveness of the different types of ET alongside adjunct therapies is still lacking in the literature.

Delivery of Care

Delivery of care can have a significant impact on the outcomes of workers, potentially causing a delay in their return-to-work (RTW).(23-25) The most effective approach to providing care for shoulder conditions in the workforce is still uncertain and requires further investigation. In the Canadian workplace, the rising incidence and prevalence of shoulder injuries are linked to increased absenteeism, impaired work performance, early retirement, job loss, and higher utilization of healthcare services.(26-29) It is important to streamline the process of delivering care to workers with shoulder conditions efficiently, to expedite RTW and reduce burden for all involved stakeholders.

Variability in care results in ineffective, mistake-prone, and expensive treatments.(25, 30) An evidence-based care pathway serves as a mechanism based on the best practices' evidence, aiming to standardize clinical procedures and enhance patients' outcomes.(9, 25, 30, 31) Broadly speaking, standardized pathways streamline care delivery, increasing satisfaction among stakeholders, optimizing clinical results, reducing costs and healthcare usage. (9, 25, 30, 31)

Understanding if a care pathway compared to usual care is able to expedite RTW of workers sustaining shoulder injuries is important and can provide guidance on optimal management of workers and sustainable RTW.

Discussions concerning the impact of an aging workforce on workers, workplaces, economies, and the sustainability of human resources are taking place worldwide.(32-36) Between 2012 and

2022, Statistics Canada reported a 42% increase in the number of adults aged 65 and older, contrasting sharply with a mere 7% increase in the 18 to 64 age group.(37) In 2022, a significant milestone was reached as one in five individuals of working age fell between 55 and 64 years old, marking the highest proportion of workers nearing retirement ever seen in Canadian history.(38) The rise in infertility rates, extended life expectancy, and delayed entry into the workforce among younger generations have been speculated as potential factors contributing to the decline in the younger population globally, prompting concerns about a potential workforce shortage.(34, 36, 38)

Global discussions on retirement policies are underway, with policymakers contemplating raising the retirement age to 67 to address this issue.(39, 40) Meanwhile, many near-retirement workers are considering prolonging their careers for various reasons, including financial incentives and a sense of purpose.(40) However, significant barriers to extending work beyond retirement age exist, including concerns about poor physical health and perceived inability to perform required tasks.(41)

Advanced age is closely linked to a higher prevalence of musculoskeletal disorders, particularly shoulder conditions, in the workforce.(2, 39, 42) Shoulder pain, known for its detrimental impact on health, (5-7) tends to worsen with age and is associated with poorer prognoses.(43) Older workers (65+) who sustain work-related injuries, particularly shoulder injuries, face disadvantages in terms of vocational rehabilitation, experiencing fewer opportunities for modified work, delayed treatment initiation, and lower likelihood of being recommended for rehabilitation compared to their younger counterparts.(39)

Musculoskeletal conditions, particularly in older workers experiencing higher levels of pain, are strongly associated with longer claim durations, leading to decreased overall wellbeing, both physically and mentally, increased job dissatisfaction, and economic burdens.(44) Prolonged claim durations are linked to decreased workers' wellbeing, including poor physical and mental health, increased job dissatisfaction and economic burden.(45) Prolonged claim durations can exacerbate financial strain, health challenges due to inactivity, and social isolation, while discrimination and discouragement in the job market can further complicate re-entry into the workforce, impacting retirement plans and overall wellbeing.(34, 46, 47)

The impact of older age on claim duration among workers with shoulder conditions is still poorly understood. One limitation in the current literature regarding factors affecting claim duration is that models do not consider the potential influence of care delivery. Variability of care can affect how well workers recover and impact outcomes such as claim duration.(9, 25, 30, 31) Understanding the factors leading to longer claim durations can guide policymakers and employers in developing targeted interventions to support older workers during rehabilitation and recovery after a shoulder injury. Leveraging Workers Compensation Board Alberta (WCB-AB) claim-loss administrative data, this study aimed to determine the impact of age on claim duration among workers with work-related shoulder injuries treated under a standardized care pathway.

Objectives

This doctoral project aimed to investigate the most effective care approaches for work-related shoulder conditions. It focused on evaluating the effectiveness of exercise therapy with/without adjunct therapies, analyzing how care delivery impacts RTW outcomes, and determining the impact of age on claim duration within the WCB-AB.

The **specific objectives** were:

1) To synthesize best available evidence by combining both direct and indirect evidence across studies on the effectiveness of exercise therapy with/without adjunct therapies compared to usual medical care for adults with chronic shoulder pain.
2) To determine if delivery of care affected RTW outcomes among workers with a first claim for a shoulder injury by comparing workers treated using a care pathway to those treated with usual care (primary objective). We also determined prognostic factors associated with RTW levels among workers with a first claim for a shoulder injury (secondary objective).
3) To determine the impact of age on claim duration among workers with work-related shoulder injuries treated under a standardized care pathway.

Study Hypotheses

The **study hypotheses** were:

1) ET with/without adjunct therapies would be more effective than usual medical care when treating individuals with chronic shoulder pain.
2) Among workers with a first claim for a shoulder injury, workers treated using a care pathway would RTW faster than those treated with usual care.
3) Among workers with a first claim for a shoulder injury, one of the prognostic factors for RTW would include the mode of delivery of care, with workers treated using a care pathway RTW faster than those treated with usual care.
4) Among workers with a first claim for a shoulder injury and treated under a standardized care pathway, age would be a prognostic factor for claim duration.

Study Approach and Outline of Dissertation

Chapter 2 addresses objective 1 through a network meta-analysis across 54 studies on the effectiveness of ET with/without adjunct therapies compared to usual medical care for adults with chronic shoulder pain. The analysis used a Frequentist hierarchical model, with results assessed for confidence using the CINeMA tool and study quality evaluated using the Cochrane Risk of Bias tool. The findings indicate that ET targeting shoulder muscles significantly reduces pain, while the addition of adjunct therapies offers questionable value. Given that pain is a primary reason for seeking treatment, healthcare professionals may consider ET as a first-line treatment for shoulder pain, exercising caution when considering adjunct therapies. This works has been accepted for publication in PLOS ONE.

Chapter 3 addresses objective 2 through a retrospective cohort study using administrative Alberta WCB data on 5,075 workers with a first-time shoulder injury claim from 2004 to 2018. Multinomial logistic regression determined the effect of delivery of care on RTW rates as well as identified prognostic factors associated with RTW levels. Despite the usual care cohort having a higher likelihood of returning to pre-accident work levels, the correlation with RTW levels was impacted by claim duration. Comparable days of receiving wage-replacement benefits one-year post-claim closure suggest that achieving RTW at modified duties in a shorter time is not detrimental, highlighting the potential benefits of implementing a care pathway. This work will be submitted to the Scandinavian Journal of Work, Environment & Health journal in March 2024.

Chapter 4 addresses objective 3 also through a retrospective cohort study using administrative Alberta WCB data (2014-2018) on 2,482 initial shoulder injury claimants. Descriptive statistics examined age cohorts' differences demographics, injury, occupational, program and self-

reported factors. Cox regression determined the impact of age on claim duration. Early treatment for work-related shoulder injuries is crucial regardless of age. While age did not have a large effect in determining claim duration, workers aged 50 and above often experience delayed treatment despite being under an equitable care pathway, possibly due to age-related biases. This work is being prepared for publication in the BMC Geriatrics Journal.

Chapter 5 provides an in-depth discussion of dissertation findings, including implications and recommendations for clinical care, WCB and future research regarding shoulder conditions in workers.

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Chapter 2: Shoulder specific exercise therapy is effective in reducing chronic shoulder pain: A network meta-analysis

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Abstract

Background: Exercise therapy (ET) is frequently an early treatment of choice when managing shoulder pain, yet evidence on its efficacy to expedite recovery is inconsistent. Moreover, the value of adding adjunct therapies (i.e. injections, manual therapy, electrotherapy) to ET is currently unclear. This study combined both direct and indirect evidence across studies on the effectiveness of ET with/without adjunct therapies compared to usual medical care for adults with chronic shoulder pain.

Methods and Findings: Using a network meta-analysis, randomized control trials comparing ET along with adjunct therapies were identified in MEDLINE, Embase, CINAHL, Sportdiscus, CENTRAL, Conference Proceedings Citation Index-Science, clinicaltrials.gov, and association websites. Outcomes included pain, range of motion (ROM), and health-related quality of life (HRQL) measures in adult patients with chronic shoulder pain. Data analysis used a Frequentist hierarchical model. CINeMA tool assessed the confidence in the results and Cochrane Risk of Bias tool assessed quality of studies. 54 studies primarily from Europe (40.38%) included 3,893 participants who were followed up to 52 weeks. Shoulder-specific ET (Mean difference (MD)= -2.1; 95% confidence interval (CI)= -3.5 to -0.7) or in combination with electro-physical agents (MD= -2.5; 95% CI= -4.2 to -0.7), injections (MD= -2.4; 95% CI= -3.9 to - 1.04) or manual therapy (MD= -2.3; 95% CI= -3.7 to -0.8) decreased pain compared to usual medical care. Trends with ROM and HRQL scores were seen; however, only Manual Therapy (MD=-12.7 and 95% CI= -24.4 to -1.0) achieved meaningfully important changes. Sensitivity analysis excluding

studies with high risk of bias showed similar results, with exception of injections that did not reach significance (MD= -1.3; 95% CI= -4.3 to 1.7).

Conclusion(s): Shoulder-specific ET provided pain relief up to 52 weeks. Adjunct therapies to shoulder-specific ET added little value in reducing pain. The quality of evidence varied between moderate and very low.

Introduction

Chronic shoulder pain is highly prevalent, with incidence rates ranging from 7.7 to 62 per 1000 persons per year and community prevalence ranging from 0.67 to 55.2% worldwide.(1) It significantly impacts patients' quality of life including health-related quality of life (HRQL) and health care utilization.(48) In Canada, for example, treating chronic shoulder pain due to rotator cuff tears has an estimated cost between Can$43million and Can$101 million annually.(9) Evidence-based guidelines on effective management strategies for chronic shoulder pain are unclear due to high heterogeneity in treatment approaches, patient populations and study methodologies used.(16) Current clinical recommendations suggest a trial of conservative management (i.e., physiotherapy, medications) followed by surgery when conservative management is ineffective for chronic shoulder pain.(49) Rehabilitation of chronic shoulder pain through exercise therapy (ET) appear to be effective in pain relief and function gains, leading to increased participation in daily activities and better HRQL.(50)

Following usual medical care (information, recommendations, and medical or pharmaceutical therapy as needed), exercise therapy (ET) is frequently a treatment choice when managing shoulder pain, yet evidence on its efficacy to expedite recovery is inconsistent.(16, 17) Moreover, the value of adjunct therapies such as manual therapy, electro-physical agents, medications, and injections with ET is currently inconsistent. Although ET for shoulder pain is supported by 10 systematic reviews,(8, 11, 17, 18, 21, 22, 51-54) only two(17, 21) had strong recommendations for the use of ET. While findings from seven systematic reviews support using a combination of manual therapy (MT) and ET for pain relief and functional improvement, others state inconclusive evidence to support a combination of MT and ET. Inconclusive findings are also reported with the use of corticosteroid injections.(20, 53) Shoulder diagnosis, ET

definitions, follow-up time are highly variable among these systematic reviews and limit comparison.

Current systematic reviews on the benefits of conservative management for shoulder pain are mostly based on either descriptive analysis or limited meta-analysis, due to data heterogeneity with variability seen with outcomes, timelines, treatment length, follow-ups, and case definitions. A persuasive concern with many of these reviews is that ET was evaluated as one general approach, although ET consists of several different approaches including shoulder-specific strengthening and ROM exercises with/without scapular exercises to non-specific shoulder exercises such as postural and functional exercises. While the effectiveness of different types of ET has been evaluated with small clinical samples and systematic reviews, the different types of ET has yet to have head-to-head comparisons. Within a clinical context, ET is not always used alone but rather with adjunct therapy. Using a network meta-analysis, this study combined both direct and indirect evidence across studies on the effectiveness of ET with/without adjunct therapies compared to usual medical care for adults with chronic shoulder pain.

Material and Methods

This network meta-analysis (NMA) is registered in the PROSPERO database (CRD 4201935093). Initially, the protocol published at PROSPERO stated that a meta-analysis was planned; however, we amended the protocol to include a network meta-analysis instead to enable the use of both direct and indirect evidence. We also amended the protocol to add the following inclusion criteria: “At least 6 weeks follow-up” and “More than 3 months of symptoms (chronic)”. Such criteria were important to better define the population being studied and the changes were made before the review started. Preferred Reporting Items for Systematic Reviews

and Meta-Analyses (PRISMA) (S1) extension statement for network meta- analyses was followed.(55)

Eligibility Criteria

This NMA included randomized or quasi-randomized control trials comparing ET with or without adjunct therapies in adult participants (aged 18 years or older) with shoulder pain for at least 3 months. At least one of the comparative groups needed to have ET as an intervention and follow-up time needed to be at least 6 weeks to detect true effect of ET. We excluded participants with previous surgery to the affected shoulder, history of shoulder dislocation, inflammatory disease, adhesive capsulitis (Frozen shoulder), scapular dyskinesis, major shoulder joint trauma, infection, avascular necrosis or neuropathy, or concomitant neck pathology. Studies not in English language, including fewer than 20 participants in the cohort, or examining holistic treatments were also excluded.

Information Sources and Search

A research health sciences librarian developed and conducted a systematic search of the following databases up to May/2022 and limited to English language: MEDLINE, Embase, CINAHL, Sportdiscus, CENTRAL, Conference Proceedings Citation Index- Science (CPCI-S), clinicaltrials.gov, and association websites (Canadian Academy of Sport and Exercise Medicine, Canadian Athletic Therapists Association, Canadian Physiotherapy Association, College of Family Physicians of Canada – Sport & Exercise Committee, Exercise is Medicine Canada, Ontario Athletic Therapist Association, Ontario Medical Association – Section on Sport & Exercise Medicine, Sport Physiotherapy Canada). Search strategy can be found in Supporting Information (S2).

Study Selection

Two independent reviewers (AS, CL) used Covidence™,(56) for title, abstract, full text screening and data extraction. Disagreement of article inclusion was resolved through consensus between reviewers or through third party adjudication if the reviewers did not arrive at consensus. Study authors were contacted if further clarifications regarding study methods and/or results were needed.

Data Extraction

Two independent reviewers (AS, CL) extracted the following data from eligible studies: demographics (number participants, age, sex, year, country, and diagnosis), interventions (type, duration, retention, maximum follow-up time) and outcomes (Pain, ROM, HRQL). All outcomes were extracted for the following timelines: post-intervention (first follow-up once intervention was completed) and longest follow-up (last study follow-up). If outcome information was unclear in the manuscript, we contacted the authors for clarifications.

Quality and Publication Bias Assessment

Two independent reviewers (AS, CM) used the Revised Cochrane risk-of-bias tool for randomized trials (RoB2) to assess the quality of each study.(57) Overall bias scores used the following criteria: **low risk of bias** (all domains were low), **some concerns** (at least one domain had some concerns, but none had high risk of bias) and **high risk of bias** (at least one domain was high or had some concerns in multiple domains that decreased the confidence in the result).(57)

Risk Of Bias due to Missing Evidence in Network meta-analysis (ROB-MEN)(58) assessed risk of bias due to missing evidence (publication bias) for all included pairwise comparisons. This

assessment considered: 1. the contribution of direct comparisons to the network meta-analysis estimates, 2. the potential presence of small-study effects, and 3. any bias from unobserved comparisons. The automatized tool then assigned a level of low risk, some concerns, or high risk of bias.(58)

Certainty of Evidence

Reviewers used the Confidence in Network Meta-Analysis (CINeMA)(59, 60) to assess the certainty of evidence for all outcomes considering the following domains: within-study bias, reporting/publication bias, indirectness, imprecision, heterogeneity, and incoherence. Final judgment summary across all domains were based on GRADE framework. (59, 60) Reviewers took into consideration that domains may be interconnected and followed CINeMA guidelines for judgment to avoid downgrading the overall level of confidence more than once for related concerns. Indirectness and incoherence were considered correlated and heterogeneity, imprecision, within-study bias and reporting bias were considered correlated.

This NMA included the assumptions of consistency and transitivity. CINeMA assessed consistency though the design-by-treatment test and by separating indirect from direct evidence (SIDE test) using the R netmeta package™. For the transitivity assumption, CINeMA considers indirectness through the distribution of potential effect modifiers, and statistical incoherence through the SIDE test.(59, 60)

Outcomes

Based on the literature, we anticipated ET with or without adjunct therapies to have an impact on shoulder pain, ROM, strength, and HRQL. Such domains are clinically important to both the patients and the clinicians to access effectiveness of therapies.(61) Because shoulder-specific

pain was measured through several pain scales, all scores were transformed to a scale from 0 (no pain) to 10 (worst pain) for comparison. We considered a difference of 20% to be clinically important.(62)

Shoulder abduction and external rotation are the most restricted ROM in patients with chronic shoulder pain and dysfunction. Even though a minimal clinically important difference has yet to be established for chronic shoulder pain population, based on the current literature a difference of 10 degrees was considered clinically important for this NMA.(63)

Disease-specific HRQL measures such as Shoulder Pain and Disability Index (SPADI), The Disabilities of the Arm, Shoulder and Hand (DASH), and Quick-DASH were included. A 10 points difference was considered clinically important.(64-67)

Data Synthesis and Analysis

Data synthesis pooled data for the outcomes of interest in the pre-specified groups, including mean or mean differences, standard deviations (SD) and/or 95% confidence intervals (CIs), follow up time, number of included participants per group, demographics (age, gender), and exercises program characteristics (total duration, post-intervention and retention). Groups were classified as the following (S3).

1) **Rotator Cuff and Scapula Exercise (RC+SCAP)**: Participants allocated to this group were treated with an exercise program that targeted both rotator cuff and scapular muscles.

2) **Rotator Cuff Exercise (RC):** Participants allocated to this group were treated with an exercise program that targeted mostly rotator cuff muscles without focusing on scapula muscles.

3) **Non-Specific RC Exercises:** Participants allocated to this group were treated with an exercise program that did not target specifically RC muscles.

4) **Electro-physical agent (EPA) + Exercise Therapy (ET):** Participants allocated to this group used electro-physical modalities in addition to their exercise program. Modalities included electrotherapy (i.e. TENS, ultrasound, laser, IFC, microwave diathermy, and/or radial extracorporeal shock-wave), thermotherapy (cold and/or heat), and dry needling.

5) **Manual Therapy (MT) + ET:** Participants allocated to this group used manual therapy in addition to their exercise program. Manual therapy techniques could include any of the following: soft tissue massage, joint mobilization (i.e. Glenohumeral, scapula, acromioclavicular, sternoclavicular, cervical and/ or thoracic), and/or manual compression of trigger points.

6) **Injections + ET:** Participants allocated to this group used injections (i.e. corticosteroid, prolotherapy, platelet-rich plasma) in addition to their exercise program.

7) **Usual Care:** Participants allocated to this group saw their family physician who gave them information, recommendations, and medical or pharmaceutical therapy as needed. Patients followed a wait-and-see approach and re-consulted with their family physician if symptoms persisted for further evaluation. We also included participants that received no treatment during the study in this group.

Statistical Analysis

Data analysis combined direct and indirect comparisons in a Frequentist hierarchical model. Data was combined using a random-effects model and included information from all studies. Relative

effects (Mean differences) and a common heterogeneity parameter (τ^2) using R Net-Meta package™ were estimated using CINeMA™ for all outcomes. Assessment of the agreement of the various sources of evidence was calculated using the design-by-treatment test and by separating indirect from direct evidence (SIDE test) using the R netmeta package™ in CINeMA™.(59, 60)

CINeMA used the flow decomposition method(59, 60) to calculate the contribution matrix. Contribution matrix included the percentage contribution of information from each study and each direct comparison to the estimation of each relative effect. Contribution matrix was used in the evaluation of contribution of within-study bias and indirectness to the confidence in the results.

NMA plots visually showed direct comparisons through edges. Nodes size represented the number of participants assigned to each intervention and node color represented ROB as described above. We imputed baseline standard deviation (SD) values when presented with mean differences from the baseline, but without a correspondent SD. Publication Bias used ROBMEN™ (58) to assess the risk of bias due to missing evidence for all possible pairwise comparisons in the network. Sensitivity analyses (excluding studies at overall high risk of bias) controlled for residual bias. The strength of evidence was measured by a synthesis of each outcome using the framework described by Salanti and colleagues(68) and implemented using the CINeMA™ (59, 60) which allowed confidence in the results to be graded as high, moderate, low, and very low.

Results

Literature search identified 16,641 citations, of which 5,678 duplicates and 10,052 were excluded. Of the 911 full-text studies reviewed, 54 studies were included(69-123) in the Network Meta-analysis (Figure 2.1). 4 articles (97, 98, 110, 111) were from 2 studies and, in the analysis, we accounted as 2 studies instead of 4. 22 (43.31%) studies received research grant funds, 3 (5.77%) received industry funds, 5 (9.62%) stated no funds and 22 (42.31%) had no information regarding funds. The majority of included studies were from Europe (21.40.38%) and the remaining from Asia, (18 ,34.6%), South America (5 (9.62%), North America (4,7.69%), and Australia (4 (7.69%). 22 out 52 studies had published protocols available.(69, 70, 73, 74, 77, 80, 81, 84, 90, 95, 98, 102, 105, 106, 108, 109, 111-113, 115, 117, 119)

Characteristics of the Included Studies

Of the 3,893 participants, the mean age was 51.26 years (SD: 7.55) with slightly over half being female (2,053 (52.7%)). The primary diagnosis was rotator cuff related shoulder pain (79%) with the remaining diagnosed as unspecified shoulder pain (21%). 6 interventions were compared to usual care. The mean intervention duration was 7.09 weeks (SD=3.67).

Quality and Publication Bias Assessment

Overall risk of bias assessment (S4) for **pain** found 19 studies at high risk(71, 75, 76, 78, 80, 82-85, 94-96, 101, 103, 107, 115, 116, 118, 121), 21 with some concerns(70, 72, 74, 77, 79, 81, 88, 89, 91, 93, 97-99, 102, 105, 114, 117, 119, 122) and 4 at low risk.(90, 108, 110, 111) For **ABD ROM,** 9 studies had high risk(71, 78, 94, 96, 99, 107, 112, 118, 121) and 6 had some concerns.(72, 77, 86, 93, 114, 122) **ER ROM** had 12 studies with high risk(71, 75, 76, 78, 85, 94, 96, 99, 107, 112, 118, 121) and 5 with some concerns.(72, 77, 93, 100, 114) **SPADI** consisted of 8 studies at high risk,(69, 75, 80, 96, 112, 113, 120, 121) 13 with some concerns(72, 79, 88, 89, 97, 98, 102, 104, 109, 117, 119, 122, 123) and 3 with low risk of bias.(106, 110, 111)

Finally, DASH had 8 studies at high risk,(69, 71, 84, 87, 103, 107, 116, 118) 7 with some concerns(70, 73, 74, 81, 88, 89, 105, 117) and 2 at low risk.(90, 108)

ROB-MEN risk of bias due to missing evidence showed some concerns for EPA+ET, RC+SCAP and Non-specific RC exercises compared to usual care for pain. For ROM, some concerns were seen for RC and EPA+ET. Finally, SPADI had some concerns with RC+SCAP. (S5)

Outcomes

Pain

All ET approaches showed large significant pain relief when compared to usual medical care post-intervention: **EPA+ET** (MD= -2.5; 95% CI= -4.2 to -0.7), **Injections+ET** (MD= -2.4; 95% CI= -3.9 to -1.04), **MT+ET** (MD=-2.3; 95% CI= -3.7 to -0.8), and **RC+SCAP** (MD= -2.1; 95% confidence interval (CI)= -3.5 to -0.7) (Table 2.1). When studies with high RoB were removed, the sensitivity analysis (S6), however, showed that injections lost both statistical and clinical significance (MD= -1.28; 95% CI= -4.28 to 1.73). SIDE test showed no major concerns with inconsistency (P>0.05; S6).

Up to 52 weeks post-intervention (longest follow-up), pain relief was retained for **EPA+ET** (MD= -2.6 and 95% CI= -4.0 to -1.2), **Injections+ET** (MD= -2.9 and 95% CI= -4.6 to -1.2), **MT+ET** (MD= -2.3 and 95% CI= -3.6 to -0.9), **RC** (MD= -1.7 and 95% CI= -3.3 to -0.1) and **RC+SCAP** (MD= -2.1 and 95% CI= -3.5 to -0.8). However, once again adding injections to ET did not show significant or clinically important pain relief when excluding high RoB studies. Confidence in the results varied between moderate to very low (Table 2.2). SIDE test showed no major concerns with inconsistency (P>0.05; S6).

Shoulder ROM and HRQL

ROM (ER; ABD) included 917 and 894 participants post-intervention. The average ER for the shoulder was 67.38 degrees (Min 36.5 to Max 95)(71, 72, 75-78, 83, 93, 94, 96, 99, 107, 112, 114, 118, 121) and for abduction was 135.8 degrees (Min 9.33 to Max 179.5).(71, 72, 77, 78, 86, 94, 96, 99, 107, 112, 114, 118, 121, 122) Shoulder-specific HRQL (SPADI, DASH) included 2,375 and 1,154 participants respectively post-intervention. SPADI(69, 72, 75, 79, 80, 86-89, 96-98, 102, 104, 106, 109-111, 113, 117, 119-123) average was 30.22 points (Min 10.1 to Max 61.4) and for DASH(69, 71, 73, 74, 81, 84, 87-90, 103, 105, 107, 108, 114, 117, 118) (124)was 26.46 points (Min 9.3 to Max 51.35). There was a trend in improving ROM (ER; ABD) and HRQL (SPADI, DASH) when compared to usual medical care; however, none achieved statistical and clinically important significant improvements (Tables 2.3-2.6). When high RoB studies were excluded, the improving trend was not seen with Injections+ET (SPADI; DASH) and non-specific RC exercises (DASH) (S6). Post-intervention trends were retained up to 52 weeks with exception of MT+ET that showed a significant and clinically important improvement in DASH scores (MD= -12.7 and 95% CI= -24.4 to -1.02); however, such improvement disappeared when excluding high RoB studies (MD= -7.7 and 95% CI= -21.1 to 5.7). Confidence in the results varied between moderate to very low (S7). SIDE test showed *some* to *major* concerns with inconsistency for DASH retention, mainly in the indirect comparisons (P=0.047); S6). For all other outcomes, SIDE test showed no *major* concerns with inconsistency (P>0.05; S6).

Discussion

Findings from this NMA were that shoulder-specific strengthening along with scapular exercises and ROM exercises are more effective in providing pain relief for chronic shoulder pain than usual medical care. Pain relief can last up to 52 weeks following an average of 7.09 weeks ET

program. Evidence shows that targeting specifically shoulder muscles improves shoulder biomechanics, leading to better movement patterns that decreases shoulder impingement and allows shoulder healing.(125) A recent RCT(124) showed that a 12-weeks supervised rehabilitation program using shoulder-specific exercises with the addition of scapular retraction exercises was effective in decreasing patients' pain and improving HRQL. However, another RCT(126) stated that adding 12-week ET (shoulder-specific or functional exercises) to formal shoulder pain education did not result in further benefits to the patients. Dube's (2023) (126) study had a well-defined education group including information on shoulder (anatomy and function), pain mechanism, pain management and activity modification. Moreover, participants watched educational videos on shoulder pain/function, chronic pain, stress, and the importance of healthy habits (sleep, eating and physical exercise). Usual care in this NMA may or may not have included an education component as part of their intervention and the content of education intervention varied among studies. Furthermore, it is important to take into account that education interventions are highly correlated with patients' levels of education and their ability to understand and implement the recommendations.(127, 128) Exercise recommendations were also part of the education component in Dube (2023) (126) study and may also have contributed to their findings.

Usual medical care frequently relies on the use of pharmaceutical management including NSAIDS and corticosteroid injections to reduce pain by decreasing the inflammatory process commonly seen in patients with chronic shoulder pain; however, the evidence is of low quality.(53) Even though a systematic review showed that both NSAIDS (SMD of −0.29, 95% CI −0.53 to −0.05) and corticosteroid injections (SMD −0.65, 95% CI −1.04 to −0.26) were more effective than no treatment, included studies were of low quality and it remained unclear how

pharmaceutical management compared to ET.(53) This NMA adds value to the current literature since it shows that shoulder-specific strengthening and ROM exercises including scapular exercises provides long-lasting pain relief for chronic shoulder pain compared to usual medical care. It also included studies that had at least 6 weeks follow-up, an important factor to detect true effect of ET. Finally, this NMA was not restricted to a specific shoulder diagnosis, rather it englobed the most common diagnosis of shoulder pain under the umbrella of rotator cuff related shoulder pain as well as unspecified shoulder pain that better reflects the population seen under current primary care.

Shoulder pain is the primary reason people seek medical treatment, since pain impacts patients both physically and emotionally.(61) Adding adjunct therapies to ET added little value when compared to shoulder-specific ET in reducing pain. We found that the addition of injections to ET lost both statistical and clinical importance compared to usual care which typically included medication. A systematic review(54) however showed that injections (SMD −0.65, 95% CI −1.04 to −0.26) were more effective than no treatment. Injections may be effective in reducing pain by decreasing the inflammatory process commonly seen in patients with chronic shoulder pain; however, the evidence is of low quality.(54)

Strengths and Limitations

This NMA has several strengths. Inclusion of RCTs studies ensured conclusions were based on best available evidence. Exclusion of studies with less than 6 weeks follow-ups enabled reliable assessment of the effect of ET with or without the addition of adjunct therapies. To the best of our knowledge, this is the first NMA that classified ET interventions taking into consideration targeted muscles (RC muscles, RC and scapula muscles or non-specific shoulder muscles) as well as did not focus the interventions to a specific diagnosis. The large sample size (3,893)

increased the power of the results. We also considered the effects of the interventions immediately post intervention and at the longest follow-up, enabling conclusions regarding intervention effect and retention.

This NMA is limited by the quality of included studies, since most studies were considered as moderate to high risk of bias. Definition of ET depended on exercises strategies; however, authors are physical therapists with specialty training in shoulder treatments increasing the reliability of definitions.(16) Adjunct therapies were considered in combination with ET and not as stand-alone interventions, limiting the conclusions regarding their effectiveness on their own. Usual care group included variable approaches, including advice, wait-and-see and potential use of pain medications; however, in current practice this is a very common pattern.(3, 129) The diagnosis criteria were variable among studies, but we used rotator cuff related shoulder pain or undefined shoulder pain terms to address this concern. We were unable to compile strength data, an important outcome to reflect ET effectiveness, due to inconsistency in measurement methods. The classification of groups in this NMA limits the ability to effectively assess targeted treatment effects of individual interventions that may have different mechanisms and effects if considered separately. In some cases, the small number of studies prevented the analysis of specific interventions such as injections and dry needling. The authors considered the purpose of each intervention to group interventions with similar approaches so there was less variability within groups.

Implications for Clinical Practice

Shoulder pain has deleterious impact on functional activities, overall health status and is associated with increased health care utilization and associated costs.(9) Health care providers need to take into consideration not only the best treatments available to treat shoulder pain but

also the costs associated with each treatment. In this NMA, ET targeting shoulder muscles decreased meaningfully shoulder pain and the addition of adjunct therapies had questionable value. On the other hand, the effect of ET and adjunct therapies on shoulder ROM and HRQL did not show significant differences. Since pain is the major reason patients seek treatment, (3) we advocate that ET be considered as the first line of treatment when dealing with chronic shoulder pain.

Implications for Future Research

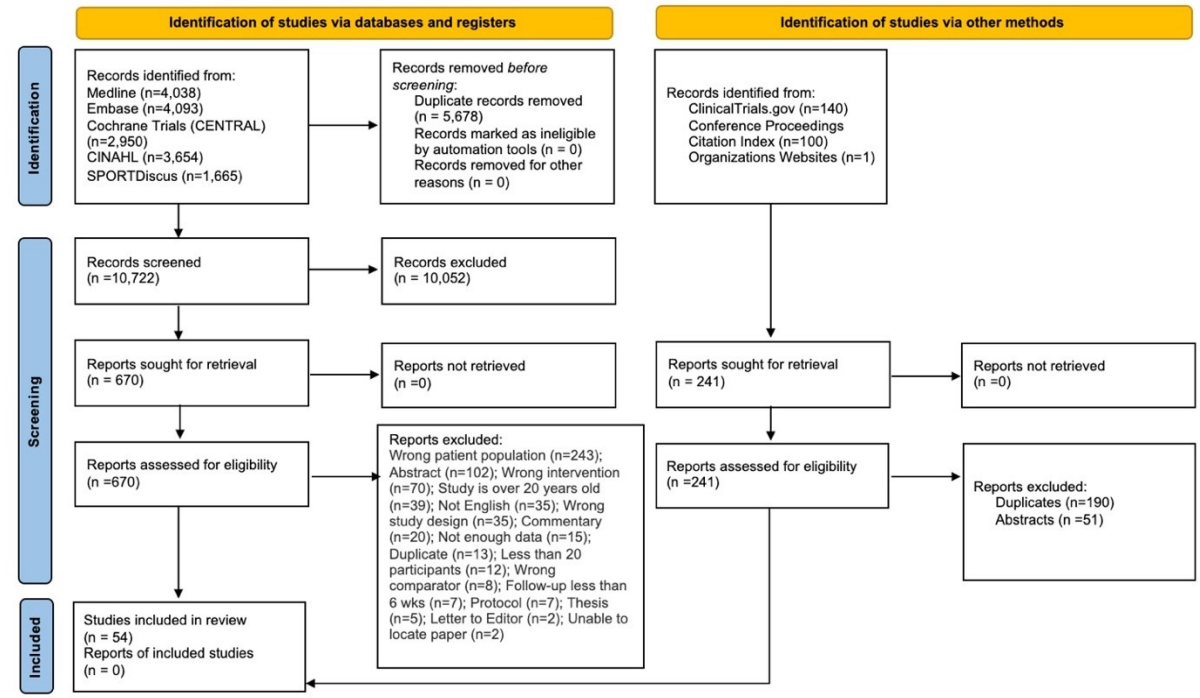
Pulling data for this NMA highlighted important barriers that need to be addressed in future trials. First, most included studies lacked published protocols, limiting the ability to judge their findings and increasing the risk of bias of included trials. Secondly, replicability and quality of studies requires detailed information on study methodology.(130) Most studies included in this NMA included general descriptions of interventions limiting the ability to properly combine information into groups and to replicate interventions in real-life clinical settings. Thirdly, the length of interventions varied between 2 to 16 weeks, yet ET requires at least 12-weeks to decrease pain and increase function.(130) Finally, even though strength is an important outcome when assessing the effectiveness of ET,(131, 132) it has been poorly reported and not feasible to synthesize the results in this NMA. Future studies need to address these barriers to increase confidence in the results and facilitate the implementation of effective interventions in clinical settings. These findings need be interpreted with caution, given the quality of evidence.

Conclusion

Compared to usual care, shoulder-specific ET including scapular exercises are more effective in decreasing pain and maintaining pain relief. Adding adjunct therapies to ET resulted in little pain relief when compared to shoulder-specific ET and usual care. Although augmenting ET with MT

had clinically important effects on health status, such effects were not seen when low quality studies were removed. Future studies need to consider important barriers such as having published protocols, including detailed information on study methodology and considering intervention lengths and responsive outcomes.

Figure 2.1. PRISMA 2020 flow diagram for new systematic reviews which included searches of databases, registers and other sources



From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71. For more information, visit: http://www.prisma-statement.org/

Table 2.1 - Mean differences (MD) and 95% Confidence Intervals (CI) for pain relief post-intervention. Statistically significant differences are bold. [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

EPA+ET	MD=-0.04 95% CI (-1.3, 1.2)	MD=-0.2 95% CI (-1.2, 0.8)	MD=-1.2 95% CI (-2.8, 0.5)	MD=-1.0 95% CI (-2.2, 0.3)	MD=-0.4 95% CI (-1.3, 0.6)	MD=**-2.5** 95% CI **(-3.9, -1.04)**
MD=0.04 95% CI (-1.2, 1.3)	**Injections+ ET**	MD=-0.2 95% CI (-1.6, 1.2)	MD=-1.1 95% CI (-3.0, 0.8)	MD=-0.9 95% CI (-2.5, 0.6)	MD=-0.3 95% CI (-1.6, 1.0)	MD=**-2.4** 95% CI **(-4.2, -0.7)**
MD=0.2 95% CI (-0.8, 1.2)	MD=0.2 95% CI (-1.2, 1.6)	**Manual Therapy+ET**	MD=-1.0 95% CI (-2.7, 0.7)	MD=-0.8 95% CI (-2.2, 0.7)	MD=-0.2 95% CI (-1.2, 0.9)	MD=**-2.3** 95% CI **(-3.7, -0.8)**
MD=1.2 95% CI (-0.5, 2.8)	MD=1.1 95% CI (-0.8, 3.0)	MD=1.0 95% CI (-0.7, 2.7)	**Non-specific RC exercises**	MD=0.2 95% CI (-1.6, 2.0)	MD=0.8 95% CI (-0.6, 2.2)	MD=-1.286 95% CI (-3.1, 0.5)
MD=1.0 95% CI (-0.3, 2.2)	MD=0.9 95% CI (-0.6, 2.5)	MD=0.8 95% CI (-0.7, 2.2)	MD=-0.2 95% CI (-2.0, 1.6)	**RC**	MD=0.6 95% CI (-0.6, 1.8)	MD=-1.5 95% CI (-3.1, 0.1)
MD=0.4 95% CI (-0.6, 1.3)	MD=0.3 95% CI (-1.0, 1.6)	MD=0.2 95% CI (-0.9, 1.2)	MD=-0.8 95% CI (-2.2, 0.6)	MD=-0.6 95% CI (-1.8, 0.6)	**RC+SCAP**	MD=**-2.1** 95% CI **(-3.5, -0.7)**
MD=2.5 95% CI (1.0, 3.9)	MD=2.4 95% CI (0.7, 4.2)	MD=2.3 95% CI (0.8, 3.7)	MD=1.3 95% CI (-0.5, 3.1)	MD=1.5 95% CI (-0.1, 3.1)	MD=2.1 95% CI (0.7, 3.5)	**Usual Medical Care**

Table 2.2: Pain Confidence in the Results

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating	Reason(s) for downgrading
MIXED EVIDENCE									
EPA+ET: Injections+ET	3	Major concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with heterogeneity and within-study bias. 1 level for some concerns with indirectness.
EPA+ET:MT	6	Some concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with heterogeneity and some concerns within-study bias. 1 level for some concerns with indirectness.
EPA+ET:RC	3	Some concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Low	1 level for some concerns with heterogeneity, imprecision and within-study bias. 1 level for some concerns with indirectness.
EPA+ET:RC+SCAP	6	Some concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with heterogeneity and some concerns within-study bias. 1 level for some concerns with indirectness.
EPA+ET: Usual Medical Care	1	Some concerns	Some concerns	Some concerns	No concerns	Some concerns	No concerns	Low	1 level for some concerns with heterogeneity, reporting bias and within-study bias. 1 level for some concerns with indirectness.
Injections+ET:MT	1	Major concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with heterogeneity and within-study bias. 1 level for some concerns with indirectness.
Injections+ET:RC	1	Major concerns	Some concerns	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with heterogeneity and reporting bias. 1 level for some concerns with indirectness.
Injections+ET:RC+SCAP	2	Major concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with heterogeneity and within-study bias. 1 level for some concerns with indirectness.
MT: RC+SCAP	4	Some concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with heterogeneity and some concerns within-study bias. 1 level for some concerns with indirectness.
MT: Usual Medical Care	2	Some concerns	Low risk	Some concerns	No concerns	Some concerns	No concerns	Low	1 level for some concerns with heterogeneity and within-study bias. 1 level for some concerns with indirectness.

Non-specific RC exercises: RC+SCAP	4	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with heterogeneity, imprecision and within-study bias.
Non-specific RC exercises: Usual Medical Care	1	Major concerns	Some concerns	No concerns	Some concerns	Some concerns	No concerns	Low	2 levels for major concerns with within-study bias and some concerns with heterogeneity, imprecision and reporting bias.
RC: RC+SCAP	3	Major concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with within-study bias and heterogeneity. 1 level for some concerns with indirectness.
RC: Usual Medical Care	1	Some concerns	Low risk	No concerns	Some concerns	No concerns	No concerns	Moderate	1 level some concerns with imprecision and within-study bias.
RC+SCAP: Usual Medical Care	1	Some concerns	Some concerns	No concerns	No concerns	Some concerns	Some concerns	Moderate	1 level some concerns with imprecision, reporting bias, heterogeneity, incoherence and within-study bias.
INDIRECT EVIDENCE									
EPA+ET: Non-specific RC exercises	0	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with imprecision, heterogeneity, and within-study bias.
Injections+ET: Non-specific RC exercises	0	Major concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity.
Injections+ET: Usual Medical Care	0	Major concerns	Low risk	Some concerns	No concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with heterogeneity. 1 level for some concerns with indirectness.
MT: Non-specific RC exercises	0	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with imprecision, heterogeneity, and within-study bias.
MT:RC	0	Some concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Low	1 level for some concerns with heterogeneity, imprecision and within-study bias. 1 level for some concerns with indirectness.
Non-specific RC exercises: RC	0	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with imprecision, heterogeneity, and within-study bias.

Table 2.3. Mean Differences (MD) and 95% Confidence Intervals (CI) for the post-intervention Range of Motion – External Rotation (ROM_ER) [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

EPA+ET	MD=2.2 95% CI (-7.4, 11.8)	MD=-0.4 95% CI (-11, 10.1)	MD=1.8 95% CI (-13.7, 17.5)	MD=1.7 95% CI (-6.4, 9.8)	MD=14.0 95% CI (-14, 42)
MD=-2.2 95% CI (-11.8, 7.4)	**Injections+ET**	MD=-2.7 95% CI (-16.2, 10.9)	MD=-0.4 95% CI (-17.8, 17)	MD=-0.5 95% CI (-10.7, 9.6)	MD=11.8 95% CI (-17.3, 40.8)
MD=0.4 95% CI (-10.1, 11)	MD=2.5 95% CI (-10.9, 16.2)	**Manual Therapy+ET**	MD=2.2 95% CI (-15.8, 20.3)	MD=2.1 95% CI (-9.3, 13.6)	MD=14.4 95% CI (-15.0, 43.9)
MD=-1.8 95% CI (-17.3, 13.7)	MD=0.4 95% CI (-17, 17.8)	MD=-2.2 95% CI (-20.3, 15.8)	**RC**	MD=-0.1 95% CI (-15.4, 15.1)	MD=12.2 95% CI (-11.1, 35.5)
MD=-1.7 95% CI (-9.8, 6.4)	MD=0.5 95% CI (-9.6, 10.7)	MD=-2.1 95% CI (-13.6, 9.3)	MD=0.1 95% CI (-15.1, 15.4)	**RC+SCAP**	MD=12.3 95% CI (-15.5, 40.2)
MD=-14 95% CI (-42, 14)	MD=-11.8 95% CI (-41, 17)	MD=-14.4 95% CI (-43.9, 15)	MD=-12.2 95% CI (-36, 11)	MD=-12.3 95% CI (-40, 15.5)	**Usual Medical Care**

Table 2.4. Mean Differences (MD) and 95% Confidence Intervals (CI) for the post-intervention Range of Motion – Abduction (ROM_ABD) [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

EPA+ET	MD=17.9 95% CI (-5.4, 41.2)	MD=-0.3 95% CI (-26.1, 25.6)	MD=6.2 95% CI (-21.8, 34.1)	MD=4 95% CI (-14.8, 22.8)	MD=15.9 95% CI (-35.7, 67)
MD=-18 95% CI (-41.2, 5.3)	**Injections+ET**	MD=-18.2 95% CI (-49.4, 13)	MD=-11.8 95% CI (-45, 21.6)	MD=-14 95% CI (-36.8, 8.9)	MD=-2.1 95% CI (-56.7, 52.6)
MD=0.3 95% CI (-25.6, 26.1)	MD=18.2 95% CI (-13, 49.4)	**Manual Therapy+ET**	MD=6.4 95% CI (-22.8, 35.7)	MD=4.3 95% CI (-19.8, 28.3)	MD=16 95% CI (-36.1, 68.3)
MD=-6.2 95% CI (-34.1, 21.8)	MD=11.8 95% CI (-21.6, 45)	MD=-6.4 95% CI (-35.7, 22.8)	**RC**	MD=-2.2 95% CI (-29.3, 24.9)	MD=9.7 95% CI (-33.6, 53)
MD=-4 95% CI (-22.8, 14.8)	MD=13.9 95% CI (-9, 36.8)	MD=-4.3 95% CI (-28.3, 19.8)	MD=2.2 95% CI (-24.9, 29.3)	**RC+SCAP**	MD=11.9 95% CI (-39.2, 63)
MD=-15.9 95% CI (-67.4, 35.7)	MD=2.1 95% CI (-52.6, 56.7)	MD=-16.1 95% CI (-68.3, 36)	MD=-9.7 95% CI (-53, 33.6)	MD=-11.9 95% CI (-62.9, 39.2)	**Usual Medical Care**

Table 2.5. Mean Differences (MD) and 95% Confidence Intervals (CI) for the post-intervention Shoulder Pain and Disability Index (SPADI) [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

EPA+ET	MD=-0.2 95% CI (-15, 15)	MD=-5.1 95% CI (-15.9, 5.7)	MD=7.5 95% CI (-13.7, 28.8)	MD=-6.5 95% CI (-22, 9.2)	MD=-4.5 95% CI (-14.5, 5.6)	MD=-14.4 95% CI (-31.8, 3)
MD=0.2 95% CI (-14.8, 15)	**Injections+ ET**	MD=-4.9 95% CI (-19.1, 9.2)	MD=7.7 95% CI (-17.4, 32.9)	MD=-6.3 95% CI (-25.8, 13.3)	MD=-4.3 95% CI (-19.2, 10.7)	MD=-14 95% CI (-34.7, 6.3)
MD=5 95% CI (-5.7, 16)	MD=4.9 95% CI (-9.2, 19)	**Manual Therapy+ET**	MD=12.7 95% CI (-10, 35.5)	MD=-1.3 95% CI (-16.8, 14)	MD=0.6 95% CI (-10, 11.3)	MD=-9.3 95% CI (-25.7, 7.2)
MD=-7.5 95% CI (-28.8, 13.7)	MD=-7.7 95% CI (-32.9, 17.4)	MD=-12.7 95% CI (-35.5, 10)	**Non-specific RC exercises**	MD=-14 95% CI (-39.4, 11.5)	MD=-12 95% CI (-33.6, 9.5)	MD=-21.9 95% CI (-48.3, 4.5)
MD=6.5 95% CI (-9.2, 22)	MD=6.3 95% CI (-13.3, 25.8)	MD=1.3 95% CI (-14.2, 16.8)	MD=14 95% CI (-11.5, 39.5)	**RC**	MD=2 95% CI (-13.3, 17.2)	MD=-8 95% CI (-23.4, 7.5)
MD=4.5 95% CI (-5.6, 14.5)	MD=4.3 95% CI (-10.7, 19.2)	MD=-0.6 95% CI (-11.3, 10)	MD=12 95% CI (-9.5, 33.6)	MD=-2 95% CI (-17.2, 13.3)	**RC+SCAP**	MD=-9.9 95% CI (-26.4, 6.6)
MD=14.4 95% CI (-3, 31.8)	MD=14 95% CI (-6.3, 34.7)	MD=9.3 95% CI (-7.2, 25.7)	MD=21.9 95% CI (-4.5, 48.3)	MD=7.9 95% CI (-7.5, 23.4)	MD=9.9 95% CI (-6.6, 26.4)	**Usual Medical Care**

Table 2.6. Mean differences (MD) and 95% Confidence Intervals (CI) for the post-intervention Disabilities of the Arm, Shoulder, and Hand (DASH**)** [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

EPA+ET	MD=-7.3 95% CI (-17, 2.5)	MD=-1 95% CI (-10.5, 8.4)	MD=-10.5 95% CI (-24.3, 3.3)	MD=-8.4 95% CI (-20.4, 3.7)	MD=-2.2 95% CI (-12.2, 7.9)	MD=-13.1 95% CI (-28, 1.9)
MD=7.3 95% CI (-2.5, 17)	**Injections+ ET**	MD=6.3 95% CI (-2.2, 14.7)	MD=-3.2 95% CI (-16.6, 10)	MD=-1.1 95% CI (-12.9, 10.7)	MD=5.1 95% CI (-4.3, 14.6)	MD=-5.8 95% CI (-20.3, 8.7)
MD=1 95% CI (-8.4, 10.5)	MD=-6.3 95% CI (-14.7, 2.2)	**Manual Therapy+ET**	MD=-9.5 95% CI (-22, 3)	MD=-7.3 95% CI (-19.7, 5)	MD=-1.1 95% CI (-9.2, 7)	MD=-12 95% CI (-25.3, 1.2)
MD=10.5 95% CI (-3.3, 24.3)	MD=3.2 95% CI (-10, 16.6)	MD=9.5 95% CI (-3, 22)	**Non-specific RC exercises**	MD=2.2 95% CI (-14.2, 18.5)	MD=8.4 95% CI (-1.1, 17.8)	MD=-2.6 95% CI (-20.2, 15)
MD=8.4 95% CI (-3.7, 20.4)	MD=1.1 95% CI (-10.7, 13)	MD=7.3 95% CI (-5, 19.7)	MD=-2.2 95% CI (-18.5, 14.2)	**RC**	MD=6.2 95% CI (-7.1, 19.5)	MD=-4.7 95% CI (-18.6, 9.2)
MD=2.2 95% CI (-7.9, 12.2)	MD=-5.1 95% CI (-14.6, 4.3)	MD=1.1 95% CI (-7, 9.2)	MD=-8.4 95% CI (-17.8, 1.1)	MD=-6.2 95% CI (-19.5, 7.1)	**RC+SCAP**	MD=-10.9 95% CI (-25.8, 4)
MD=13.1 95% CI (-1.9, 28)	MD=5.8 95% CI (-8.7, 20.3)	MD=12.3 95% CI (-1.2, 25.3)	MD=2.6 95% CI (-15, 20.2)	MD=4.7 95% CI (-9.2, 18.6)	MD=10.9 95% CI (-4, 25.8)	**Usual Medical Care**

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Supporting Information – S1: Search Strategies

Database: MEDLINE Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other NonIndexed Citations and Daily; 1946 to May 22, 2022

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1 Bursitis/ and (gleno* or rotator cuff* or shoulder*).mp. (1493)
2 Rotator Cuff/ (7642)
3 Rotator Cuff Injuries/ (7019)
4 exp Scapula/ (8718)
5 Shoulder/ (14725)
6 Shoulder Impingement Syndrome/ (1901)
7 Shoulder Injuries/ (4946)
8 Shoulder Joint/ (20642)
9 Shoulder Pain/ (5528)
10 Tendinopathy/ and (gleno* or rotator cuff* or shoulder*).mp. (1614)
11 Tenosynovitis/ and (gleno* or rotator cuff* or shoulder*).mp. (177)
12 ((acromion* or coracoid* or gleno* or infra-spinatus* or infraspinatus* or rotator cuff* or shoulder* or scapul* or supra-spinatus* or supraspinatus* or teres minor*) adj3 (bursiti* or capsuliti* or degenerati* or disease* or disorder* or imping* or inflam* or injur* or pain* or patholog* or problem* or ruptur* or stiff* or strain* or stress* or tear* or tendin* or tendoni* or tendono* or tenosyno* or torn* or trauma* or weak* or wear*)).tw,kf.
(28923)
13 frozen shoulder*.tw,kf. (1280)
14 SLAP tear*.tw,kf. (254)
15 or/1-14 [Combined MeSH & text words for shoulder pathology] (59861)
16 Acupressure/ (898)
17 Acupuncture Therapy/ (18740)
18 Acupuncture/ (1932)
19 Adrenal Cortex Hormones/tu [Therapeutic use] (34233)
20 Anti-Inflammatory Agents/ (89508)
21 Anti-Inflammatory Agents, Non-Steroidal/ (71022)
22 Conservative Treatment/ (4586)
23 Cryotherapy/ (5585)
24 Electric Stimulation Therapy/ (21638)
25 exp Exercise Therapy/ (59571)
26 General Practitioners/ (9648)
27 Glucocorticoids/ (68999)
28 exp Hyperthermia, Induced/ (36233)
29 Injections, Intra-Articular/ (8850)
30 Methylprednisolone/ (19872)
31 "Physical and Rehabilitation Medicine"/ (3494)
32 Physical Therapy Modalities/ (39492)
33 Physicians, Family/ (16949)
34 Physicians, Primary Care/ (4183)
35 Physicians' Offices/ (1787)
36 *Postural Balance/ (16599)
37 *Posture/ (29281)
38 Primary Care/ (87908)
39 Primary Health Care/ (87908)
40 Rehabilitation/ (18654)
41 Ultrasonography, Interventional/ (26449)
42 Watchful Waiting/ (4903)

43 (acupunctur* or acupressure*).tw,kf. (26396)
44 ((adjust* or intervention* or modif* or stabil*) adj2 postur*).tw,kf. (6061)
45 (anti-inflammator* or antiinflammator* or NSAID*).tw,kf. (218606)
46 ((appl* or pack* or pad*) adj2 (hot or heat*)).tw,kf. (3943)
47 ((appl* or pack or pad*) adj2 (ice or cold)).tw,kf. (2065)
48 ((care* or healthcare*) adj2 primary).tw,kf. (172455)
49 chiropract*.tw,kf. (6495)
50 (cold therap* or cryotherap*).tw,kf. (8541)
51 ((conservative* or non-operative* or non-surgical* or nonoperative* or nonsurgical*) adj3 (manage* or therap* or treat*)).tw,kf. (116721)
52 ((cortico* or cortiso* or glucocortico* or prednison* or steroid*) adj2 (inject* or shot*)).tw,kf. (116721)
53 ((doctor* or physician*) adj office*).tw,kf. (5269)
54 dry needling*.tw,kf. (779)
55 (exercis* adj2 therap*).tw,kf. (9939)
56 general practi*.tw,kf. (89189)
57 icing.tw,kf. (949)
58 interferential current*.tw,kf. (224)
59 manual therap*.tw,kf. (3189)
60 motion therap*.tw,kf. (107)
61 (physio-therap* or physiotherap* or physical therap*).tw,kf. (58434)
62 rehab*.tw,kf. (204126)
63 ((resistance or strength* or weight*) adj1 train*).tw,kf. (17398)
64 (stretches or stretching).tw,kf. (39391)
65 (wait* adj2 watch*).tw,kf. (4477)
66 or/16-65 [Combined MeSH & text words for conservative management] (1314570)
67 and/15,66 [Combined concepts for shoulder pathology & conservative management] (12609)
68 randomized controlled trial.pt. (568162)
69 controlled clinical trial.pt. (94879)
70 randomized.ab. (560853)
71 placebo.ab. (228198)
72 clinical trials as topic.sh. (199869)
73 randomly.ab. (381983)
74 trial.ti. (262251)
75 or/68-74 (1445842)
76 exp Animals/ not Humans/ (5004231)
77 75 not 76 [Cochrane Highly Sensitive Search Strategy for identifying randomized trials in MEDLINE: sensitivity- and precision-maximizing version (2008 revision); Lefebvre C, et al. Retrieved: http://handbook.cochrane.org/chapter_6/6_searching_for_studies.htm] (1329754)
78 and/67,77 [RCT filter applied] (2425)
79 clinical trial.pt. (535034)
80 comparative study.pt. (1911325)
81 exp case control studies/ (1320425)
82 exp cohort studies/ (2347670)
83 (cohort adj (study or studies)).tw. (271563)
84 (comparative adj (study or studies)).tw. (113407)
85 control.tw. (2861354)
86 controlled.tw. (885936)
87 ((design* or studies or study or test*) adj2 (post* adj2 pre*)).tw. (21526)
88 (follow up adj (study or studies)).tw. (53519)
89 longitudinal.tw. (291178)
90 (non-random* or nonrandom*).tw. (44552)
91 (observational adj (study or studies)).tw. (139420)
92 (quasi-random* or quasirandom*).tw. (5350)

93 retrospective.tw. (659754)
94 or/79-93 (7630528)
95 exp Animals/ not Humans/ (5004231)
96 (animal* or bovine* or calves or camel* or canine* or cat or cats or chimp* or dog or dogs or equine* or feline* or goat* or hamster* or horse* or llama* or mice* or monkey* or mouse* or pig or piglet* or pigs or porcine* or primate* or rabbit* or rat or rats or rodent* or sheep* or simian* or swine*).ti. (2403377)
97 94 not (95 or 96) [Observational study filter - not validated] (6359238)
98 and/67,97 [Observational filter applied] (5665)
99 or/78,98 [Shoulder pathologies & conservative management w/ combined study design filters] (6006)
100 exp Child/ not (exp Adult/ and exp Child/) (1329811)
101 (adolescen* or child* or infan* or juvenile* or neonat* or p?ediatric* or youth*).ti. (1523889)
102 99 not (100 or 101) [Exclude pediatric studies] (5869)
103 exp Aged/ not ((Adult/ or Middle Aged/ or Young Adult/) and exp Aged/) (738577)
104 (aged or elder* or geriatric* or older adult* or senior*).ti. (248761)
105 102 not (103 or 104) [Exclude older adult studies] (5697)
106 *Anesthetics, Local/ (23822)
107 *Brachial Plexus Block/ (667)
108 (an?esth* or brachial plexus block*).ti. (156682)
109 105 not (106 or 107 or 108) [Exclude anesthetic interventions] (5481)
110 exp *Arthritis/ (237401)
111 (arthriti* or osteoarthri* or OA).ti. (148522)
112 109 not (110 or 111) [Exclude arthritis studies] (5262)
113 exp *Breast Neoplasms/ (279440)
114 exp *"Head and Neck Neoplasms"/ (293155)
115 cancer*.ti. (1165335)
116 112 not (113 or 114 or 115) [Exclude cancer studies] (5118)
117 exp *Perioperative Care/ (58494)
118 (intraop* or operative* or periop* or postop*).ti. (188666)
119 116 not (117 or 118) [Exclude perioperative interventions] (4938)
120 *Shoulder Dislocation/ (5360)
121 (bankart* or dislocat* or instab* or subluxat*).ti. (57816)
122 119 not (120 or 121) [Exclude dislocation studies] (4574)
123 exp *Stroke/ (122747)
124 (isch?em* or stroke* or TIA).ti. (260051)
125 122 not (123 or 124) [Exclude stroke studies] (4359)
126 (editorial or comment or letter or newspaper article).pt. (2077106)
127 125 not 126 [Exclude opinion pieces] (4306)
128 limit 127 to english (4041)
129 remove duplicates from 128 (4031)

Database: **Wiley Cochrane Trials (CENTRAL)**
Strategy:

ID	Search
#1	[mh ^"Bursitis"] AND (gleno* or (rotator NEAR/1 cuff*) or shoulder*):ti,ab,kw 309
#2	[mh ^"Rotator Cuff"] 436
#3	[mh ^"Rotator Cuff Injuries"] 597
#4	[mh "Scapula"] 208
#5	[mh ^"Shoulder"] 642
#6	[mh ^"Shoulder Impingement Syndrome"] 415
#7	[mh ^"Shoulder Injuries"] 119
#8	[mh ^"Shoulder Joint"] 816
#9	[mh ^"Shoulder Pain"] 1093
#10	[mh ^"Tendinopathy"] and (gleno* or (rotator NEAR/1 cuff*) or shoulder*):ti,ab,kw 251
#11	[mh ^"Tenosynovitis"] and (gleno* or (rotator NEAR/1 cuff*) or shoulder*):ti,ab,kw 15
#12	((acromion* or coracoid* or gleno* or (infra NEAR/1 spinatus*) or infraspinatus* or (rotator NEAR/1 cuff*) or shoulder* or scapul* or (supra NEAR/1 spinatus*) or supraspinatus* or (teres NEAR/1 minor*)) NEAR/3 (bursiti* or capsuliti* or degenerati* or disease* or disorder* or imping* or inflam* or injur* or pain* or patholog* or problem* or ruptur* or stiff* or strain* or stress* or tear* or tendin* or tendoni* or tendono* or tenosyno* or torn* or trauma* or weak* or wear*)):ti,ab,kw 6660
#13	(frozen NEAR/1 shoulder*):ti,ab,kw 507
#14	(SLAP NEAR/1 tear*):ti,ab,kw 5
#15	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 7603
#16	[mh ^"Acupressure"] 419
#17	[mh ^"Acupuncture Therapy"] 3315
#18	[mh ^"Acupuncture"] 162
#19	[mh ^"Adrenal Cortex Hormones"/tu] 1394
#20	[mh ^"Anti-Inflammatory Agents"] 6162
#21	[mh ^"Anti-Inflammatory Agents, Non-Steroidal"] 6766
#22	[mh ^"Conservative Treatment"] 178
#23	[mh ^"Cryotherapy"] 763
#24	[mh ^"Electric Stimulation Therapy"] 2026
#25	[mh "Exercise Therapy"] 16029
#26	[mh ^"General Practitioners"] 332
#27	[mh ^"Glucocorticoids"] 4777
#28	[mh "Hyperthermia, Induced"] 1807
#29	[mh ^"Injections, Intra-Articular"] 1423
#30	[mh ^"Methylprednisolone"] 2820
#31	[mh ^"Physical and Rehabilitation Medicine"] 20
#32	[mh ^"Physical Therapy Modalities"] 4092
#33	[mh ^"Physicians, Family"] 462
#34	[mh ^"Physicians, Primary Care"] 175

#35 [mh ^"Postural Balance"] 3139
#36 [mh ^"Posture"] 3485
#37 [mh ^"Primary Health Care"] 4685
#38 [mh ^"Rehabilitation"] 322
#39 [mh ^"Ultrasonography, Interventional"] 2249
#40 [mh ^"Watchful Waiting"] 365
#41 (acupunctur* or acupressure*):ti,ab,kw 17527
#42 ((adjust* or intervention* or modif* or stabil*) NEAR/2 postur*):ti,ab,kw 1443
#43 ((anti NEAR/1 inflammator*) or antiinflammator* or NSAID*):ti,ab,kw 34729
#44 ((appl* or pack* or pad*) NEAR/2 (hot or heat*)):ti,ab,kw 934
#45 ((appl* or pack or pad*) NEAR/2 (ice or cold)):ti,ab,kw 776
#46 chiropract*:ti,ab,kw 1190
#47 ((cold NEAR/1 therap*) or cryotherap*):ti,ab,kw 2556
#48 ((conservative* or (non NEAR/1 operative*) or (non NEAR/1 surgical*) or nonoperative* or nonsurgical*) NEAR/3 (manage* or therap* or treat*)):ti,ab,kw 12148
#49 ((cortico* or cortiso* or glucocortico* or prednison* or steroid*) NEAR/2 (inject* or shot*)):ti,ab,kw 3421
#50 ((doctor* or physician*) NEAR/1 office*):ti,ab,kw 627
#51 (dry NEAR/1 needling*):ti,ab,kw 805
#52 (exercis* NEAR/2 therap*):ti,ab,kw 18190
#53 (general NEAR/1 practi*):ti,ab,kw 12388
#54 icing:ti,ab,kw 57
#55 (interferential NEAR/1 current*):ti,ab,kw 267
#56 (manual NEAR/1 therap*):ti,ab,kw 2062
#57 (motion NEAR/1 therap*):ti,ab,kw 221
#58 ((physio NEAR/1 therap*) or physiotherap* or (physical NEAR/1 therap*)):ti,ab,kw 26484
#59 rehab*:ti,ab,kw 56888
#60 ((resistance or strength* or weight*) NEAR/1 train*):ti,ab,kw 13510
#61 (stretches or stretching):ti,ab,kw 6573
#62 (wait* NEAR/2 watch*):ti,ab,kw 1101
#63 #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38 OR #39 OR #40 OR #41 OR #42 OR #43 OR #44 OR #45 OR #46 OR #47 OR #48 OR #49 OR #50 OR #51 OR #52 OR #53 OR #54 OR #55 OR #56 OR #57 OR #58 OR #59 OR #60 OR #61 OR #62 192838
#64 #63 AND #15 3968
#65 [mh "Child"] NOT ([mh "Adult"] AND [mh "Child"]) 43935
#66 (adolescen* or child* or infan* or juvenile* or neonat* or paediatric* or pediatric* or youth*):ti 138440
#67 #64 NOT (#65 OR #66) 3944
#68 [mh "Aged"] NOT (([mh ^"Adult"] OR [mh ^"Middle Aged"] OR [mh ^"Young Adult"]) AND [mh "Aged"]) 26097
#69 (aged or elder* or geriatic* or older adult* or senior*):ti 36989
#70 #67 NOT (#68 OR #69) 3892
#71 [mh ^"Anesthetics, Local"] 9079

#72	[mh ^"Brachial Plexus Block"] 212
#73	(anaesth* or anesth* or ("brachial plexus" NEAR/1 block*)):ti 30328
#74	#70 NOT (#71 OR #72 OR #73) 3678
#75	[mh "Arthritis"] 17202
#76	(arthriti* or osteoarthri* or OA):ti 26564
#77	#74 NOT (#75 OR #76) 3561
#78	[mh "Breast Neoplasms"] 14489
#79	[mh "Head and Neck Neoplasms"] 6517
#80	cancer*:ti 110905
#81	#77 NOT (#78 OR #79 OR #80) 3421
#82	[mh "Perioperative Care"] 12780
#83	(intraop* or operative* or periop* or postop*):ti 42731
#84	#81 NOT (#82 OR #83) 3286
#85	[mh ^"Shoulder Dislocation"] 165
#86	(bankart* or dislocat* or instab* or subluxat*):ti 1956
#87	#84 NOT (#85 OR #86) 3186
#88	[mh "Stroke"] 11365
#89	(ischaem* or ischem* or stroke* or TIA):ti 42334
#90	#87 NOT (#88 OR #89) 2982

Database: CINAHL Plus with Full Text via EBSCOhost
Strategy:

#	Query	Limiters/Expanders	Results
S1	(MH "Bursitis") and (TI (gleno* or "rotator cuff*" or shoulder*) or AB (gleno* or "rotator cuff*" or shoulder*))	Search modes - Find all my search terms	321
S2	(MH "Rotator Cuff+")	Search modes - Find all my search terms	3,589
S3	(MH "Rotator Cuff Injuries")	Search modes - Find all my search terms	3,177
S4	(MH "Scapula+")	Search modes - Find all my search terms	3,021
S5	(MH "Shoulder")	Search modes - Find all my search terms	7,385
S6	(MH "Shoulder Impingement Syndrome")	Search modes - Find all my search terms	1,476
S7	(MH "Shoulder Injuries")	Search modes - Find all my search terms	2,312
S8	(MH "Shoulder Joint+")	Search modes - Find all my search terms	6,845
S9	(MH "Shoulder Pain")	Search modes - Find all my search terms	4,463
S10	(MH "Tendinopathy") and (TI (gleno* or "rotator cuff*" or	Search modes - Find all my search terms	630

	shoulder*) or AB (gleno* or "rotator cuff*" or shoulder*))		
S11	(MH "Tenosynovitis+") and (TI (gleno* or "rotator cuff*" or shoulder*) or AB (gleno* or "rotator cuff*" or shoulder*))	Search modes - Find all my search terms	62
S12	TI ((acromion* or coracoid* or gleno* or "infra spinatus*" or infraspinatus* or "rotator cuff*" or shoulder* or scapul* or "supra spinatus*" or supraspinatus* or "teres minor*") N3 (bursiti* or capsuliti* or degenerati* or disease* or disorder* or imping* or inflam* or injur* or pain* or patholog* or problem* or ruptur* or stiff* or strain* or stress* or tear* or tendin* or tendoni* or tendono* or tenosyno* or torn* or trauma* or weak* or wear*)) or AB ((acromion* or coracoid* or gleno* or "infra spinatus*" or infraspinatus* or "rotator cuff*" or shoulder* or scapul* or "supra spinatus*" or supraspinatus* or "teres minor*") N3 (bursiti* or capsuliti* or degenerati* or disease* or disorder* or imping* or inflam* or injur* or pain* or patholog* or problem* or ruptur* or stiff* or strain* or stress* or tear* or tendin* or tendoni* or tendono* or tenosyno* or torn* or trauma* or weak* or wear*))	Search modes - Find all my search terms	14,172
S13	TI "frozen shoulder*" or AB "frozen shoulder*"	Search modes - Find all my search terms	561
S14	TI "SLAP tear*" or AB "SLAP tear*"	Search modes - Find all my search terms	136
S15	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14	Search modes - Find all my search terms	27,893
S16	(MH "Acupressure")	Search modes - Find all my search terms	1,500
S17	(MH "Acupuncture")	Search modes - Find all my search terms	15,722
S18	(MH "Adrenal Cortex Hormones/TU")	Search modes - Find all my search terms	8,725
S19	(MH "Antiinflammatory Agents")	Search modes - Find all my search terms	13,061
S20	(MH "Antiinflammatory Agents, Non-Steroidal")	Search modes - Find all my search terms	15,032

S21	(MM "Balance, Postural")	Search modes - Find all my search terms	11,615
S22	(MH "Cryotherapy")	Search modes - Find all my search terms	3,145
S23	(MH "Dry Needling")	Search modes - Find all my search terms	402
S24	(MH "Glucocorticoids+")	Search modes - Find all my search terms	19,618
S25	(MH "Heat-Cold Application")	Search modes - Find all my search terms	848
S26	(MH "Hyperthermia, Induced")	Search modes - Find all my search terms	1,387
S27	(MH "Injections, Intraarticular")	Search modes - Find all my search terms	3,144
S28	(MH "Methylprednisolone")	Search modes - Find all my search terms	3,440
S29	(MH "Physical Medicine")	Search modes - Find all my search terms	1,941
S30	(MH "Physical Therapy")	Search modes - Find all my search terms	37,704
S31	(MH "Physicians, Family")	Search modes - Find all my search terms	22,237
S32	(MM "Posture")	Search modes - Find all my search terms	7,888
S33	(MH "Primary Health Care")	Search modes - Find all my search terms	70,750
S34	(MH "Rehabilitation")	Search modes - Find all my search terms	19,549
S35	(MH "Therapeutic Exercise+")	Search modes - Find all my search terms	60,172
S36	TI (acupunctur* or acupressure*) or AB (acupunctur* or acupressure*)	Search modes - Find all my search terms	16,327
S37	TI ((adjust* or intervention* or modif* or stabil*) N2 postur*) or AB ((adjust* or intervention* or modif* or stabil*) N2 postur*)	Search modes - Find all my search terms	2,969
S38	TI ("anti inflammator*" or antiinflammator* or NSAID*) or AB ("anti inflammator*" or antiinflammator* or NSAID*)	Search modes - Find all my search terms	35,327
S39	TI ((appl* or pack* or pad*) N2 (hot or heat*)) or AB ((appl* or pack* or pad*) N2 (hot or heat*))	Search modes - Find all my search terms	985
S40	TI ((appl* or pack or pad*) N2 (ice or cold)) or AB ((appl* or pack or pad*) N2 (ice or cold))	Search modes - Find all my search terms	937
S41	TI ((care* or healthcare*) N2 primary) or AB ((care* or healthcare*) N2 primary	Search modes - Find all my search terms	103,162

S42	TI chiropract* or AB chiropract*	Search modes - Find all my search terms	15,962
S43	TI ("cold therap*" or cryotherap*) or AB ("cold therap*" or cryotherap*)	Search modes - Find all my search terms	2,059
S44	TI ((conservative* or "non operative*" or "non surgical*" or nonoperative* or nonsurgical*) N3 (manage* or therap* or treat*)) or AB ((conservative* or "non operative*" or "non surgical*" or nonoperative* or nonsurgical*) N3 (manage* or therap* or treat*))	Search modes - Find all my search terms	28,699
S45	TI ((cortico* or cortiso* or glucocortico* or prednison* or steroid*) N2 (inject* or shot*)) or AB ((cortico* or cortiso* or glucocortico* or prednison* or steroid*) N2 (inject* or shot*))	Search modes - Find all my search terms	4,504
S46	TI ((doctor* or physician*) N1 office*) or AB ((doctor* or physician*) N1 office*)	Search modes - Find all my search terms	12,635
S47	TI "dry needling*" or AB "dry needling*"	Search modes - Find all my search terms	747
S48	TI (exercis* N2 therap*) or AB (exercis* N2 therap*)	Search modes - Find all my search terms	5,524
S49	TI "general practi*" or AB "general practi*"	Search modes - Find all my search terms	33,898
S50	TI icing or AB icing	Search modes - Find all my search terms	137
S51	TI "interferential current*" or AB "interferential current*"	Search modes - Find all my search terms	157
S52	TI "manual therap*" or AB "manual therap*"	Search modes - Find all my search terms	2,920
S53	TI "motion therap*" or AB "motion therap*"	Search modes - Find all my search terms	32
S54	TI ("physio therap*" or physiotherap* or "physical therap*") or AB ("physio therap*" or physiotherap* or "physical therap*")	Search modes - Find all my search terms	46,977
S55	TI rehab* or AB rehab*	Search modes - Find all my search terms	108,495
S56	TI ((resistance or strength* or weight*) N1 train*) or AB (resistance or strength* or weight*) N1 train*)	Search modes - Find all my search terms	10,507

S57	TI (stretches or stretching) or AB (stretches or stretching)	Search modes - Find all my search terms	9,641
S58	TI (wait* N2 watch*) or AB (wait* N2 watch*)	Search modes - Find all my search terms	1,371
S59	S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53 OR S54 OR S55 OR S56 OR S57 OR S58	Search modes - Find all my search terms	547,705
S60	S15 AND S59	Search modes - Find all my search terms	8,326
S61	(MH "Clinical Trials+")	Search modes - Find all my search terms	337,511
S62	(MH "Placebos")	Search modes - Find all my search terms	13,676
S63	(MH "Quantitative Studies")	Search modes - Find all my search terms	31,875
S64	(MH "Random Assignment")	Search modes - Find all my search terms	73,608
S65	PT Clinical trial	Search modes - Find all my search terms	112,441
S66	TX (allocat* N1 random*)	Search modes - Find all my search terms	18,709
S67	TX ((doubl* N1 blind*) or (doubl* N1 mask*))	Search modes - Find all my search terms	1,251,203
S68	TX clinic* N1 trial*	Search modes - Find all my search terms	393,497
S69	TX placebo*	Search modes - Find all my search terms	112,366
S70	TX randomi* control* trial*	Search modes - Find all my search terms	369,395
S71	TX ((singl* N1 blind*) or (singl* N1 mask*))	Search modes - Find all my search terms	23,248
S72	TX ((trebl* N1 blind*) or (trebl* N1 mask*))	Search modes - Find all my search terms	9
S73	TX ((tripl* N1 blind*) or (tripl* N1 mask*))	Search modes - Find all my search terms	984
S74	S61 OR S62 OR S63 OR S64 OR S65 OR S66 OR S67 OR S68 OR S69 OR S70 OR S71 OR S72 OR S73	Search modes - Find all my search terms	1,767,159

S75	S60 AND S74	Search modes - Find all my search terms	3,010
S76	(MH "Control Group")	Search modes - Find all my search terms	12,927
S77	(MH "Correlational Studies")	Search modes - Find all my search terms	28,630
S78	(MH "Matched-Pair Analysis")	Search modes - Find all my search terms	2,130
S79	(MH "Nonexperimental Studies+")	Search modes - Find all my search terms	858,711
S80	TI "case control*" or AB "case control*"	Search modes - Find all my search terms	41,065
S81	TI cohort* or AB cohort*	Search modes - Find all my search terms	269,197
S82	TI "comparative stud*" or AB "comparative stud*"	Search modes - Find all my search terms	17,361
S83	TI (control or controlled) or AB (control or controlled)	Search modes - Find all my search terms	730,468
S84	TI "cross sectional" or AB "cross sectional"	Search modes - Find all my search terms	186,557
S85	TI "descriptive stud*" or AB "descriptive stud*"	Search modes - Find all my search terms	22,232
S86	TI ((design* or studies or study or test*) N2 (post* or pre*)) or AB ((design* or studies or study or test*) N2 (post* or pre*))	Search modes - Find all my search terms	379,109
S87	TI ("follow up" or followup) or AB ("follow up" or followup)	Search modes - Find all my search terms	301,167
S88	TI observational or AB observational	Search modes - Find all my search terms	87,026
S89	TI "population stud*" or AB "population stud*"	Search modes - Find all my search terms	5,282
S90	TI prospective or AB prospective	Search modes - Find all my search terms	208,260
S91	TI longitudinal or AB longitudinal	Search modes - Find all my search terms	104,173
S92	TI ("multi dimensional" or multidimensional) or AB ("multi dimensional" or multidimensional)	Search modes - Find all my search terms	15,192
S93	TI "natural experiment*" or AB "natural experiment*"	Search modes - Find all my search terms	1,149
S94	TI ("non random*" or nonrandom*) or AB ("non random*" or nonrandom*)	Search modes - Find all my search terms	11,731

S95	TI ("quasi random*" or quasirandom*) or AB ("quasi random*" or quasirandom*)	Search modes - Find all my search terms	2,185
S96	TI retrospective or AB retrospective	Search modes - Find all my search terms	198,137
S97	S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82 OR S83 OR S84 OR S85 OR S86 OR S87 OR S88 OR S89 OR S90 OR S91 OR S92 OR S93 OR S94 OR S95 OR S96	Search modes - Find all my search terms	2,031,596
S98	S60 AND S97	Search modes - Find all my search terms	3,916
S99	S75 OR S98	Search modes - Find all my search terms	4,940
S100	((MH "Vertebrates+") NOT MH Human)	Search modes - Find all my search terms	213,299
S101	TI (animal* or bovine* or calves or camel* or canine* or cat or cats or chimp* or dog or dogs or equine* or feline* or goat* or hamster* or horse* or llama* or mice* or monkey* or mouse* or pig or piglet* or pigs or porcine* or primate* or rabbit* or rat or rats or rodent* or sheep* or simian* or swine*)	Search modes - Find all my search terms	120,656
S102	S100 OR S101	Search modes - Find all my search terms	251,330
S103	S99 NOT S102	Search modes - Find all my search terms	4,912
S104	(MH "Child+") NOT (MH "Adult+" and MH "Child+")	Search modes - Find all my search terms	558,128
S105	TI (adolescen* or child* or infan* or juvenile* or neonat* or paediatric* or pediatric* or youth*)	Search modes - Find all my search terms	595,911
S106	S104 OR S105	Search modes - Find all my search terms	828,285
S107	S103 NOT S106	Search modes - Find all my search terms	4,759
S108	(MH "Aged+") NOT ((MH "Adult" or MH "Middle Age" or MH "Young Adult") and MH "Aged+"))	Search modes - Find all my search terms	288,823
S109	TI (aged or elder* or geriatic* or older adult* or senior*)	Search modes - Find all my search terms	134,933
S110	S108 OR S109	Search modes - Find all my search terms	355,979
S111	S107 NOT S110	Search modes - Find all my search terms	4,625

S112	(MM "Anesthetics, Local")	Search modes - Find all my search terms	5,771
S113	(MM "Brachial Plexus Block")	Search modes - Find all my search terms	338
S114	TI (anaesth* or anesth* or "brachial plexus block*")	Search modes - Find all my search terms	38,586
S115	S112 OR S113 OR S114	Search modes - Find all my search terms	41,924
S116	S111 NOT S115	Search modes - Find all my search terms	4,557
S117	(MM "Arthritis+")	Search modes - Find all my search terms	66,925
S118	TI (arthriti* or osteoarthri* or OA)	Search modes - Find all my search terms	49,993
S119	S117 OR S118	Search modes - Find all my search terms	76,268
S120	S116 NOT S119	Search modes - Find all my search terms	4,475
S121	(MM "Breast Neoplasms+")	Search modes - Find all my search terms	77,632
S122	(MM "Head and Neck Neoplasms+")	Search modes - Find all my search terms	49,109
S123	TI cancer*	Search modes - Find all my search terms	321,119
S124	S121 OR S122 OR S123	Search modes - Find all my search terms	374,828
S125	S120 NOT S124	Search modes - Find all my search terms	4,342
S126	(MM "Perioperative Care+")	Search modes - Find all my search terms	33,439
S127	TI (intraop* or operative* or periop* or postop*)	Search modes - Find all my search terms	54,696
S128	S126 OR S127	Search modes - Find all my search terms	77,907
S129	S125 NOT S128	Search modes - Find all my search terms	4,220
S130	(MM "Shoulder Dislocation")	Search modes - Find all my search terms	1,467
S131	TI (bankart* or dislocat* or instab* or subluxat*)	Search modes - Find all my search terms	14,002
S132	S130 OR S131	Search modes - Find all my search terms	14,394
S133	S129 NOT S132	Search modes - Find all my search terms	3,994
S134	(MM "Stroke+")	Search modes - Find all my search terms	58,553
S135	TI (ischaem* or ischem* or or stroke* or TIA)	Search modes - Find all my search terms	15,795
S136	S134 OR S135	Search modes - Find all my search terms	65,756
S137	S133 NOT S136	Search modes - Find all my search terms	3,847

S138	TI (editor* or comment* or letter* or news*)	Search modes - Find all my search terms	223,631
S139	S137 NOT S138	Search modes - Find all my search terms	3,783
S140	S137 NOT S138	Limiters - English Language Search modes - Find all my search terms	3,654

Database: SPORTDiscus with Full Text via EBSCOhost
Strategy:

#	Query	Limiters/Expanders	Results
S1	DE "BURSITIS" and (TI (gleno* or "rotator cuff*" or shoulder*) or AB (gleno* or "rotator cuff*" or shoulder*))	Search modes - Find all my search terms	153
S2	DE "ROTATOR cuff"	Search modes - Find all my search terms	1,461
S3	DE "ROTATOR cuff -- Wounds & injuries"	Search modes - Find all my search terms	4,404
S4	DE "SCAPULA"	Search modes - Find all my search terms	1,146
S5	DE "SHOULDER"	Search modes - Find all my search terms	4,325
S6	DE "SHOULDER injuries"	Search modes - Find all my search terms	1,884
S7	DE "SHOULDER joint"	Search modes - Find all my search terms	1,980
S8	DE "SHOULDER joint injuries"	Search modes - Find all my search terms	260
S9	DE "SHOULDER pain"	Search modes - Find all my search terms	1,178
S10	DE "SYNOVITIS" and (TI (gleno* or "rotator cuff*" or shoulder*) or AB (gleno* or "rotator cuff*" or shoulder*))	Search modes - Find all my search terms	14
S11	DE "TENDINITIS" and (TI (gleno* or "rotator cuff*" or shoulder*) or AB (gleno* or "rotator cuff*" or shoulder*))	Search modes - Find all my search terms	436
S12	DE "TENDINOSIS" and (TI (gleno* or "rotator cuff*" or shoulder*) or AB (gleno* or "rotator cuff*" or shoulder*))	Search modes - Find all my search terms	36
S13	TI ((acromion* or coracoid* or gleno* or "infra spinatus*" or infraspinatus* or "rotator cuff*" or shoulder* or scapul* or "supra spinatus*" or supraspinatus* or "teres minor*") N3 (bursiti* or capsuliti* or degenerati* or disease* or disorder* or imping* or inflam* or	Search modes - Find all my search terms	8,935

	injur* or pain* or patholog* or problem* or ruptur* or stiff* or strain* or stress* or tear* or tendin* or tendoni* or tendono* or tenosyno* or torn* or trauma* or weak* or wear*)) or AB ((acromion* or coracoid* or gleno* or "infra spinatus*" or infraspinatus* or "rotator cuff*" or shoulder* or scapul* or "supra spinatus*" or supraspinatus* or "teres minor*") N3 (bursiti* or capsuliti* or degenerati* or disease* or disorder* or imping* or inflam* or injur* or pain* or patholog* or problem* or ruptur* or stiff* or strain* or stress* or tear* or tendin* or tendoni* or tendono* or tenosyno* or torn* or trauma* or weak* or wear*))		
S14	TI "frozen shoulder*" or AB "frozen shoulder*"	Search modes - Find all my search terms	243
S15	TI "SLAP tear*" or AB "SLAP tear*"	Search modes - Find all my search terms	62
S16	S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13 OR S14 OR S15	Search modes - Find all my search terms	15,286
S17	DE "ACUPRESSURE"	Search modes - Find all my search terms	257
S18	DE "ACUPUNCTURE"	Search modes - Find all my search terms	997
S19	DE "ADRENOCORTICAL hormones"	Search modes - Find all my search terms	988
S20	DE "ANTI-inflammatory agents"	Search modes - Find all my search terms	1,094
S21	DE "COLD therapy"	Search modes - Find all my search terms	847
S22	DE "ELECTRIC stimulation"	Search modes - Find all my search terms	4,109
S23	DE "EXERCISE therapy"	Search modes - Find all my search terms	6,878
S24	DE "GLUCOCORTICOIDS"	Search modes - Find all my search terms	570
S25	DE "INJECTIONS"	Search modes - Find all my search terms	1,319
S26	DE "MEDICAL rehabilitation"	Search modes - Find all my search terms	4,522
S27	DE "NONSTEROIDAL anti-inflammatory agents"	Search modes - Find all my search terms	1,001
S28	DE "PHYSICAL medicine"	Search modes - Find all my search terms	992
S29	DE "PHYSICIANS (General practice)"	Search modes - Find all my search terms	1,424
S30	DE "POSTURE"	Search modes - Find all my search terms	9,524

S31	TI (acupunctur* or acupressure*) or AB (acupunctur* or acupressure*)	Search modes - Find all my search terms	1,527
S32	TI ((adjust* or intervention* or modif* or stabil*) N2 postur*) or AB ((adjust* or intervention* or modif* or stabil*) N2 postur*)	Search modes - Find all my search terms	2,392
S33	TI ("anti inflammator*" or antiinflammator* or NSAID*) or AB ("anti inflammator*" or antiinflammator* or NSAID*)	Search modes - Find all my search terms	4,585
S34	TI ((appl* or pack* or pad*) N2 (hot or heat*)) or AB ((appl* or pack* or pad*) N2 (hot or heat*))	Search modes - Find all my search terms	481
S35	TI ((appl* or pack or pad*) N2 (ice or cold)) or AB ((appl* or pack or pad*) N2 (ice or cold))	Search modes - Find all my search terms	605
S36	TI ((care* or healthcare*) N2 primary) or AB ((care* or healthcare*) N2 primary	Search modes - Find all my search terms	4,272
S37	TI chiropract* or AB chiropract*	Search modes - Find all my search terms	2,034
S38	TI ("cold therap*" or cryotherap*) or AB ("cold therap*" or cryotherap*)	Search modes - Find all my search terms	918
S39	TI ((conservative* or "non operative*" or "non surgical*" or nonoperative* or nonsurgical*) N3 (manage* or therap* or treat*)) or AB ((conservative* or "non operative*" or "non surgical*" or nonoperative* or nonsurgical*) N3 (manage* or therap* or treat*))	Search modes - Find all my search terms	6,029
S40	TI ((cortico* or cortiso* or glucocortico* or prednison* or steroid*) N2 (inject* or shot*)) or AB ((cortico* or cortiso* or glucocortico* or prednison* or steroid*) N2 (inject* or shot*))	Search modes - Find all my search terms	1,365
S41	TI ((doctor* or physician*) N1 office*) or AB ((doctor* or physician*) N1 office*)	Search modes - Find all my search terms	208
S42	TI "dry needling*" or AB "dry needling*"	Search modes - Find all my search terms	358
S43	TI (exercis* N2 therap*) or AB (exercis* N2 therap*)	Search modes - Find all my search terms	2,888

S44	TI "general practi*" or AB "general practi*"	Search modes - Find all my search terms	1,325
S45	TI icing or AB icing	Search modes - Find all my search terms	238
S46	TI "interferential current*" or AB "interferential current*"	Search modes - Find all my search terms	89
S47	TI "manual therap*" or AB "manual therap*"	Search modes - Find all my search terms	1,533
S48	TI "motion therap*" or AB "motion therap*"	Search modes - Find all my search terms	15
S49	TI ("physio therap*" or physiotherap* or "physical therap*") or AB ("physio therap*" or physiotherap* or "physical therap*")	Search modes - Find all my search terms	23,375
S50	TI rehab* or AB rehab*	Search modes - Find all my search terms	41,381
S51	TI ((resistance or strength* or weight*) N1 train*) or AB (resistance or strength* or weight*) N1 train*)	Search modes - Find all my search terms	22,499
S52	TI (stretches or stretching) or AB (stretches or stretching)	Search modes - Find all my search terms	13,055
S53	TI (wait* N2 watch*) or AB (wait* N2 watch*)	Search modes - Find all my search terms	44
S54	S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36 OR S37 OR S38 OR S39 OR S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 OR S49 OR S50 OR S51 OR S52 OR S53	Search modes - Find all my search terms	136,623
S55	S16 AND S54	Search modes - Find all my search terms	4,092
S56	TX (allocat* N1 random*)	Search modes - Find all my search terms	5,995
S57	TX ((doubl* N1 blind*) or (doubl* N1 mask*))	Search modes - Find all my search terms	20,119
S58	TX clinic* N1 trial*	Search modes - Find all my search terms	46,522
S59	TX placebo*	Search modes - Find all my search terms	30,087
S60	TX randomi* control* trial*	Search modes - Find all my search terms	76,823

S61	TX ((singl* N1 blind*) or (singl* N1 mask*))	Search modes - Find all my search terms	4,614
S62	TX ((trebl* N1 blind*) or (trebl* N1 mask*))	Search modes - Find all my search terms	2
S63	TX ((tripl* N1 blind*) or (tripl* N1 mask*))	Search modes - Find all my search terms	188
S64	S56 OR S57 OR S58 OR S59 OR S60 OR S61 OR S62 OR S63	Search modes - Find all my search terms	110,477
S65	S55 AND S64	Search modes - Find all my search terms	970
S66	TI "case control*" or AB "case control*"	Search modes - Find all my search terms	4,079
S67	TI cohort* or AB cohort*	Search modes - Find all my search terms	23,689
S68	TI "comparative stud*" or AB "comparative stud*"	Search modes - Find all my search terms	3,724
S69	TI (control or controlled) or AB (control or controlled)	Search modes - Find all my search terms	139,543
S70	TI "cross sectional" or AB "cross sectional"	Search modes - Find all my search terms	24,457
S71	TI "descriptive stud*" or AB "descriptive stud*"	Search modes - Find all my search terms	1,278
S72	TI ((design* or studies or study or test*) N2 (post* or pre*)) or AB ((design* or studies or study or test*) N2 (post* or pre*))	Search modes - Find all my search terms	86,051
S73	TI ("follow up" or followup) or AB ("follow up" or followup)	Search modes - Find all my search terms	34,751
S74	TI observational or AB observational	Search modes - Find all my search terms	8,057
S75	TI "population stud*" or AB "population stud*"	Search modes - Find all my search terms	670
S76	TI prospective or AB prospective	Search modes - Find all my search terms	21,406
S77	TI longitudinal or AB longitudinal	Search modes - Find all my search terms	15,271
S78	TI ("multi dimensional" or multidimensional) or AB ("multi dimensional" or multidimensional)	Search modes - Find all my search terms	3,468
S79	TI "natural experiment*" or AB "natural experiment*"	Search modes - Find all my search terms	171

S80	TI ("non random*" or nonrandom*) or AB ("non random*" or nonrandom*)	Search modes - Find all my search terms	1,218
S81	TI ("quasi random*" or quasirandom*) or AB ("quasi random*" or quasirandom*)	Search modes - Find all my search terms	199
S82	TI retrospective or AB retrospective	Search modes - Find all my search terms	13,193
S83	S66 OR S67 OR S68 OR S69 OR S70 OR S71 OR S72 OR S73 OR S74 OR S75 OR S76 OR S77 OR S78 OR S79 OR S80 OR S81 OR S82	Search modes - Find all my search terms	286,893
S84	S55 AND S83	Search modes - Find all my search terms	1,730
S85	S65 OR S84	Search modes - Find all my search terms	2,006
S86	TI (animal* or bovine* or calves or camel* or canine* or cat or cats or chimp* or dog or dogs or equine* or feline* or goat* or hamster* or horse* or llama* or mice* or monkey* or mouse* or pig or piglet* or pigs or porcine* or primate* or rabbit* or rat or rats or rodent* or sheep* or simian* or swine*)	Search modes - Find all my search terms	42,013
S87	S85 NOT S86	Search modes - Find all my search terms	1,995
S88	TI (adolescen* or child* or infan* or juvenile* or neonat* or paediatric* or pediatric* or youth*)	Search modes - Find all my search terms	75,691
S89	S87 NOT S88	Search modes - Find all my search terms	1,961
S90	TI (aged or elder* or geriatric* or older adult* or senior*)	Search modes - Find all my search terms	22,761
S91	S89 NOT S90	Search modes - Find all my search terms	1,951
S92	TI (anaesth* or anesth* or "brachial plexus block*")	Search modes - Find all my search terms	807
S93	S91 NOT S92	Search modes - Find all my search terms	1,946
S94	TI (arthriti* or osteoarthri* or OA)	Search modes - Find all my search terms	6,098
S95	S93 NOT S94	Search modes - Find all my search terms	1,934
S96	TI cancer*	Search modes - Find all my search terms	11,692
S97	S95 NOT S96	Search modes - Find all my search terms	1,912

S98	TI (intraop* or operative* or periop* or postop*)	Search modes - Find all my search terms	3,465
S99	S97 NOT S98	Search modes - Find all my search terms	1,877
S100	TI (bankart* or dislocat* or instab* or subluxat*)	Search modes - Find all my search terms	5,840
S101	S99 NOT S100	Search modes - Find all my search terms	1,728
S102	TI (ischaem* or ischem* or or stroke* or TIA)	Search modes - Find all my search terms	791
S103	S101 NOT S102	Search modes - Find all my search terms	1,728
S104	TI (editor* or comment* or letter* or news*)	Search modes - Find all my search terms	50,610
S105	S103 NOT S104	Search modes - Find all my search terms	1,711
S106	S103 NOT S104	Limiters - Language: English Search modes - Find all my search terms	1,665

Database: Conference Proceedings Citation Index – Science (CPCI-S) – 1990-present (Web of Science Core Collection)
Strategy:

# 29	**100**	(#27 NOT #28) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 28	**50,474**	(TI=(ischaem* or ischem* or stroke* or TIA)) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 27	**114**	(#25 NOT #26) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 26	**17,600**	(TI=(bankart* or dislocat* or instab* or subluxat*)) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 25	**122**	(#23 NOT #24) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 24	**21,910**	(TI=(intraop* or operative* or periop* or postop*)) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 23	**123**	(#21 NOT #22) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 22	**192,963**	(TI=cancer*) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 21	**123**	(#19 NOT #20) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 20	**32,804**	(TI=(arthriti* or osteoarthri* or OA)) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 19	**123**	(#17 NOT #18) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*

# 18	8,554	(TI=(anaesth* or anesth* or "brachial plexus block*")) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 17	123	(#15 NOT #16) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 16	83,390	(TI=(aged or elder* or geriatic* or older adult* or senior*)) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 15	123	(#13 NOT #14) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 14	137,265	(TI=(adolescen* or child* or infan* or juvenile* or neonat* or paediatric* or pediatric* or youth*)) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 13	124	(#11 NOT #12) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 12	252,765	(TI=(animal* or bovine* or calves or camel* or canine* or cat or cats or chimp* or dog or dogs or equine* or feline* or goat* or hamster* or horse* or llama* or mice* or monkey* or mouse* or pig or piglet* or pigs or porcine* or primate* or rabbit* or rat or rats or rodent* or sheep* or simian* or swine*)) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 11	124	(#8 OR #10) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 10	118	(#6 AND #9) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 9	1,486,782	(TS=("case control*" or cohort* or "comparative stud*" or control or controlled or "cross sectional" or "descriptive stud*" or ((design* or studies or study or test*) NEAR/2 (post* or pre*)) or "follow up" or followup or observational or "population stud*" or prospective or longitudinal or "multi dimensional" or multidimensional or "natural experiment*" or "non random*" or nonrandom* or "quasi random*" or quasirandom* or retrospective))*AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 8	47	(#6 AND #7) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 7	66,836	(TS=((allocat* NEAR/1 random*) or (doubl* NEAR/1 blind*) or (doubl* NEAR/1 mask*) or (clinic* NEAR/1 trial*) or placebo* or "randomi* control* trial*" or (singl* NEAR/1 blind*) or (singl* NEAR/1 mask*) or (trebl* NEAR/1 blind*) or (trebl* NEAR/1 mask*) or (tripl* NEAR/1 blind*) or (tripl* NEAR/1 mask*)))*AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 6	244	(#4 AND #5) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 5	111,193	(TS=(acupunctur* or acupressure* or ((adjust* or intervention* or modif* or stabil*) NEAR/2 postur*) or "anti inflammator*" or antiinflammator* or NSAID* or ((appl* or pack* or pad*) NEAR/2 (hot or heat*)) or ((appl* or pack or pad*) NEAR/2 (ice or cold)) or ((care* or healthcare*) NEAR/2 primary) or chiropract* or "cold therap*" or cryotherap* or ((conservative* or "non operative*" or "non surgical*" or nonoperative* or nonsurgical*) NEAR/3 (manage* or therap* or treat*)) or ((cortico* or cortiso* or glucocortico* or prednison* or steroid*) NEAR/2 (inject* or shot*)) or ((doctor* or physician*) NEAR/1 office*) or "dry needling*" or (exercis* NEAR/2 therap*) or "general practi*" or icing or "interferential current*" or "manual therap*" or "motion therap*" or "physio therap*" or physiotherap* or "physical therap*" or rehab* or ((resistance or strength* or weight*)

		NEAR/1 train*) or stretches or stretching or (wait* NEAR/2 watch*))) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 4	1,293	(#1 OR #2 OR #3) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 3	2	(TS="SLAP tear*") *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 2	57	(TS="frozen shoulder*") *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*
# 1	1,259	(TS=((acromion* or coracoid* or gleno* or "infra spinatus*" or infraspinatus* or "rotator cuff*" or shoulder* or scapul* or "supra spinatus*" or supraspinatus* or "teres minor*") NEAR/3 (bursiti* or capsuliti* or degenerati* or disease* or disorder* or imping* or inflam* or injur* or pain* or patholog* or problem* or ruptur* or stiff* or strain* or stress* or tear* or tendin* or tendoni* or tendono* or tenosyno* or torn* or trauma* or weak* or wear*))) *AND* **LANGUAGE:** (English) *Indexes=CPCI-S Timespan=1990-2018*

Summary of Association Website Search

Website	Search method	# of records found	Note
Canadian Academy of Sport and Exercise Medicine	Searched the website using keywords for shoulder term	1	"Kocher 1998" found through searching bibliography of "snowboarding injuries" under the section "past CASEM statements"
Canadian Athletic Therapists Association			Login username/ password is needed to access papers
Canadian Physiotherapy Association	Searched the website using keywords for shoulder term Searched the publication section	0	
College of Family Physicians of Canada – Sport & Exercise Committee	Searched the website using keywords for shoulder term Searched the publication section	0	
Exercise is Medicine Canada	Searched the website using keywords for shoulder term Searched with "publication" term	0	
Exercise is Medicine Canada	Searched the website using keywords for shoulder term Searched through "public resources" section	0	The site contains several blog posts related when using the keywords search, I did not see any reported studies

Ontario Medical Association – Section on Sport & Exercise Medicine	Searched the website using keywords for shoulder term Searched with “publication” term		Not available to public
Sport Physiotherapy Canada	Searched the website using keywords for shoulder term Searched with “publication” term	0	

Supporting Information – S2: Description of Interventions by Study

Author, year	Definition	Group 1	Group 2	Group 3
Aceituno-Gómez et al., 2019 (33)	EPA+ET vs RC	•High-intensity laser therapy • Exercise therapy: hot pack; autopassives exercises; active assistive mobilization on shoulder (flexion, abduction, internal and external rotation); shoulder exercises with weight (flexion, internal and external rotation), pendulum exercises, cold pack	• Sham-laser • Exercise therapy: hot pack; autopassives exercises; active assistive mobilization on shoulder (flexion, abduction, internal and external rotation); shoulder exercises with weight (flexion, internal and external rotation), pendulum exercises, cold pack	
Ager et al., 2019 (34)	RC + SCAP vs MT+ET	• Upper Extremity Neuromuscular Training Program: postural and scapulothoracic control, weight-bearing exercises, neuromuscular re-education (RC complex, serratus anterior, trapezius), body blade exercises, proprioception and motor control exercises, functional activities.	• One-on-One Usual Physiotherapy Care: active exercise rehabilitation approach which included strengthening and neuromuscular training exercises	
Akbaba et al., 2019 (35)	MT+ET vs RC+SCAP	• Ischemic compression active of myofascial trigger points in addition to standard conservative treatment program, ergonomic recommends, and instructions to assume and maintain good posture • Home exercise: gentle static stretching and relaxation exercises at home	• Standard conservative treatment program, ergonomic recommends, and instructions to assume and maintain good posture • Home exercise: gentle static stretching and relaxation exercises at home	
Akyol et al., 2012 (36)	EPA+ET vs RC+SCAP	• Therapeutic Microwave diathermy • Hot pack (20 min) • Exercise program composed of 15-min shoulder active range of motion (Codman's pendulum, wall-climbing, and shoulder wheel), 5-min stretching and 10-min strengthening exercise including rotator cuff muscles, rhomboids, levator scapulae, and serratus anterior with an elastic band	• Sham Microwave diathermy • Hot pack (20 min) • Exercise program composed of 15-min shoulder active range of motion (Codman's pendulum, wall-climbing, and shoulder wheel), 5-min stretching and 10-min strengthening exercise including rotator cuff muscles, rhomboids, levator scapulae, and	

			serratus anterior with an elastic band	
Arias-Buria et al., 2017 (37)	EPA+ET vs RC+SCAP	• Dry needling on active trigger points (deltoid, supraspinatus, infraspinatus, teres minor and major, and subscapularis) • Eccentric program: 3 exercises, focusing on the supraspinatus, infraspinatus, and scapular muscles • Home exercise: same as exercise program	• Eccentric program: 3 exercises, focusing on the supraspinatus, infraspinatus, and scapular muscles • Home exercise: same as exercise program	
Arias-Buria et al., 2015 (38)	EPA+ET vs RC+SCAP	• US-Guided Percutaneous Electrolysis • Galvanic current through acupuncture needle • Eccentric program: 3 exercises, focusing on the supraspinatus, infraspinatus, and scapular muscles • Home exercise: same as exercise program	• Eccentric program: 3 exercises, focusing on the supraspinatus, infraspinatus, and scapular muscles • Home exercise: same as exercise program	
Atici et al., 2021 (39)	MT+ETvs EPA+ET	• Soft tissue mobilization • Home exercise: pectoral stretching, wand exercises, and theraband exercises for the infraspinatus and supraspinatus for strengthening	• Hot pack, TENS, continuous therapeutic ultrasound • Home exercise: pectoral stretching, wand exercises, and theraband exercises for the infraspinatus and supraspinatus for strengthening	
Aytar et al., 2015 (40)	MT+ET vs EPA+ET vs RC+SCAP	• Scapular mobilization: consisted of the application of superior and inferior gliding, rotations, and distraction to the scapula of affected shoulder • Hot pack and convencional TENS • Home exercise: the same exercises as done in the supervised execise group	• Sham Scapular Mobilization: hands were randomly put on the scapula, and then just skin was moved • Hot pack and convencional TENS • Home exercise: the same exercises as done in the supervised execise group	• Supervised exercise: Stretching (posterior capsule, external rotation, flexion and abduction stretch, pectoral stretch) and strengthening (serratus anterior, external rotation, and inferior glide) exercises were performed in front of the mirror with supervision • Hot pack and convencional TENS • Home exercise: the same exercises

Barra López et al., 2013 (41)	MT+ET vs EPA+ET	• Diacutaneous Fibrolysis treatment • Protocolised treatment based on therapeutic exercises, analgesic electrotherapy and cryotherapy	• Protocolised treatment based on therapeutic exercises, analgesic electrotherapy and cryotherapy	
Baskurt et al., 2011 (42)	RC+SCAP vs RC	• Scapular stabilization exercises: scapular proprioceptive neuromuscular facilitation (PNF) exercises, scapular clock exercise, standing weight shift, double arm balancing, scapular depression, wall push up, wall slide exercises • Flexibility exercises: posterior and inferior capsule stretching, forward flexion range of motion, abduction range of motion, internal rotation stretching with towel • Strengthening exercises: subscapularis, infraspinatus, supraspinatus, and anterior part of deltoid and posterior part of deltoid strengthening	• Flexibility exercises: posterior and inferior capsule stretching, forward flexion range of motion, abduction range of motion, internal rotation stretching with towel • Strengthening exercises: subscapularis, infraspinatus, supraspinatus, and anterior part of deltoid and posterior part of deltoid strengthening	
Bennell et al., 2010 (43)	MT+ET vs Usual Medical Care	• Soft tissue massage (anterior and posterior shoulder tissues), thoracic spine mobilisation (T1-8), cervical spine mobilisation (C5-7), scapular retraining, postural taping, thoracic extension • Home exercises: Supervised and done as home programme	• Sham ultrasound therapy and light application of a non-therapeutic gel to the shoulder region • No instruction in exercise techniques and no manual therapy	
Berg 2021 (44)	Non-specific RC exercises vs RC+SCAP	• High-intensity aerobic training in intervals performed with a workload • Home exercises: individually customized scapular stabilizing, rotator cuff, and pain-free ROM exercises	• Home exercises: individually customized scapular stabilizing, rotator cuff, and pain-free ROM exercises	
Bron 2011 (45)	MT+ET vs Usual Medical Care	• Myofascial trigger points by manual compression • Home exercise: simple gentle static stretching and relaxation exercises. When appropriate, the relaxation	• Remained on a waiting list	

		exercises were augmented by using a portable myofeedback device instructed to apply heat, such as a hot shower or hot packs		
Celik 2009 (46)	RC+SCAP vs RC	• Soulder flexion below 90 degrees, abduction, T-bar (wand) exercises containing internal-external rotation and extension, posterior capsule stretching and internal rotation exercises and rotator cuff strengthening exercises • Home exercise: same program plus ice application	• Shoulder exercises over 90 degrees, posterior and inferior capsule stretching exercises, rotator cuff strengthening and internal rotation exercises • Home exercise: same program plus ice application	
Celik 2009 (47)	Injections+ET vs EPA+ET	• Subacromial injection • Wand exercises, posterior and inferior capsule stretching exercises, internal rotation exercises and rotator cuff and scapulotorasic strengthening exercises. In addition, physiotherapists applied manually articular range of motion exercises • Home exercise: same program plus ice application	• Wand exercises, posterior and inferior capsule stretching exercises, internal rotation exercises and rotator cuff and scapulotorasic strengthening exercises. In addition, physiotherapists applied manually articular range of motion exercises • TENS • Home exercise: same program plus ice application	
Centeno 2020 (48)	Injections+ET vs RC	• Injection of autologous BMC and platelet products • Home exercise: stretches in all planes along with nonweighted exercises incorporating strengthening of scapular stabilizing muscles as well as the triceps and the rotator cuff muscles	• Home exercise: stretching, strengthening, and stability exercises	

Cha 2014 (49)	EPA+ET vs Usual Medical Care	• Warm-up: ultrasonic wave, laser therapy, stationary cycling and standing stretching • Work-out 1st phase: prone horizontal at 90-100° with external rotation, prone extension with ER, prone horizontal abduction at 90° with elbow flexion wirh ER, forward flexion, abduction, shrugon floor • Work-out 2nd phase: internal rotation scaption, ER scaption, military press, internal hospizontal abduction, external horizontal abduction, triceps extension, biceps curl, shoulder rowing • Work-out 3rd phase: horizontal abduction, straight arm press, internl rotation, ER, press-up • Cool-down: stretching, icing, electrotherapy, air compressor	• No rehabilitation exercise	
Chen 2009 (50)	MT+ET vs RC	• Passive joint mobilisations (performed either as a passive oscillatory movement or a sustained stretch with or without tiny amplitude oscillations at the limit of the range) • Advice and exercises aimed at restoring neuromuscular control of the shoulder muscles in order to restore the dynamic stability and muscle force couple co-ordination of the shoulder region	• Advice and exercises aimed at restoring neuromuscular control of the shoulder muscles in order to restore the dynamic stability and muscle force couple co-ordination of the shoulder region	
Crawshaw 2010 (51)	Injections+ET vs MT+ET	• Subacromial corticosteroid injection • Exercise and manual therapy: mobilisation techniques and exercises for each patient from six mobilisation techniques and 23 exercises. Resistive exercises were avoided for two weeks after the corticosteroid injection	•Exercise and manual therapy: mobilisation techniques and exercises for each patient from six mobilisation techniques and 23 exercises.	

Daghiani 2022 (52)	Injections+ET vs MT+ET	• Subacromial corticosteroid injection	• Supervised comprehensive physiotherapy: matched with the individual's impairments. Protocol consisted of MT+ETtechniques and exercises includes: glenohumeral and scapular mobilization techniques; stretching and strengthening exercises for glenohumeral and scapulothoracic muscles, exercises for dynamic and static scapular control, proprioception and balance exercises • Home exercise: the same of supervised	
deMiguelValtierra 2018 (53)	EPA+ET vs MT+ET	• Percutaneous electrolysis sessions • US-guidedpercutaneous electrolysis • Exercises: passive joint mobilizations targeting the glenohumeral joint, acromioclavicular joint, stermoclavicular joint, and scapulothoracic joint, and associated soft tissues structures. Three exercises focusing on supraspinatus, and scapular stabilizer muscles	• Exercises: passive joint mobilizations targeting the glenohumeral joint, acromioclavicular joint, stermoclavicular joint, and scapulothoracic joint, and associated soft tissues structures. Three exercises focusing on supraspinatus, and scapular stabilizer muscles	
deOliveira 2021 (54)	MT+ET vs RC+SCAP	• Kinesiotaping • Rehabilitation progra: sensorimotor training using motor control exercises, patient education and strengthening exercises. • Home exercises: sensorimotor training and strengthening exercises	• Rehabilitation program: sensorimotor training using motor control exercises, patient education and strengthening exercises. • Home exercises: sensorimotor training and strengthening exercises	
Dejaco 2017 (55)	RC+SCAP vs RC	• Eccentric exercise (at home): supine lying eccentric exercise for the external rotators with an elastic band and an empty-can abduction exercise in the scapular plane	• Conventional exercise (at home): a dumbbell full-can abduction exercise in the scapular plane, external and internal rotation in 0° of abduction using an elastic band, shoulder shrugs, knee push-up with a plus, prone horizontal abduction with external rotation, stretching	

			exercises for the pectoralis muscles and the cross-body adduction stretch	
Dickens 2005 (56)	MT+ET vs Usual Medical Care	• Acromioclavicular joint, thoracic, cervical spine and glenohumeral joint mobilisation, exercise therapy including attention to muscle imbalance, postural advice, strapping and, very occasionally, electrotherapy • Home exercise: same exercises	• Normal activities of daily living whilst waiting for surgery	
Dilek 2016 (57)	EPA+ET vs Non-specific RC exercises	• Proprioceptive exercise (balance, rotation, scapular stabilization, dynamic stabilization) • Phase 1: active rest, ROM exercises (pendulum exercises, passive and active assisted ROM with a stick), posterior capsular stretches, and patient education for activity modification • Phase 2: strengthening exercises of the rotator cuff, scapular stabilizers, and deltoid muscles. For strengthening rotator cuff muscles, isometric exercises, therabands, and free weights were used • Phase 3: activities progressively increased • Home exercise: same as phase 1 to 3	• Phase 1: active rest, ROM exercises (pendulum exercises, passive and active assisted ROM with a stick), posterior capsular stretches, and patient education for activity modification • Phase 2: strengthening exercises of the rotator cuff, scapular stabilizers, and deltoid muscles. For strengthening rotator cuff muscles, isometric exercises, therabands, and free weights were used • Phase 3: activities progressively increased • TENS and Hot Pack • Home exercise: same as phase 1 to 3	
Dogan 2021 (58)	Injections+ET vs EPA+ET	• Subacromial injection • Exercise: Passive ROM, stretching and pendulum. After gaining full ROM, isometricisotonic strenghtening exercises for RC and scapula stabilizer muscles were started with dumbbell and therabands	• Exercise: Passive ROM, stretching and pendulum. After gaining full ROM, isometricisotonic strenghtening exercises for RC and scapula stabilizer muscles were started with dumbbell and therabands • Ultrasound, hot pack and interferential current • Home exercise: same exercises	

Ekici 2021 (59)	MT+ETvs EPA+ET	• Trigger point deep friction massage (infraspinatus, supraspinatus, subscapularis, the upper part of the trapezius and levator scapula muscles)	• Trigger point dry needling (infraspinatus, supraspinatus, subscapularis, the upper part of the trapezius and levator scapula muscles)	
Elsodany 2018 (60)	EPA+ET vs RC+SCAP	• High-intensity laser therapy •ROM exercises in the form of a pendulum exercise progressed to active assisted ROM exercises with canes and active exercises in front of a mirror using opposite hands. Flexibility, postural, and strengthening exercises focused on the rotator cuff muscles using a Thera-Band and scapular stabilization exercises •Home exercises: sam as supervised	•Sham laser •ROM exercises in the form of a pendulum exercise progressed to active assisted ROM exercises with canes and active exercises in front of a mirror using opposite hands. Flexibility, postural, and strengthening exercises focused on the rotator cuff muscles using a Thera-Band and scapular stabilization exercises •Home exercises: sam as supervised	
Engebretsen 2009 2011(61, 62)	EPA+ET vs RC+SCAP	• Radial extracorporeal shockwave • Supervised exercises: inspection of alignment (including the scapula and the glenohumeral joint), relearning of normal movement patterns. Manual techniques for loosening tense muscles, an elastic rubber band, and a sling fixed to the ceiling were used. Endurance exercises were performed, principles of closed and open kinetic chain and plyometric exercises • Home exercise: correction of alignment during daily living and simple low loaded exercises with a thin elastic cord	• Supervised exercises: inspection of alignment (including the scapula and the glenohumeral joint), relearning of normal movement patterns. Manual techniques for loosening tense muscles, an elastic rubber band, and a sling fixed to the ceiling were used. Endurance exercises were performed, principles of closed and open kinetic chain and plyometric exercises • Home exercise: correction of alignment during daily living and simple low loaded exercises with a thin elastic cord	
Eslamian 2012 (63)	EPA+ET vs RC	• Low-level laser treatment • Superficial heat therapy (hot pack), deep-heat therapy (ultrasound), electrotherapy or trans-cutaneous electrical nerve stimulation (TENS) for pain relief and an exercise program for a total ten-session period	• Superficial heat therapy (hot pack), deep-heat therapy (ultrasound), electrotherapy or trans-cutaneous electrical nerve stimulation (TENS) for pain relief and an exercise program for a total ten-session period	

GalacedeFreitas 2014 (64)	EPA+ET vs RC	• Pulsed electromagnetic field • Program of exercises that focused on shoulder strengthening • Home exercise: same as supervised	• Sham pulsed electromagnetic field • Program of exercises that focused on shoulder strengthening • Home exercise: same as supervised	
Geraets 2005 (65)	Non-specific RC exercise vs Usual Medical care	• Graded exercise therapy: behavioural treatment program characterised by graded activity, time contingency, and operant conditioning. Program's activities are related to specific shoulder functions such as reaching, supporting, pushing, pulling, hitting, and stabilising, with work-related activities receiving special attention	• Usual care consisted of information, recommendations, and pain-contingent medical or pharmaceutical therapy	
Gomes 2018 (66)	EPA+ET vs MT+ET	• Interferential current • Cervical traction, myofascial release of the upper trapezius, sleeper's stretch, punch exercise, activation of the inferior trapezius muscle, activation of the middle trapezius muscle, rotator cuff exercise (internal rotation and external exercise), rotation on the wall using a ball	• Cervical traction, myofascial release of the upper trapezius, sleeper's stretch, punch exercise, activation of the inferior trapezius muscle, activation of the middle trapezius muscle, rotator cuff exercise (internal rotation and external exercise), rotation on the wall using a ball	
Hallgren 2014 (67)	RC+SCAP vs Non-specific RC exercise	• Included eccentric exercises for the rotator cuff and a combination of concentric and eccentric exercises for scapula stabilisers, all with progression of load	• Six active movements for the neck and shoulder without any load or progression shoulder abduction, retraction and elevation, neck retraction and stretch of upper trapezius and pectoralis major muscles	
Heron 2017 (68)	RC vs RC+SCAP	• Chain resisted band exercises: lateral rotation, medial rotation and abduction using rubber resistance bands.	• Closed chain exercises: exercises to activate the rotator cuff as a group, namely a double-arm wall press up, a pressup in four point kneeling and an exercise whereby the participant adopted a seated position and pressed their hands into the chair, as if trying to lift their body	

Holmgren 2012 (69)	RC+SCAP vs Non-specific RC exercises	• Specific exercise group: focused on strengthening eccentric exercises for the rotator cuff and strengthening concentric/eccentric exercises for the scapula stabilisers. The programme consisted of six different exercises: two eccentric exercises for the rotator cuff (supraspinatus, infraspinatus, and teres minor), three concentric/eccentric exercises for the scapula stabilisers (middle and lower trapezius, rhomboideus, and serratus anterior), and a posterior shoulder stretch • Home exercise	• Control exercise group: six unspecific movement exercises for the neck and shoulder without any external load (shoulder abduction in the frontal plane, shoulder retraction, shoulder elevation, neck retraction, stretch of upper trapezius and pectoralis major) • Home exercise: stretching exercise	
Hopewell 2021 (70)	RC vs Usual Care	• Progressive exercise (≤6 sessions): Exercises commonly affected by a rotator cuff disorder: resisted external rotation, flexion, and abduction of the shoulder • Participants were given a folder containing an advice booklet, exercise action planner, diary, and instructions on their exercise programme set up in collaboration with the physiotherapist. Resistance bands were issued as required	• Best practice advice (one session): Participants were given a folder containing an advice booklet, diary, and instructions of a a simple set of self-guided exercises • The exercises were designed using similar concepts to the progressive exercise intervention, such as increased resistance and done five times per week, but these were a simpler range of exercise options that were not supervised	
Ilhanli 2015 (71)	Injections+ET vs EPA+ET	• Platelet-rich plasma injection: three intra-articular Injections+ET with an interval of one week • After the third injection, ROM, pandicular, and stretching exercises were allowed and one month after the end of Injections+ET, patients were recommended to begin the strengthening program as tolerated	• Hot pack, ultrasound, TENS, range of motion, stretching and strengthening exercises • Home exercise: same as supervised	

Ingwersen 2019 (72)	Non-specific RC exercises vs RC+SCAP	• Psychomotor therapy sessions: different therapeutic techniques, including soft manual palpation of muscles, with a focus on shoulder, arm, and neck muscles, in order to improve consciousness and understanding of signals from the sensory and kinesthetic system. The sessions also consisted of breathing and bodily awareness exercises. • Exersice: consisted mostly of strengthening and stabilization exercises for the glenohumeral joint with focus on the rotator cuff muscles, and the scapula-thoracic muscles. Posture correction and stretching exercises were applied if relevant	• Exercise: consisted mostly of strengthening and stabilization exercises for the glenohumeral joint with focus on the rotator cuff muscles, and the scapula-thoracic muscles. Posture correction and stretching exercises were applied if relevant	
KazempourMofrad 2021 (73)	Injections+ET vs EPA+ET	• Neurofascial Dextrose Prolotherapy injection	• Hot pack, TENS and ultrasound. Instructed to carry out an exercise program consisted of stretching and flexibility, range ofmotion, and strengthening exercises of the shoulder and rotator cuff	
Kvalvaag 2017 2018 (74, 75)	EPA+ET vs RC+SCAP	• Radial extracorporeal shock wave therapy • Exercise: relearning of normal movement patterns, awareness of posture and the use of manual techniques for tense muscles. Elastic rubber band for relaxed repetitive movements. Increase the eccentric force, incorporating scapular control and dynamic scapular stability. Endurance exercises with gradually increasing resistance • Home exercise: Same as supervised	• Sham radial extracorporeal shock wave therapy • Exercise: relearning of normal movement patterns, awareness of posture and the use of manual techniques for tense muscles. Elastic rubber band for relaxed repetitive movements. Increase the eccentric force, incorporating scapular control and dynamic scapular stability. Endurance exercises with gradually increasing resistance • Home exercise: Same as supervised	

Lewis 2017 (76)	RC+SCAP vs EPA+ET	• Shoulder range of movement exercises; resisted internal and external rotation exercises; generalized shoulder strengthening exercises (e.g. pulling and pushing against resistance); weight-bearing exercises (e.g. pushing Swiss ball against wall, weight through arms on Swiss ball); lower limb exercises (e.g. step-ups with concomitant upper limb elevation); and cool-down exercises	• Six treatments of acupuncture • Shoulder range of movement exercises; resisted internal and external rotation exercises; generalized shoulder strengthening exercises (e.g. pulling and pushing against resistance); weight-bearing exercises (e.g. pushing Swiss ball against wall, weight through arms on Swiss ball); lower limb exercises (e.g. step-ups with concomitant upper limb elevation); and cool-down exercises	
Littlewood 2016 (77)	Non-specific RC exercises vs EPA+ET	• Self-managed exercise: affected shoulder is exercised against gravity, a resistive therapeutic band or hand weight was used. Isometric abduction and progress to isotonic abduction	• Usual physiotherapy: might include a range of interventions including advice, stretching, exercise, manual therapy, massage, strapping, acupuncture, electrotherapy, corticosteroid injection at the discretion of the treating physiotherapist	
Lombardi 2008 (78)	RC vs Usual Medical Care	• Progressive resistance training program: resistence exercises for flexion, extension, medial rotation, and lateral rotation of the shoulder	• Control group remained on a waiting list	
MartinsdaSilva 2020 (79)	RC+SCAP vs MT+ET	• Exercise group: seven eccentric exercises (shoulder/scapular elevation up to 90°, internal rotation as if scratching the back, external rotation, internal rotation, extension movement, wall push-ups)	• Kinesio tape with application of the elastic bandage • Exercise group: seven eccentric exercises (shoulder/scapular elevation up to 90°, internal rotation as if scratching the back, external rotation, internal rotation, extension movement, wall push-ups)	

Marzetti 2014 (80)	Non-specific RC exercise vs RC+SCAP	• Neurocognitive therapeutic exercise: aimed to teach the patient how to control pathological elements (joint stiffness, pain, muscle contraction, and muscle atrophy) avoiding compensation and how to rebuild and recover movements in a smooth and functional way. Thr first three exercises aimed at restoring shoulder fragmentation and counterbalance; the second set consisted of four exercises aimed at centering the humeral head in the glenoid fossa during active movements and introducing counterbalancing mechanism of the scapula during upper limb movements; the last three exercises aimed at recovering maximum ROM of the affected shoulder	• Traditional therapeutic exercise: contained mainly strengthening exercises focused on the rotator cuff and scapular stabilizing muscles, stretching exercises, Codman's pendulum exercises and exercises against elastic band resistance	
Mintken 2016 (81)	MT+ET vs RC+SCAP	• MT+ETplus exercise: received the same ROM exercisesas exercise group with the addition of high-dose cervicothoracic MT+ETduring the first 2 treatment sessions (5 thoracic spine high-velocity, low-amplitude techniques targeting the upper, middle, and lower thoracic spine and 1 low-velocity technique directed at the lower cervical spine), followed by the same exercise protocol as the exercise group for visits 3 through 8	• Exercise Group: treated with 2 sessions of a general cervical ROM exercise, a general thoracic-mobility exercise. Visits 3 through 8 included instruction in a stretching and 3-phase progressive strengthening program. Muscle re-education exercises for the scapular stabilizers and rotator cuff, flexibility exercises, and exercises to promote an erect posture through chin tucks and scapular retraction was also conducted	
Nejati 2017 (82)	Injections+ET vs RC+SCAP	• Platelet-Rich Plasma Injection • Did not participate in exercise therapy for 6 months	• Exercise therapy: warm-up aerobic activities, isometric shoulder exercise and the passive ROM exercise, postural exercises (eg, chin tuck and scapular retraction) and glenohumeral ROM exercises cross-body and neck stretches, shoulder abduction or scaption	

			(scapular plane elevation), strength training was performed on the external and internal rotator cuff muscles • Home exercise: same as supervised	
Santello 2020 (83)	RC+SCAP vs Usual Medical Care	• Intervention group: in the first session they received a booklet with illustrations and descriptions of the home-based exercise program and a DVD containing videos and descriptions of each exercise. Also performed each exercise and had the opportunity to repeat or ask questions about the exercise program. Exercise program inclide self-stretching (stretching of the descending part of the trapezius muscle, minor pectoralis muscle, posterior and inferior structures of the shoulder), joint mobility (shoulder protraction and retraction with the hands resting on the wall, shoulder abduction rising with the fingers by the wall, scapular retraction and depression while pushing down and back on a stable surface with hand and shoulder elevation and lowering in the sagittal plane holding a tube) and, strengthening (strengthening of the internal and external rotator and the abductor muscles with a moderate resistive therapeutic band, which was given to the participants. Strengthening of the anterior serratus muscle with 1 kg dumbbells in the supine position, which was also given to the participants)	• Control group: explanation about their shoulder pain condition during the first session and were advised to perform neck self-massage, use ice to relieve the pain, avoid sleeping and carrying weights on the painful arm, and avoid pulling, pushing heavy objects and raising the painful arm repeatedly	

Schedler 2020 (84)	RC vs Usual Medical Care	• Traditional training: home-based progressive elastic resistance (theraband) exercise program of the rotator cuff muscles. Additionally, an illustrated exercise booklet was provided for the home-based sessions	• Passive control group: instructed to maintain their habitual physical activity level and to refrain from all extraneous upper-body resistance training for the duration of the study	
Seven 2017 (85)	Injections+ET vs RC+SCAP	• Prolotherapy injection • Home exercise: 3 times a day after 3 days of Injections+ET	• Exercise: limited glenohumeral internal rotation and tightness of muscles originating from the coracoid processwere rehabilitated with open stretching in the supine position .Scapula control was provided by exercises of the trapezius and serratus anterior muscles. RC activation exercises were then given, including horizontal andvertical closed-chain, horizontal open-chain, and diagonal closed-chain exercises • Home exercise: same exercises	
vandenDolder 2003 (86)	MT+ET vs RC+SCAP	• Soft tissue massage around the shoulder • Exercise: instruction and demonstration of an individualized shoulder exercise program including: exercises to improve range of motion, strength, and motor control (including scapular control)	• Exercise: instruction and demonstration of an individualized shoulder exercise program including: exercises to improve range of motion, strength, and motor control (including scapular control)	
Yiasemides 2011 (87)	MT+ET vs RC+SCAP	•Passive mobilization: low-velocity passive joint mobilizations applied to any of the shoulder region joints (ie, glenohumeral, sternoclavicular, and acromioclavicular joints) and passive mobilization of the scapula •Advice: limiting movement to the pain-free ROM; maintaining normal scapulohumeral rhythm within pain-free ROM; using the affected upper limb in a slow, careful manner; using techniques to minimize shoulder pain (eg,	•Advice: limiting movement to the pain-free ROM; maintaining normal scapulohumeral rhythm within pain-free ROM; using the affected upper limb in a slow, careful manner; using techniques to minimize shoulder pain (eg, during dressing and reaching); and preferentially using the nonaffected upper limb •Exercises designed to restore neuromuscular control at the shoulder.	

		during dressing and reaching); and preferentially using the nonaffected upper limb •Exercises designed to restore neuromuscular control at the shoulder.		

Supporting Information – S3: Risk of Bias

Legend:

+	Low risk
!	Some concerns
-	High risk
D1	Randomisation process
D2	Deviations from the intended interventions
D3	Missing outcome data
D4	Measurement of the outcome
D5	Selection of the reported result

Study ID	Experimental	Comparator	Outcome	Weight	D1	D2	D3	D4	D5	Overall
Aceituno-Gomes 2019	EPA+ET	RC	DASH	1	-	!	+	+	!	-
Ager 2019	MT+ET	RC+SCAP	DASH	1	+	+	+	+	!	!
Akbaba 2019	MT+ET	RC+SCAP	DASH	1	+	-	-	+	!	-
Arias-Buria 2015 and 2017	EPA+ET	RC+SCAP	DASH	1	+	+	+	+	!	!
Bron 2011	MT+ET	Usual Care	DASH	1	+	+	+	+	!	!
Centeno 2020	Injections+ET	RC	DASH	1	+	-	+	+	!	-
Crawshaw 2010	Injections+ET	MT+ET	DASH	1	+	-	!	+	!	-
Daghiani 2022	Injections+ET	MT+ET	DASH	1	+	+	+	+	!	!
de Miguel Valtierra 2018	MT+ET	EPA+ET	DASH	1	+	+	+	+	!	!
de Oliveira 2021	MT+ET	RC+SCAP	DASH	1	+	+	+	+	+	+
Halgren 2014	RC+SCAP	Non-specific RC exercises	DASH	1	+	-	+	+	!	-
Holmgren 2012	Non-specific RC exercises	RC+SCAP	DASH	1	+	+	+	+	!	!
Ilhanli 2015	Injections+ET	EPA+ET	DASH	1	+	-	-	!	!	-
Ingwersen 2019	Non-specific RC exercises	RC+SCAP	DASH	1	+	+	+	+	+	+
Marzetti 2014	RC+SCAP	Non-specific RC exercises	DASH	1	+	+	-	+	!	-
Mintken 2016	MT+ET	RC+SCAP	DASH	1	+	+	+	+	!	!
Nejati 2017	Injections+ET	RC+SCAP	DASH	1	!	-	+	+	!	-
Aceituno-Gomes 2019	EPA+ET	RC	Pain	1	-	!	+	+	!	-
Ager 2019	MT+ET	RC+SCAP	Pain	1	+	+	+	+	!	!
Akbaba 2019	MT+ET	RC+SCAP	Pain	1	+	-	-	+	!	-
Akyol 2012	EPA+ET	RC+SCAP	Pain	1	+	-	+	+	!	!
Arias-Buria 2015	EPA+ET	RC+SCAP	Pain	1	+	+	+	+	!	!
Arias-Buria 2017	EPA+ET	RC+SCAP	Pain	1	+	+	+	+	!	!
Atici 2021	EPA+ET	MT+ET	Pain	1	-	-	+	+	!	-
Aytar 2015	MT+ET	RC+SCAP	Pain	1	+	-	+	+	!	-
Barra Lopez 2013	EPA+ET	MT+ET	Pain	1	!	+	+	+	!	!
Baskurt 2011	RC+SCAP	RC	Pain	1	!	-	+	+	!	-
Bennell 2010	MT+ET	Usual Care	Pain	1	!	+	+	+	!	!
Berg 2021	Non-specific RC exercises	RC+SCAP	Pain	1	+	-	+	-	!	-
Bron 2011	MT+ET	Usual Care	Pain	1	+	+	+	+	!	!
Celik 2009	RC+SCAP	RC	Pain	1	!	-	-	-	!	-
Celik 2009_2	EPA+ET	Injections+ET	Pain	1	!	-	-	+	!	-
Centeno 2020	Injections+ET	RC	Pain	1	+	-	+	+	!	-
Cha 2014	EPA+ET	Usual Care	Pain	1	!	-	+	-	!	-
Daghiani 2022	Injections+ET	MT+ET	Pain	1	+	+	+	+	!	!
de Miguel Valtierra 2018	MT+ET	EPA+ET	Pain	1	+	+	+	+	!	!
de Oliveira 2021	MT+ET	RC+SCAP	Pain	1	+	+	+	+	+	+
Dejaco 2017	RC+SCAP	RC	Pain	1	+	+	+	+	!	!
Dilek 2016	Non-specific RC exercises	EPA+ET	Pain	1	+	+	+	+	!	!
Dogan 2021	Injections+ET	EPA+ET	Pain	1	!	-	-	+	!	-
Ekici 2021	MT+ET	EPA+ET	Pain	1	+	-	-	+	!	-
Elsodany 2018	RC+SCAP	EPA+ET	Pain	1	+	-	+	+	!	-
Engebretsen 2009 and 2011	EPA+ET	RC+SCAP	Pain	1	+	+	+	+	!	!
Eslamian 2012	EPA+ET	RC	Pain	1	+	!	+	+	!	!
Galace de Freitas 2014	EPA+ET	RC	Pain	1	+	+	+	+	!	!
Garaets 2005	Non-specific RC exercises	Usual Care	Pain	1	+	+	+	-	!	-
Gomes 2018	MT+ET	EPA+ET	Pain	1	+	+	+	+	!	!
Halgren 2014	RC+SCAP	Non-specific RC exercises	Pain	1	+	-	+	+	!	-
Holmgren 2012	Non-specific RC exercises	RC+SCAP	Pain	1	+	+	+	+	!	!
Ilhanli 2015	Injections+ET	EPA+ET	Pain	1	+	-	-	!	!	-
Ingwersen 2019	Non-specific RC exercises	RC+SCAP	Pain	1	+	+	+	+	+	+
Kvalvaag 2017 and 2018	EPA+ET	RC+SCAP	Pain	1	+	+	+	+	+	+
Lombardi 2008	RC	Usual Care	Pain	1	+	+	+	+	!	!
Martins da Silva 2020	MT+ET	RC+SCAP	Pain	1	+	-	+	+	!	-
Marzetti 2014	RC+SCAP	Non-specific RC exercises	Pain	1	+	+	-	+	!	-
Mintken 2016	MT+ET	RC+SCAP	Pain	1	+	+	+	+	!	!
Nejati 2017	Injections+ET	RC+SCAP	Pain	1	!	-	+	+	!	-
Santello 2020	RC+SCAP	Usual Care	Pain	1	!	+	!	+	!	!
Seven 2017	Injections+ET	RC+SCAP	Pain	1	!	-	-	+	!	-
vandenDolder 2003	MT+ET	RC+SCAP	Pain	1	+	+	+	+	!	!
Akbaba 2019	MT+ET	RC+SCAP	ROM_ABD	1	+	-	-	+	!	-
Akyol 2012	EPA+ET	RC+SCAP	ROM_ABD	1	+	-	+	+	!	!
Barra Lopez 2013	EPA+ET	MT+ET	ROM_ABD	1	!	+	+	+	!	!
Baskurt 2011	RC+SCAP	RC	ROM_ABD	1	!	-	+	!	!	-
Chen 2009	MT+ET	RC	ROM_ABD	1	+	+	+	+	!	!
Dilek 2016	Non-specific RC exercises	EPA+ET	ROM_ABD	1	+	+	+	+	!	!
Dogan 2021	Injections+ET	EPA+ET	ROM_ABD	1	!	-	-	+	!	-
Elsodany 2018	RC+SCAP	EPA+ET	ROM_ABD	1	+	-	+	+	!	-
Eslamian 2012	EPA+ET	RC	ROM_ABD	1	+	-	+	+	!	-
Ilhanli 2015	Injections+ET	EPA+ET	ROM_ABD	1	+	-	-	!	!	-
Lewis 2017	EPA+ET	RC+SCAP	ROM_ABD	1	+	+	-	+	!	-
Lombardi 2008	RC	Usual Care	ROM_ABD	1	+	+	+	+	!	!
Nejati 2017	Injections+ET	RC+SCAP	ROM_ABD	1	!	-	+	+	!	-
Seven 2017	Injections+ET	RC+SCAP	ROM_ABD	1	!	-	-	+	!	-
vandenDolder 2003	MT+ET	RC+SCAP	ROM_ABD	1	+	+	+	+	!	!
Akbaba 2019	MT+ET	RC+SCAP	ROM_ER	1	+	-	-	+	!	-
Akyol 2012	EPA+ET	RC+SCAP	ROM_ER	1	+	-	+	+	!	!
Atici 2021	EPA+ET	MT+ET	ROM_ER	1	-	-	+	+	!	-
Aytar 2015	MT+ET	RC+SCAP	ROM_ER	1	+	-	+	+	!	-
Barra Lopez 2013	EPA+ET	MT+ET	ROM_ER	1	!	+	+	+	!	!
Baskurt 2011	RC+SCAP	RC	ROM_ER	1	!	-	+	!	!	-
Celik 2009_2	EPA+ET	Injections+ET	ROM_ER	1	!	-	-	+	!	-
Dilek 2016	Non-specific RC exercises	EPA+ET	ROM_ER	1	+	+	+	+	!	!
Dogan 2021	Injections+ET	EPA+ET	ROM_ER	1	!	-	-	+	!	-
Elsodany 2018	RC+SCAP	EPA+ET	ROM_ER	1	+	-	+	+	!	-
Eslamian 2012	EPA+ET	RC	ROM_ER	1	+	-	+	+	!	-
Galace de Freitas 2014	EPA+ET	RC	ROM_ER	1	+	+	+	+	!	!
Ilhanli 2015	Injections+ET	EPA+ET	ROM_ER	1	+	-	-	!	!	-
Lewis 2017	EPA+ET	RC+SCAP	ROM_ER	1	+	+	-	+	!	-
Lombardi 2008	RC	Usual Care	ROM_ER	1	+	+	+	+	!	!
Nejati 2017	Injections+ET	RC+SCAP	ROM_ER	1	!	-	+	+	!	-
Seven 2017	Injections+ET	RC+SCAP	ROM_ER	1	!	-	-	+	!	-
Aceituno-Gomes 2019	EPA+ET	RC	SPADI	1	-	!	+	+	!	-
Akyol 2012	EPA+ET	RC+SCAP	SPADI	1	+	-	+	+	!	!
Atici 2021	EPA+ET	MT+ET	SPADI	1	-	-	+	+	!	-
Bennell 2010	MT+ET	Usual Care	SPADI	1	!	+	+	+	!	!
Berg 2021	Non-specific RC exercises	RC+SCAP	SPADI	1	+	-	+	-	!	-
Daghiani 2022	Injections+ET	MT+ET	SPADI	1	+	+	+	+	!	!
de Miguel Valtierra 2018	MT+ET	EPA+ET	SPADI	1	+	+	+	+	!	!
Elsodany 2018	RC+SCAP	EPA+ET	SPADI	1	+	-	+	+	!	-
Engebretsen 2009 and 2011	EPA+ET	RC+SCAP	SPADI	1	+	+	+	+	!	!
Gomes 2018	MT+ET	EPA+ET	SPADI	1	+	+	+	+	!	!
Heron 2017	RC+SCAP	RC	SPADI	1	+	+	+	+	!	!
Hopewell 2021	RC	Usual Care	SPADI	1	+	+	+	+	+	+
KazempourMofrad 2021	Injections+ET	EPA+ET	SPADI	1	!	!	+	-	!	!
Kvalvaag 2017 and 2018	EPA+ET	RC+SCAP	SPADI	1	+	+	+	+	+	+
Lewis 2017	EPA+ET	RC+SCAP	SPADI	1	+	+	-	+	!	-
Littlewood 2016	EPA+ET	Non-specific RC exercises	SPADI	1	+	+	-	!	+	-
Mintken 2016	MT+ET	RC+SCAP	SPADI	1	+	+	+	+	!	!
Santello 2020	RC+SCAP	Usual Care	SPADI	1	!	+	!	+	!	!
Schedler 2020	RC	Usual Care	SPADI	1	+	-	-	+	!	-
Seven 2017	Injections+ET	RC+SCAP	SPADI	1	!	-	-	+	!	-
vandenDolder 2003	MT+ET	RC+SCAP	SPADI	1	+	+	+	+	!	!
Yiasemides 2011	MT+ET	RC+SCAP	SPADI	1	!	+	+	+	!	!

Supporting Information – S4: Publication Bias Tables by Outcomes

PAIN [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

treat1	treat2	Evaluation of contribution from evidence with suspected bias	Nma Effect	Nmr Effect	Evaluation of small-study effects	Overall Rob	mixed
EPA+ET	Injections+ET	No Substantial Contribution	-0.07 (-1.13 to 1.00)	-0.44 (-2.06 to 1.25)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	MT+ET	No Substantial Contribution	-0.13 (-0.96 to 0.69)	-0.24 (-1.62 to 1.12)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC	No Substantial Contribution	-0.96 (-2.04 to 0.11)	-0.32 (-2.92 to 2.52)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC+SCAP	No Substantial Contribution	-0.41 (-1.19 to 0.35)	-0.51 (-1.69 to 0.69)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	Usual Medical Care	Substantial Contribution Favouring treat1	-2.42 (-3.66 to -1.15)	-2.30 (-3.90 to -0.56)	No Evidence of small-study effects	Some Concerns	mixed/only direct
Injections+ET	MT+ET	No Substantial Contribution	-0.05 (-1.24 to 1.12)	0.19 (-1.71 to 2.05)	No Evidence of small-study effects	Low Risk	mixed/only direct
Injections+ET	RC	Substantial Contribution Favouring treat1	-0.90 (-2.22 to 0.46)	0.13 (-2.54 to 2.98)	No Evidence of small-study effects	Some Concerns	mixed/only direct
Injections+ET	RC+SCAP	No Substantial Contribution	-0.34 (-1.44 to 0.75)	-0.06 (-1.63 to 1.46)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	RC+SCAP	No Substantial Contribution	-0.29 (-1.12 to 0.54)	-0.26 (-1.54 to 1.01)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	Usual Medical Care	No Substantial Contribution	-2.29 (-3.53 to -1.07)	-2.04 (-3.67 to -0.41)	No Evidence of small-study effects	Low Risk	mixed/only direct
Non-specific RC exercises	RC+SCAP	No Substantial Contribution	0.82 (-0.42 to 2.05)	1.64 (-0.26 to 3.50)	No Evidence of small-study effects	Low Risk	mixed/only direct
Non-specific RC exercises	Usual Medical Care	Substantial Contribution Favouring treat1	-1.18 (-2.74 to 0.35)	-0.15 (-2.15 to 1.80)	No Evidence of small-study effects	Some Concerns	mixed/only direct
RC	RC+SCAP	No Substantial Contribution	0.54 (-0.53 to 1.62)	-0.18 (-2.77 to 2.27)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC	Usual Medical Care	No Substantial Contribution	-1.46 (-2.87 to -0.06)	-2.00 (-4.73 to 0.74)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC+SCAP	Usual Medical Care	Substantial Contribution Favouring treat1	-2.00 (-3.24 to -0.77)	-1.80 (-3.30 to -0.23)	No Evidence of small-study effects	Some Concerns	mixed/only direct
EPA+ET	Non-specific RC exercises	No Substantial Contribution	-1.24 (-2.66 to 0.19)	-2.13 (-4.21 to -0.04)	No Evidence of small-study effects	Low Risk	indirect
MT+ET	RC	No Substantial Contribution	-0.84 (-2.04 to 0.37)	-0.08 (-2.74 to 2.79)	No Evidence of small-study effects	Low Risk	indirect

Range of Motion – Abduction (ROM_ABD)

[MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

treat1	treat2	Evaluation of contribution from evidence with suspected bias	Nma Effect	Nmr Effect	Evaluation of small-study effects	Overall Rob	mixed
EPA+ET	Injections+ET	No Substantial Contribution	18.09 (-4.16 to 40.09)	16.58 (-33.93 to 62.39)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	MT+ET	No Substantial Contribution	-0.23 (-24.49 to 24.25)	16.47 (-49.27 to 83.13)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC	No Substantial Contribution	6.43 (-19.18 to 32.50)	9.59 (-52.49 to 75.24)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC+SCAP	No Substantial Contribution	4.25 (-13.36 to 21.57)	8.00 (-25.97 to 39.14)	No Evidence of small-study effects	Low Risk	mixed/only direct
Injections+ET	RC+SCAP	No Substantial Contribution	-13.83 (-35.68 to 7.52)	-8.22 (-43.26 to 28.62)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	RC	No Substantial Contribution	6.64 (-20.37 to 33.99)	-6.10 (-92.88 to 76.65)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	RC+SCAP	No Substantial Contribution	4.47 (-18.77 to 26.64)	-8.75 (-74.37 to 56.11)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC	RC+SCAP	No Substantial Contribution	-2.27 (-27.95 to 22.25)	-2.09 (-58.41 to 52.94)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC	Usual Medical Care	Substantial Contribution Favouring treat2	10.31 (-27.13 to 51.34)	-44.94 (-233.05 to 240.88)	No Evidence of small-study effects	Some Concerns	mixed/only direct
EPA+ET	Usual Medical Care	No Substantial Contribution	16.75 (-27.40 to 64.92)	-27.69 (-221.57 to 246.81)	No Evidence of small-study effects	Some Concerns	indirect
Injections+ET	MT+ET	No Substantial Contribution	-18.25 (-47.86 to 11.67)	0.34 (-73.88 to 77.34)	No Evidence of small-study effects	Low Risk	indirect
Injections+ET	RC	Substantial Contribution Favouring treat2	-11.59 (-42.61 to 19.58)	-5.72 (-67.95 to 57.26)	No Evidence of small-study effects	Low Risk	indirect
MT+ET	Usual Medical Care	No Substantial Contribution	16.99 (-28.25 to 66.37)	-44.02 (-243.98 to 235.01)	No Evidence of small-study effects	Some Concerns	indirect
RC+SCAP	Usual Medical Care	Substantial Contribution Favouring treat1	12.38 (-30.77 to 60.75)	-35.92 (-228.04 to 238.56)	No Evidence of small-study effects	Some Concerns	indirect
Injections+ET	Usual Medical Care	No Substantial Contribution	-1.16 (-48.88 to 50.12)	-49.72 (-241.68 to 232.27)	No Evidence of small-study effects	Some Concerns	indirect

Range of Motion – External Rotation (ROM_ER) [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

treat1	treat2	Evaluation of contribution from evidence with suspected bias	Nma Effect	Nmr Effect	Evaluation of small-study effects	Overall Rob	mixed
EPA+ET	Injections+ET	No Substantial Contribution	2.44 (-5.93 to 10.61)	5.71 (-13.01 to 23.41)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	MT+ET	No Substantial Contribution	-0.34 (-9.49 to 8.80)	2.63 (-14.73 to 19.29)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC	No Substantial Contribution	1.99 (-11.82 to 15.21)	9.16 (-19.97 to 38.82)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC+SCAP	No Substantial Contribution	2.07 (-5.23 to 8.82)	5.97 (-6.42 to 17.86)	No Evidence of small-study effects	Low Risk	mixed/only direct
Injections+ET	RC+SCAP	No Substantial Contribution	-0.29 (-9.18 to 7.97)	0.27 (-13.73 to 14.64)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	RC+SCAP	No Substantial Contribution	2.40 (-7.88 to 12.22)	3.39 (-16.12 to 22.79)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC	RC+SCAP	No Substantial Contribution	0.07 (-13.01 to 13.28)	-3.23 (-30.48 to 22.74)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC	Usual Medical Care	Substantial Contribution Favouring treat2	11.82 (-10.02 to 33.31)	16.48 (-132.17 to 226.93)	No Evidence of small-study effects	Some Concerns	mixed/only direct
EPA+ET	Usual Medical Care	No Substantial Contribution	13.84 (-13.13 to 39.20)	25.02 (-116.33 to 231.85)	No Evidence of small-study effects	Some Concerns	indirect
Injections+ET	MT+ET	No Substantial Contribution	-2.81 (-14.51 to 9.03)	-3.07 (-26.91 to 20.89)	No Evidence of small-study effects	Low Risk	indirect
Injections+MT	RC	Substantial Contribution Favouring treat1	-0.45 (-15.75 to 14.29)	3.41 (-26.01 to 35.25)	No Evidence of small-study effects	Low Risk	indirect
MT+ET	RC	No Substantial Contribution	2.33 (-13.71 to 17.68)	6.64 (-26.22 to 40.26)	No Evidence of small-study effects	Low Risk	indirect
MT+ET	Usual Medical Care	No Substantial Contribution	14.21 (-13.63 to 40.79)	22.47 (-120.17 to 229.32)	No Evidence of small-study effects	Some Concerns	indirect
RC+SCAP	Usual Medical Care	Substantial Contribution Favouring treat1	11.84 (-14.59 to 37.31)	18.58 (-122.48 to 225.39)	No Evidence of small-study effects	Some Concerns	indirect
Injections+ET	Usual Medical Care	No Substantial Contribution	11.45 (-16.11 to 37.52)	17.84 (-122.01 to 227.03)	No Evidence of small-study effects	Some Concerns	indirect

Shoulder Pain and Disability Index (SPADI) [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

treat1	treat2	Evaluation of contribution from evidence with suspected bias	Nma Effect	Nmr Effect (smallest observed variance)	Evaluation of small-study effects	Overall Rob	mixed
EPA+ET	Injections+ET	No Substantial Contribution	-0.09 (-17.34 to 16.84)	15.53 (-13.25 to 41.04)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	MT+ET	No Substantial Contribution	-5.10 (-17.40 to 7.12)	7.64 (-11.82 to 28.54)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	Non-specific RC exercises	No Substantial Contribution	7.58 (-15.92 to 31.76)	-16.90 (-75.28 to 45.91)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC	No Substantial Contribution	-6.72 (-24.34 to 10.78)	28.50 (-2.33 to 59.19)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC+SCAP	No Substantial Contribution	-4.49 (-15.92 to 7.13)	-8.12 (-26.11 to 10.11)	No Evidence of small-study effects	Low Risk	mixed/only direct
Injections+ET	MT+ET	No Substantial Contribution	-5.12 (-21.16 to 11.03)	-8.33 (-32.72 to 24.05)	No Evidence of small-study effects	Low Risk	mixed/only direct
Injections+ET	RC+SCAP	No Substantial Contribution	-4.35 (-21.39 to 12.95)	-23.44 (-53.36 to 8.27)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	RC	No Substantial Contribution	-1.56 (-18.80 to 15.70)	21.28 (-14.77 to 53.00)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	RC+SCAP	No Substantial Contribution	0.60 (-11.15 to 12.99)	-16.13 (-37.39 to 7.11)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	Usual Medical Care	No Substantial Contribution	-9.84 (-28.67 to 8.91)	-7.07 (-38.66 to 20.92)	No Evidence of small-study effects	Low Risk	mixed/only direct
Non-specific RC exercises	RC+SCAP	No Substantial Contribution	-12.10 (-36.30 to 11.43)	8.67 (-52.55 to 66.83)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC	RC+SCAP	No Substantial Contribution	2.27 (-14.79 to 19.59)	-36.69 (-68.76 to -3.49)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC	Usual Medical Care	No Substantial Contribution	-8.15 (-26.01 to 9.29)	-28.09 (-53.71 to -5.89)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC+SCAP	Usual Medical Care	Substantial Contribution Favouring treat1	-10.64 (-29.33 to 8.16)	8.54 (-23.91 to 36.94)	No Evidence of small-study effects	Some Concerns	mixed/only direct
EPA+ET	Usual Medical Care	Substantial Contribution Favouring treat1	-14.99 (-34.57 to 4.56)	0.36 (-28.69 to 26.91)	No Evidence of small-study effects	Low Risk	indirect
Injections+ET	RC	Substantial Contribution Favouring treat1	-6.72 (-28.54 to 15.74)	13.12 (-23.50 to 51.21)	No Evidence of small-study effects	Low Risk	indirect
Non-specific RC exercises	Usual Medical Care	Substantial Contribution Favouring treat1	-22.59 (-52.56 to 6.97)	17.25 (-56.23 to 82.32)	No Evidence of small-study effects	Low Risk	indirect

Disabilities of the Arm, Shoulder, and Hand (DASH) [MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

treat1	treat2	Evaluation of contribution from evidence with suspected bias	Nma Effect	Nmr Effect (smallest observed variance)	Evaluation of small-study effects	Overall Rob	mixed
EPA+ET	Injections+ET	No Substantial Contribution	-7.85 (-18.26 to 2.77)	-13.79 (-35.77 to 4.70)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	MT+ET	No Substantial Contribution	-0.64 (-10.63 to 9.55)	-4.22 (-21.38 to 10.43)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC	No Substantial Contribution	-8.63 (-21.43 to 4.31)	-21.36 (-141.61 to 89.67)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	RC+SCAP	No Substantial Contribution	-2.28 (-12.87 to 8.23)	-5.80 (-24.91 to 10.23)	No Evidence of small-study effects	Low Risk	mixed/only direct
Injections+ET	MT+ET	No Substantial Contribution	7.22 (-1.59 to 15.77)	9.60 (-2.82 to 23.60)	No Evidence of small-study effects	Low Risk	mixed/only direct
Injections+ET	RC	Substantial Contribution Favouring treat1	-0.85 (-13.51 to 11.85)	-7.60 (-127.46 to 108.99)	No Evidence of small-study effects	Some Concerns	mixed/only direct
Injections+ET	RC+SCAP	No Substantial Contribution	5.61 (-4.12 to 15.05)	7.92 (-5.58 to 22.55)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	RC+SCAP	No Substantial Contribution	-1.61 (-9.32 to 5.93)	-1.56 (-12.92 to 9.08)	No Evidence of small-study effects	Low Risk	mixed/only direct
MT+ET	Usual Medical Care	No Substantial Contribution	-12.48 (-26.80 to 0.87)	4.15 (-23.08 to 49.34)	No Evidence of small-study effects	Low Risk	mixed/only direct
Non-specific RC exercises	RC+SCAP	No Substantial Contribution	8.26 (-1.75 to 18.31)	79.13 (-60.98 to 218.25)	No Evidence of small-study effects	Low Risk	mixed/only direct
RC	Usual Medical Care	No Substantial Contribution	-4.44 (-19.53 to 9.92)	23.19 (-78.47 to 133.47)	No Evidence of small-study effects	Low Risk	mixed/only direct
EPA+ET	Non-specific RC exercises	No Substantial Contribution	-10.54 (-24.96 to 3.88)	-84.51 (-228.22 to 54.19)	No Evidence of small-study effects	Low Risk	indirect
EPA+ET	Usual Medical Care	Substantial Contribution Favouring treat1	-13.10 (-29.08 to 2.00)	0.05 (-30.28 to 45.19)	No Evidence of small-study effects	Low Risk	indirect
MT+ET	RC	Substantial Contribution Favouring treat1	-8.07 (-21.05 to 5.26)	-17.87 (-134.88 to 96.30)	No Evidence of small-study effects	Low Risk	indirect
Non-specific RC exercises	Usual Medical Care	Substantial Contribution Favouring treat1	-2.60 (-21.16 to 15.08)	85.85 (-52.11 to 233.95)	No Evidence of small-study effects	Low Risk	indirect
RC	RC+SCAP	No Substantial Contribution	6.48 (-7.69 to 20.13)	16.88 (-98.78 to 132.70)	No Evidence of small-study effects	Low Risk	indirect
RC+SCAP	Usual Medical Care	Substantial Contribution Favouring treat1	-10.92 (-26.50 to 4.05)	5.93 (-22.97 to 51.80)	No Evidence of small-study effects	Low Risk	indirect
Injections+ET	Non-specific RC exercises	No Substantial Contribution	-2.67 (-16.65 to 11.05)	-71.27 (-209.73 to 71.42)	No Evidence of small-study effects	Low Risk	indirect
Injections+ET	Usual Medical Care	No Substantial Contribution	-5.27 (-20.81 to 9.33)	13.55 (-16.05 to 60.71)	No Evidence of small-study effects	Low Risk	indirect

Supporting Information – S5: Post-Intervention Sensitivity Analysis: Pain, Range of Motion – Abduction (ROM_ABD), Health-Related Quality of Life (HRQL) (Shoulder Pain and Disability Index (SPADI), Disabilities of the Arm, Shoulder, and Hand (DASH))

[MD=Mean Difference; 95% CI=95% Confidence Intervals; **EPA** = Electro-physical agent, **ET**= Exercise Therapy, **RC**= Rotator Cuff, **SCAP=** Scapula]

Post- Intervention Sensitivity Analysis: Including only Medium to low ROB: Pain

EPA+ET	-1.450 (-4.337, 1.437)	-0.470 (-1.632, 0.693)	-0.583 (-2.701, 1.535)	-1.241 (-2.729, 0.247)	0.084 (-0.981, 1.149)	-2.728 (-4.329, -1.128)
1.450 (-1.437, 4.337)	Injections+ET	0.980 (-1.663, 3.623)	0.866 (-2.565, 4.298)	0.209 (-2.922, 3.339)	1.534 (-1.369, 4.436)	-1.278 (-4.284, 1.728)
0.470 (-0.693, 1.632)	-0.980 (-3.623, 1.663)	MT+ET	-0.114 (-2.303, 2.076)	-0.771 (-2.449, 0.906)	0.554 (-0.647, 1.754)	-2.258 (-3.691, -0.826)
0.583 (-1.535, 2.701)	-0.866 (-4.298, 2.565)	0.114 (-2.076, 2.303)	Non-specific RC exercises	-0.658 (-3.053, 1.738)	0.667 (-1.164, 2.498)	-2.145 (-4.538, 0.248)
1.241 (-0.247, 2.729)	-0.209 (-3.339, 2.922)	0.771 (-0.906, 2.449)	0.658 (-1.738, 3.053)	RC	1.325 (-0.220, 2.870)	-1.487 (-3.260, 0.286)
-0.084 (-1.149, 0.981)	-1.534 (-4.436, 1.369)	-0.554 (-1.754, 0.647)	-0.667 (-2.498, 1.164)	-1.325 (-2.870, 0.220)	RC+SCAP	-2.812 (-4.353, -1.271)
2.728 (1.128, 4.329)	1.278 (-1.728, 4.284)	2.258 (0.826, 3.691)	2.145 (-0.248, 4.538)	1.487 (-0.286, 3.260)	2.812 (1.271, 4.353)	Usual Medical Care

Post-Intervention Sensitivity analysis excluding studies with high risk of bias: ROM_ABD

EPA+ET	-4.698 (-21.581, 12.185)	3.258 (-15.863, 22.379)	-11.703 (-32.354, 8.948)	12.958 (-17.026, 42.943)
4.698 (-12.185, 21.581)	MT+ET	7.957 (-10.759, 26.672)	-7.005 (-26.088, 12.078)	17.657 (-12.071, 47.384)
-3.258 (-22.379, 15.863)	-7.957 (-26.672, 10.759)	RC	-14.961 (-39.641, 9.718)	9.700 (-13.396, 32.796)
11.703 (-8.948, 32.354)	7.005 (-12.078, 26.088)	14.961 (-9.718, 39.641)	RC+SCAP	24.661 (-9.139, 58.462)
-12.958 (-42.943, 17.026)	-17.657 (-47.384, 12.071)	-9.700 (-32.796, 13.396)	-24.661 (-58.462, 9.139)	Usual Medical Care

Post-Intervention Sensitivity analysis excluding studies with high risk of bias: SPADI

EPA+ET	-19.677 (-49.784, 10.431)	-3.337 (-17.149, 10.476)	-0.431 (-21.313, 20.450)	0.556 (-13.419, 14.531)	-14.907 (-35.284, 5.470)
19.677 (-10.431, 49.784)	Injections+ET	16.340 (-10.412, 43.092)	19.245 (-12.815, 51.306)	20.232 (-8.893, 49.358)	4.770 (-26.878, 36.417)
3.337 (-10.476, 17.149)	-16.340 (-43.092, 10.412)	MT+ET	2.905 (-14.763, 20.574)	3.892 (-7.624, 15.409)	-11.570 (-28.479, 5.338)
0.431 (-20.450, 21.313)	-19.245 (-51.306, 12.815)	-2.905 (-20.574, 14.763)	RC	0.987 (-16.512, 18.486)	-14.476 (-32.532, 3.581)
-0.556 (-14.531, 13.419)	-20.232 (-49.358, 8.893)	-3.892 (-15.409, 7.624)	-0.987 (-18.486, 16.512)	RC+SCAP	-15.463 (-32.529, 1.604)
14.907 (-5.470, 35.284)	-4.770 (-36.417, 26.878)	11.570 (-5.338, 28.479)	14.476 (-3.581, 32.532)	15.463 (-1.604, 32.529)	Usual Medical Care

Post-Intervention Sensitivity analysis excluding studies with high risk of bias: DASH

EPA+ET	-20.712 (-38.066, -3.357)	-3.142 (-11.841, 5.558)	-11.988 (-24.719, 0.744)	-0.642 (-21.873, 20.590)	-5.927 (-14.927, 3.072)	-10.842 (-25.938, 4.255)
20.712 (3.357, 38.066)	Injections+ET	17.570 (2.553, 32.587)	8.724 (-10.376, 27.825)	20.070 (-4.438, 44.578)	14.784 (-2.060, 31.628)	9.870 (-9.566, 29.306)
3.142 (-5.558, 11.841)	-17.570 (-32.587, -2.553)	MT+ET	-8.846 (-20.649, 2.957)	2.500 (-16.868, 21.868)	-2.786 (-10.415, 4.844)	-7.700 (-20.038, 4.638)
11.988 (-0.744, 24.719)	-8.724 (-27.825, 10.376)	8.846 (-2.957, 20.649)	Non-specific RC exercises	11.346 (-11.335, 34.027)	6.060 (-2.946, 15.066)	1.146 (-15.929, 18.221)
0.642 (-20.590, 21.873)	-20.070 (-44.578, 4.438)	-2.500 (-21.868, 16.868)	-11.346 (-34.027, 11.335)	RC	-5.286 (-26.102, 15.531)	-10.200 (-25.129, 4.729)
5.927 (-3.072, 14.927)	-14.784 (-31.628, 2.060)	2.786 (-4.844, 10.415)	-6.060 (-15.066, 2.946)	5.286 (-15.531, 26.102)	RC+SCAP	-4.914 (-19.421, 9.592)
10.842 (-4.255, 25.938)	-9.870 (-29.306, 9.566)	7.700 (-4.638, 20.038)	-1.146 (-18.221, 15.929)	10.200 (-4.729, 25.129)	4.914 (-9.592, 19.421)	Usual Medical Care

Supporting Information – S6: Confidence in Results: Pain, Range of Motion – External Rotation (ROM_ER), Range of Motion – Abduction (ROM_ABD), Health-Related Quality of Life (HRQL) (Shoulder Pain and Disability Index (SPADI), Disabilities of the Arm, Shoulder, and Hand (DASH))

Range of Motion – External Rotation

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating	Reason(s) for downgrading
MIXED EVIDENCE									
EPA+ET:Injections+ET	3	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity 1 level for some concerns with indirectness
EPA+ET:MT+ET	3	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
EPA+ET:RC	1	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
EPA+ET:RC+SCAP	4	Major concerns	Low risk	No concerns	No concerns	Major concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
Injections+ET:RC+SCAP	2	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity 1 level for some concerns with indirectness
MT+ET:RC+SCAP	2	Major concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity
RC:RC+SCAP	1	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
RC:Usual Medical Care	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias and reporting bias
INDIRECT EVIDENCE									
EPA+ET:Usual Medical Care	0	Major concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision and some concerns with reporting study bias
Injections+ET:MT+ET	0	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
Injections+ET:RC	0	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
Injections+ET:Usual Medical Care	0	Major concerns	Some Concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision and some concerns with reporting study bias
MT+ET:RC	0	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
MT+ET:Usual Medical Care	0	Major concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision and some concerns with reporting study bias
RC+SCAP:Usual Medical Care	0	Major concerns	Some Concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision and some concerns with reporting study bias

Range of Motion – Abduction

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating	Reason(s) for downgrading
MIXED EVIDENCE									
EPA+ET:Injections+ET	2	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity 1 level for some concerns with indirectness
EPA+ET:MT+ET	1	Some concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias
EPA+ET:RC	1	Some concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias
EPA+ET:RC+SCAP	3	Major concerns	Low risk	Some concerns	Major concerns	No concerns	No concerns	Very Low	2 levels for major concerns with within-study bias and imprecision 1 level for some concerns with indirectness
Injections+ET:RC+SCAP	2	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity 1 level for some concerns with indirectness
MT+ET:RC	1	Some concerns	Low risk	Some concerns	Major concerns	No concerns	No concerns	Very low	2 levels for major concerns with imprecision and some concerns with within-study bias 1 level for some concerns with indirectness
MT+ET:RC+SCAP	2	Some concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias
RC:RC+SCAP	1	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and within-study bias
RC:Usual Medical Care	1	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias and reporting bias
INDIRECT EVIDENCE									
EPA+ET:Usual Medical Care	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias and reporting bias
Injections+ET:MT+ET	0	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and within-study bias
Injections+ET:RC	0	Major concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and within-study bias
Injections+ET:Usual Medical Care	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias and reporting bias
MT+ET:Usual Medical Care	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias and reporting bias
RC+SCAP:Usual Medical Care	0	Some concerns	Some concerns	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias and reporting bias

Shoulder Pain and Disability Index (SPADI)

Comparison	Numb of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating	Reason(s) for downgrading
Mixed Evidence									
EPA+ET:Injections+ET	1	Major concern	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
EPA+ET:MT+ET	3	Some concern	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Low	1 level for some concerns with within-study bias, imprecision, and heterogeneity 1 level for some concerns with indirectness
EPA+ET:Non-specific RC exercises	1	Major concern	Low risk	No concerns	Some concerns	Some concerns	No concerns	Low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity
EPA+ET:RC	1	Some concern	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
EPA+ET:RC+SCAP	4	Some concern	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Low	1 level for some concerns with within-study bias, imprecision and heterogeneity 1 level for some concerns with indirectness
Injections+ET:MT+ET	2	Major concern	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity 1 level for some concerns with indirectness
Injections+ET:RC+SCAP	1	Major concern	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity 1 level for some concerns with indirectness
MT+ET:RC	1	Some concern	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias
MT+ET:RC+SCAP	3	Some concern	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with heterogeneity and some concerns with within-study bias 1 level for some concerns with indirectness
MT+ET:Usual Medical Care	1	Some concern	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
Non-specific RC exercises:RC+SCAP	1	Major concern	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity 1 level for some concerns with indirectness
RC:RC+SCAP	1	Some concern	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and for some concerns with within-study bias
RC:Usual Medical Care	2	Some concern	Low risk	No concerns	Some concerns	Some concerns	Some concerns	Moderate	1 level for some concerns with within-study bias, imprecision, heterogeneity and incoherence
RC+SCAP:Usual Medical Care	1	Some concern	Some concerns	No concerns	Some concerns	Some concerns	Some concerns	Moderate	1 level for some concerns with within-study bias, imprecision, reporting bias, heterogeneity and incoherence
Indirect Evidence									
EPA+ET:Usual Medical Care	0	Some concern	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
Injections+ET:Non-specific RC exercises	0	Major concern	Low risk	Some concerns	Major concerns	No concerns	No concerns	Very low	2 levels for major concerns with within-study bias and imprecision 1 level for some concerns with indirectness
Injections+ET:RC	0	Some concern	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias
Injections+ET:Usual Medical Care	0	Some concern	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
MT+ET:Non-specific RC exercises	0	Major concern	Low risk	Some concerns	Major Concerns	No concerns	No concerns	Very low	2 levels for major concerns with within-study bias and imprecision 1 level for some concerns with indirectness
Non-specific RC exercises:RC	0	Major concern	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with within-study bias and imprecision
Non-specific RC exercises:Usual Medical Care	0	Some concern	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity

Disabilities of the Arm, Shoulder, and Hand (DASH)

Comparison	Number of studies	Within-study bias	Reporting bias	Indirectness	Imprecision	Heterogeneity	Incoherence	Confidence rating	Reason(s) for downgrading
MIXED EVIDENCE									
EPA+ET:Injections+ET	1	Major concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity
EPA+ET:MT+ET	1	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
EPA+ET:RC	1	Major concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity
EPA+ET:RC+SCAP	1	Some concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Low	1 level for some concerns with within-study bias, imprecision and heterogeneity 1 level for some concerns with indirectness
Injections+ET:MT+ET	2	Major concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity
Injections+ET:RC	1	Major concerns	Some Concerns	Some concerns	Major concerns	No concerns	No concerns	Very low	2 levels for major concerns with within-study bias and imprecision and some concerns with reporting bias and heterogeneity 1 level for some concerns with indirectness
Injections+ET:RC+SCAP	1	Major concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Low	2 levels for major concerns with within-study bias and some concerns with imprecision and heterogeneity
MT+ET:RC+SCAP	3	Some concerns	Low risk	Some concerns	No concerns	Major concerns	No concerns	Very low	2 levels for major concerns with heterogeneity and some concerns with within-study bias 1 level for some concerns with indirectness
MT+ET:Usual Medical Care	1	Some concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Low	1 level for some concerns with within-study bias, imprecision and heterogeneity 1 level for some concerns with indirectness
Non-specific RC exercises:RC+SCAP	3	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
RC:Usual Medical Care	1	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
INDIRECT EVIDENCE									
EPA+ET:Non-specific RC exercises	0	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
EPA+ET:Usual Medical Care	0	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
Injections+ET:Non-specific RC exercises	0	Some concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias
Injections+ET:Usual Medical Care	0	Some concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Low	1 level for some concerns with within-study bias, imprecision and heterogeneity 1 level for some concerns with indirectness
MT+ET:Non-specific RC exercises	0	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
MT+ET:RC	0	Some concerns	Low risk	No concerns	Some concerns	Some concerns	No concerns	Moderate	1 level for some concerns with within-study bias, imprecision and heterogeneity
Non-specific RC exercises:RC	0	Some concerns	Low risk	No concerns	Major concerns	No concerns	No concerns	Low	2 levels for major concerns with imprecision and some concerns with within-study bias
Non-specific RC exercises:Usual Medical Care	0	Some concerns	Some concerns	Some concerns	Major concerns	No concerns	No concerns	Very low	2 levels for major concerns with imprecision and some concerns with within-study bias and reporting bias 1 level for some concerns with indirectness
RC:RC+SCAP	0	Major concerns	Low risk	Some concerns	Some concerns	Some concerns	No concerns	Very low	2 levels for major concerns with within-study bias and some concerns imprecision and heterogeneity 1 level for some concerns with indirectness
RC+SCAP:Usual Medical Care	0	Some concerns	Some concerns	Some concerns	Some concerns	Some concerns	No concerns	Low	1 level for some concerns with within-study bias, reporting bias, imprecision and heterogeneity 1 level for some concerns with indirectness

Chapter 3: A care pathway is effective in reducing claim duration among workers with time lost shoulder injuries: a retrospective cohort study

A version of this chapter has been prepared for submission at the **Scandinavian Journal of Work, Environment & Health as, "**Anelise Silveira, Lauren Beaupre, Donald Voaklander, Riikka Niemelainen, Allyson Jones. **Care pathway is effective in reducing claim duration among workers with time lost shoulder injuries: a retrospective cohort study."** This work has been funded by Workers' Compensation Board in Alberta.

Abstract

Objectives: To determine the effect of care delivery on return-to-work (RTW) levels and identify prognostic factors among workers filing their first shoulder injury claim.

Methods: This retrospective cohort study included 5,075 workers with a first claim for shoulder injury between 2004-2018. 2,593 workers in the *Usual Care Cohort* (2004-2008) received standard consultations, while 2,482 workers in the *Care Pathway Cohort* (2014-2018) underwent specialized assessments and collaborative planning for RTW. Multinomial logistic regression determined the effect of delivery of care on RTW levels and identified determinant demographics, injury, occupational and program factors associated with RTW levels.

Results: 92.4% of injuries were traumatic, with sprains/strains most common (64%). Median claim duration: 114 days (IQR=140), with 80.6% receiving wage-replacement benefits initially. The care pathway cohort, younger with shorter claims, had 1.8 times greater risk of returning to modified duties (95% confidence interval (CI): 1.4; 2.3). For claims exceeding 12-months, the care pathway cohort had higher likelihood of returning to pre-accident (Relative Risk Ratio (RRR)=2, 95%CI=1.3, 3.3). Days receiving wage-replacement benefits 12-months post-claim closure were similar between cohorts (p=0.8). Prolonged claims and poor RTW program compliance were linked to higher likelihood of not RTW.

Conclusions: Despite challenges such as prolonged claim durations and compliance issues, the findings demonstrate the effectiveness of the care pathway in facilitating a quicker return to modified duties without compromising long-term RTW outcome. This underscores the importance of proactive intervention strategies like care pathways in optimizing workplace rehabilitation outcomes and minimizing long-term disability.

Keywords: shoulder claim, care delivery, return-to-work, claim

Introduction

Delivery of treatment can significantly impact workers' outcomes leading to delayed return-to-work (RTW).(25, 30, 31) The optimal approach to delivering treatment for shoulder injuries among workers remains uncertain and requires further investigation. Within the Canadian workforce, increasing incidence and prevalence of shoulder injuries are associated with work absenteeism, impaired work performance, early retirement, job loss, and increased healthcare utilization.(26-29) Among Canadian firefighters, for example, shoulder pain has a point-prevalence of 23% (312/1,491; 95%CI 15-33).(27) Efficiently streamlining shoulder care delivery among workers with shoulder injuries may improve RTW outcomes and mitigate the economic, societal, and personal impacts of shoulder injuries on patients, workplaces, and healthcare systems.

Variability in care leads to inefficient, error-prone and costly treatments.(25, 30) Evidence-based care pathways aim to standardize clinical practices and improve patient outcomes by leveraging best-practice evidence.(9, 25, 30, 31) In general, evidence-based clinical pathways standardize delivery of care, improve stakeholder satisfaction and clinical outcomes, decrease costs/health care utilization, and decrease number of complications.(9, 25, 30, 31)

Understanding if a care pathway compared to usual care expedites RTW of workers sustaining shoulder injuries is important and can provide guidance on improving management of workers. Leveraging claim-loss administrative data, this study compared the impact of different delivery methods (care pathway versus usual care) on RTW rates. It also identified demographics, injury, occupational and program factors linked to RTW levels. It was hypothesized that the implementation of care pathway would expedite RTW in workers with work-related shoulder injuries.

Methods

Study Design and Participants:

This population-based retrospective cohort study used administrative data from a workers' compensation system, including all adult workers (18+ years of age) who filed their initial claim for a shoulder injury between 2004 and 2018. The 2014-2018 cohort comprised workers who underwent a care pathway, while the 2004-2008 cohort consisted of workers receiving usual care. We excluded workers seen between 2009 and 2013 as they were part of the pilot phase for the care pathway, which involved adjustments and modifications as workers progressed through the system and was considered a run-in period preceding the full implementation of the care pathway. This study was approved by the designated Health Research Ethics Board (Pro00096157). Given the nature of the study and the anonymization of data before release to the researchers, the ethics board waived informed consent.

Procedures:

Existing conceptual models for RTW are continuously evolving and require additional validation across various contexts related to RTW. Despite ongoing developments, there is a general agreement that the relationship between impairment, work disability, and RTW is multidimensional and interactive, and should consider individual characteristics and the workplace context in which the impairment occurs.(133) For the development of this study, we used the *Readiness for RTW following injury or illness framework* that was in-line with the existing conceptual models for RTW and considers physical recovery, motivation, behavior, and interaction with healthcare providers, workplace, and insurance as important factors related to effective RTW.(134) Given the conceptual framework and the availability of administrative data, this study incorporated various factors, including demographics, injury-related, occupational, and

program-related variables. These factors were considered to potentially explain differences in RTW levels between the two cohorts in the context of shoulder injuries.

Case Ascertainment:

A data analyst identified eligible workers based on the following International Classification of Diseases (ICD-9) diagnostic codes: First or second diagnosis with Part of Body (POB) = 21000 (Shoulder) except if Nature Of Injury (NOI) = 01200 (Fracture). Claims opened between '2004-01-01' and '2008-12-31' identified the usual care cohort and claims opened between '2014-01-01' and '2018-12-31' identified the care pathway cohort.

Cohorts:

Usual Care Cohort (2004-2008): The initial worker consultation took place at a workers' compensation center, where a general family physician conducted a medical status examination (MSE). In this process, the physician would diagnose the condition, which might involve requesting imaging if necessary or referral to a surgical consult. The physician was not given a standardized shoulder assessment and referrals were made based on physician and WCB discretion. Following the diagnosis, the worker was directed to one of the following intensive rehabilitations programs:

Provider Program – Workers are provided with the services of an exercise therapist, physical therapist, and consulting occupational therapist to improve their strength and functionality. They receive prescribed programs such as stretching, strength training (often involving work simulation), and physiotherapy exercises tailored to their injuries. Workers also receive education on managing their injuries, symptoms, and pacing techniques. Educational workshops,

individual psychology services are available if needed. Treatment interventions take place at the provider's site.

Worksite Program – Workers received all the treatment interventions, with the exception of an initial team assessment, at the worker's work premises. Based on the MSE and Basic Functional Capacity Evaluation (BFCE), along with the initial team assessment, the workers' compensation personnel determined worksite interventions required, and program team member(s) providing such interventions. Workers received weekly visits from clinicians at the worksite, where they received education and feedback on various topics including body mechanics, pacing, and symptom management. Additionally, job duties could be enhanced through these sessions.

Complex Program – This program offered specialized interventions tailored to meet the medical, functional, musculoskeletal, psychosocial, and vocational needs of workers facing significant barriers to safe and sustainable RTW. To qualify for admission into the Complex Program, workers exhibited substantial limitations due to pain, along with three or more of the following criteria: high medication usage, significant sleep disturbances, frequent visits to healthcare providers, lack of improvement with previous interventions, history of prolonged claims, and notable psychological issues such as anxiety, depression, or kinesiophobia (fear of movement). Clinicians within the program focused on addressing barriers to RTW while providing education on the injury and pain management techniques. They offered workers counseling and group psychoeducational sessions to assist them in better understanding and managing their injuries, fostering self-management skills for improved outcomes.

Care Pathway Cohort (2014-2018): Workers with shoulder claims underwent an initial assessment by both a physician and a physical therapist, both specializing in shoulder care. A

consensus between both specialists regarding diagnosis, need for diagnostic imaging/referral to a surgical consult, and assigned rehabilitation program needed to be achieved. Notable differences from the usual care processes included the introduction of specialized assessments at claim start, the implementation of a hybrid rehabilitation program for all workers (started in 2009), and the introduction of collaborative team meetings involving workers, healthcare providers, employers, and workers' compensation insurance members to discuss a RTW plan. The engagement of all stakeholders in the process aimed to guarantee a secure and effective RTW.

The Hybrid rehabilitation program combined provider- and worksite-based approaches, allowing workers to attend service interventions periodically throughout the week. Workers were expected to attend the program for 2.5 days per week, ensuring a minimum of 5 days of attendance over two weeks. Each program day included activities such as functional restoration exercises, general conditioning, counseling, and/or educational workshops, each lasting at least two (2) hours.

Measures

Independent variables:

Demographics: The administrative database recorded age in years, sex assigned at birth (male or female), and the need for an interpreter. An interpreter was required when English was not the first language of the worker and communicating in English was a barrier to the success of the program and to a return-to-work outcome.

Injury Factors:

Injury Type: The nature of injury was determined based on the International Classification of Diseases, 9th Edition (ICD-9).

Injuries at time of the claim were categorized based on ICD-9 codes: *Traumatic*, which resulted from physical injury or trauma, and *non-traumatic*, which were associated with no history of physical injury or trauma.

Involved Part of Body: The database contained information regarding primary and secondary body parts used in the claim. We classified the body parts as:

- *Shoulder Only*: The body part listed was shoulder and there were no secondary body parts involved in the claim.
- *Shoulder + Other*: The claim listed different body parts, one was shoulder and the other could be any body part other than shoulder.

Diagnosis: Each claim's diagnosis was categorized through the utilization of a maximum five-digit ICD-9-CM code. Diagnoses were consolidated into three main groups: *sprains/strains* (soft tissue injuries to muscles, tendons, and/or ligaments), *arthropathies and related pathologies* (joints and surrounding structures), and *other* which included other and unknown diagnosis.

Occupational Factors:

Type of Work: We used the National Occupational Classification (NOC) five digit code of the worker's pre-accident occupation type.(135) Each occupation was defined in terms of the type and level of skill required for the date of accident occupation. The type of skill was assigned based on the ten broad occupational areas (values are from 0 to 9).(135) Given the small number of workers in some categories, for the purpose of this study, pre-accident occupations were grouped as follows: ***Technical and Industrial Occupations*** combined

Trades/Transport/Equipment, Primary Industry, and Processing/Manufacturing/Utilities. ***Administration, Social, and Scientific Occupations*** were formed by merging Management, Business/Finance/Administration, Social Science/Education/Government/Rel, Natural & Applied Science, and Art & Culture. ***Health Occupations*** remained separate, while ***Sales and Service*** jobs were grouped.

Availability of Modified Duties at claim start: Dichotomous data indicating whether workers had modified duties available at claim start was included. Modified duties involved adjusting a worker's tasks or responsibilities to accommodate health limitations, disabilities, or temporary conditions.

Currently working at first RTW: The information provided included dichotomous data indicating whether workers were actively working at the start of the claim.

Number of days receiving wage-replacement benefits 1 year after claim closure: Workers received wage replacement for the number of days following their discharge from the last rehabilitation program within 12-months. This variable was used as proxy for longer-term indirect measure of RTW status, since receiving wage after claim closure shows that workers did not successfully RTW.(136) Please note that this variable was not included in the model, since the model looked at determinants of RTW at claim closure. We used it descriptively to compare groups 1 year after claim closure.

Program Factors:

Cohort: Included previous described cohorts: care pathway (2014-2018) and usual care (2004-2008).

Receiving Benefits at Claim Start: Included dichotomous data (yes/no) on which workers were receiving benefits defined as wage replacement at claim start.

Time-to-Treatment: Number of days between the date of accident and the date of first rehabilitation program treatment. Considering this variable was skewed to the right, data were categorized into three groups based on clinical meaning: 0-3 months, 3-6 months, and 6+ months. Delaying treatment beyond 3 months can often lead to the injury becoming chronic. These groupings aligns with the expectation that the majority of shoulder injuries tend to resolve within a year from the time of injury. (137, 138) Treatment starting at 6+ months for any shoulder injury is considered very delayed with poor outcomes.(137, 138)

Duration Claim: Number of days between accident date to discharge of last rehabilitation program within the claim. Considering the non-linear nature of this variable, we opted to categorize it into three groups: 0-3 months, 3-12 months, and 12+ months. Similar as time-to-treatment, this decision was informed by the fact that delayed treatment beyond 3 months can often lead to the injury becoming chronic. Additionally, this categorization aligns with the expectation that the majority of shoulder injuries tend to resolve within a year from the time of injury.(137, 138)

No Compliance with rehabilitation program: Number of working days the worker was physically absent from the program but the worker did not notify program staff prior to the absence (i.e., sick time, non-attendance) and did not receive authorization from the workers' compensation insurance.

Outcome Measure (Dependent Variable):

Return-to-Work (RTW): It was defined as a categorical variable: 1) RTW pre-accident, 2) Modified Duties and 3) Not RTW at claim discharge. A successful outcome was considered if workers were back to work either at pre-accident or modified duties levels.

Statistical Analysis:

Descriptive statistics included independent t-tests (continuous), Mann–Whitney U (continuous, not normally distributed), and chi-square tests (categorical variables) to examine cohort differences for outcomes of interest at study entry. Post-hoc tests with Bonferroni adjustments were performed for significant different variables with more than 2 categories. Multinomial logistic regression (MLR) determined the effect of delivery of care on RTW rates as well as identified demographics, injury, occupational and program factors associated with RTW levels (pre-accident, modified or not back to work).

A purposeful model-building approach was employed, incorporating variables deemed statistically significant according to model rules, as well as variables that, although not statistically significant, were considered clinically important based on current literature.(139) First, correlations among all independent variables were examined to check for multicollinearity (i.e. if 2 or more independent variables are measuring the same concept). Second, *univariate analysis* between RTW and each independent variable was performed. Independent variables significant at $p<0.20$ and clinically important variables were considered in the multivariable model. At the *Multivariable Model* step**,** independent variables significant at $p<0.05$ and clinically important variables were included in the MLR main effect model. The impact of excluded variables in the multivariable model was tested by assessing changes in regression coefficients (β) of remaining independent variables, retaining removed variables if any coefficient changed by 15% or more. The linearity assumption was tested for continuous

variables using fractional polynomials and categorized variables that were not linear according to the current literature (i.e. duration of claim and time to first assessment). Plausible interactions were tested and included the statistically significant ones at $p<0.05$ in the final model (Cohorts and claim duration; modified duties availability and currently working). The likelihood test assessed the model fitting. Analyses were performed using STATA/BE version 18.(140) For all analyses a p-level of < 0.05 was considered as statistically significant.

Results

Of the 5,075 workers who submitted their initial claim for shoulder injuries between the periods 2004-2008 (n=2,593) and 2014-2018 (n=2,482), the mean age was 53.7 (SD = 13.5) years, with 2,886 (56.9%) males. The vast majority of injuries (92.4%, n=4,688) of injuries were traumatic, with 75.3% (n=3,821) of claims specifically involving shoulder injuries only. Among the diagnoses, sprains and strains were prevalent, accounting for 63.7% (n=3,233) of the cases. 51.4% (n=2,601) of the population was engaged in technical and industrial occupations, and a significant portion, 78.3% (n=3,970) of workers, participated in the provider rehabilitation program. On average, claims had a median duration of 114 (IQR = 140) days, with 80.6% (n=4,088) of workers receiving wage-replacement benefits at the onset of the claim. There was no difference between cohorts regarding the number of days receiving wage replacement following claim discharge (p=0.8). This variable was used as proxy for longer-term indirect measure of RTW status (Table 3.1).

Effect of Delivery of Care on RTW rates

Descriptive analysis showed that the care pathway cohort, compared to usual care, was younger (MD=12.9, 95% CI=12.3, 13.6), had shorter claims (MD=66.4; 95% CI=49.1, 83.7), and quicker treatment start (MD=39.4; 95% CI=27.2, 51.5). Additionally, the care pathway cohort had a

higher incidence of injuries involving multiple body parts (34.3% vs 15.5%, p<0.001), a greater proportion of workers allocated to the hybrid program (29.6% vs 0.5%, p<0.001), and a lower percentage of workers receiving benefits at the start of the claim (73.8% vs 87%, p<0.001) compared to the usual care cohort. There was also a significant difference between cohorts regarding availability of modified duties at claim start, with the care pathway cohort having 62.5% versus 28.6% for the usual care cohort (p<0.001). The number of days receiving benefits one-year post-claim closure was similar between cohorts (Table 3.1).

Multinomial Logistic Regression showed the risk among the care pathway cohort being back to modified duties compared to pre-accident level was 1.8 greater (95%CI: 1.4, 2.3) than the risk among the usual care cohort. For claims exceeding 12 months, the care pathway cohort demonstrated a higher likelihood (RRR=2, 95%CI=1.3, 3.3) of returning to pre-accident compared modified levels than the usual care cohort (Table 3.2).

Factors associated with RTW levels:

Multinomial Logistic Regression analysis identified several demographics, injury, occupational, and program-related factors that significantly increased the likelihood of RTW at modified duties compared to the pre-accident state. Among demographic factors, increases in age were associated with an increased likelihood of RTW at modified duties (RRR=1.01, 95% CI: 1.004; 1.02), as was the use of an interpreter (RRR=2.4, 95% CI: 1.6, 3.6).

In terms of injury factors, workers diagnosed with arthropathies had a higher likelihood of RTW at modified duties (RRR=1.2, 95% CI: 1.01, 1.4). Occupational factors also played a role, with working in healthcare (RRR=1.3, 95% CI: 1.01, 1.7), engaging in work at claim start (RRR=1.5, 95% CI: 1.2, 1.9), receiving wage replacement (RRR=1.8, 95% CI: 1.5, 2.2), and the availability

of modified duties at the start of treatment (RRR=1.8, 95% CI: 1.4, 2.3) all contributing to an increased likelihood of RTW at modified duties.

Lastly, program-related factors, such as longer claim durations and decreased compliance, were associated with an elevated probability of RTW at modified duties (Table 3.2).

In the comparison between workers who did not RTW and those returning at pre-accident work level, certain factors increased the likelihood of workers not returning to work. The need for an interpreter was associated with a substantially increased risk (RRR=2.4, 95% CI: 1.4, 4.1), emphasizing the impact of communication for the workers on RTW outcome.

Prolonged claim durations, exceeding 12 months, significantly increased the likelihood of not RTW (RRR=8.7, 95% CI: 5.6, 13.5), underlining the challenges associated with extended claim periods. Poor compliance with rehabilitation program had a small effect on RTW outcome (RRR=1.07, 95% CI: 1.03, 1.1), showing the importance of adherence to treatment plans (Table 3.2).

Delayed initiation of treatment, specifically treatment starting six months or later post-accident, was associated with an increased risk of not RTW (RRR=1.4, 95% CI: 1.03, 1.8) (Table 3.2).

Discussion

Implementation of the care pathway shortened claim duration, expedited the initiation of treatment, and enhanced modified duties availability. Notably, with pathway implementation, claims closure with workers RTW at modified duties was frequently used when the care pathway, contrasting to the usual care cohort where claims took longer, but workers RTW at pre-accident levels. RTW at a modified capacity, as opposed to pre-accident levels, is impacted by

factors such as advanced age, use of an interpreter, a diagnosis of arthropathies, employment in healthcare, working at the onset of shoulder treatment, receiving wage replacement benefits at the start of the claim, availability of modified duties, a longer claim duration, and decreased compliance. It is noteworthy that factors linked to not being back to work at pre-accident level, included the need for an interpreter, longer claim duration, decreased compliance, and delayed treatment start.

Limited evidence exists on the implementation of care pathways and determinants of RTW among workers with shoulder injuries. An Australian study, examining the impact of a care pathway on shoulder pain in workers showed that delayed care led to increased claim duration and reduced odds of RTW at pre-accident levels.(141) A retrospective review of prospectively collected data on 1,773 consecutive workers undergoing shoulder surgery found that younger age, less stiffness, and working before surgery were the best predictors for RTW.(142) Although the study populations differed slightly from ours, these findings align with our results and contribute to the limited body of evidence on care pathway implementation and determinants of RTW in workers with shoulder injuries.

Effect of delivery of care on RTW rates

The key question arising from the study results is whether the care pathway was effective compared to usual care in expediting RTW. While workers in the care pathway experienced shorter claim durations, they RTW at modified duties. On the other hand, those in the usual care cohort had longer claims but more frequently returned to pre-accident levels. From an insurance perspective, any level of RTW is considered a successful outcome; however, this may not necessarily align with the worker's viewpoint. As per the readiness for RTW following injury or illness framework, a successful RTW should consider physical recovery, motivation, behavior,

and interaction with a number of parties (health care providers, workplace, and insurance).(134) Unfortunately, the administrative data used in this study lacked worker-specific clinical data to answer the question from a worker standpoint. Despite this limitation, the data indicated that a quicker return to modified duties did not result in a higher number of days receiving wage replacement benefits one-year post-claim closure. This served as a proxy for a longer-term, indirect measure of RTW status, suggesting that the care pathway cohort RTW sooner than usual care, albeit returning with modified duties. (136)

The care pathway cohort was significantly younger than the usual care cohort, which impacted the comparison of cohorts and the effect of the care pathway implementation on RTW rates. However, contradictory evidence exists on the impact of age on RTW. For example, a systematic review stated that older age (50+ years) is associated with negative RTW outcomes (143), while another systematic review showed compelling evidence that 45–54 year old workers often experienced unfavorable RTW outcomes in occupational settings.(144) The classification of workers into categories such as young, middle-aged, and older posed a challenge for making meaningful comparisons across the studies. In this study, MLR controlled for age and reinforced that the relationship between cohorts and RTW outcomes is impacted by claim duration, with shorter claim durations leading to expedited RTW. Therefore, the data suggested that implementing a care pathway led to a positive outcome faster even after controlling for age.

When comparing cohorts, program process changes may explain the differences in RTW rates. A physician and a physiotherapist, who both specialized in shoulder care, performed the initial assessment and treatment allocation in the care pathway cohort. In contrast, a general family physician, without specialization in shoulder, assessed and determined treatment in the usual care cohort. Current evidence shows that compared to practitioners with increased musculoskeletal

(MSK) knowledge, general practitioners have a decreased confidence in diagnosing and managing shoulder pain, frequently relying on diagnostic imaging that may further delay treatment start.(129, 145, 146) It is important to consider that such results may be biased by low response rate in studies using surveys(129, 146) and a limited sample size in the study using semi-structured interviews.(145) A randomized control trial (RCT) including 103 shoulder patients screened by physiotherapists and 105 shoulder patients screened by a general practitioners in primary care showed a higher referral accuracy to appropriate interventions among physiotherapists ($p=0.002$), including decreased number of referrals for further investigations ($p<0.039$) and shorter waiting time-to-treatment start ($p<0.001$).(147)

Another interesting finding is the number of body parts involved. In the care pathway cohort, 852 (34.3%) workers had an injury involving multiple body parts, compared to 402 (15.5%) workers within the usual care cohort ($p<0.001$). A more thorough assessment where consensus between 2 healthcare providers is required may have increased the likelihood of identifying multiple body parts affected by the injury. A consensus for primary care clinical decision-making for managing shoulder pain reinforces the use of triage clinics using a team-based model to deliver a high-quality healthcare and decrease inefficiencies.(148) This team-based approach, consistent with the care pathway cohort, shows an enhanced diagnostic capability in identifying multiple issues and contributes to the overall efficiency of healthcare delivery. Alternatively, a shift in the workers' system procedures, incorporating a more comprehensive intake process post work-related injuries, could have increased the chances of detecting involvement of multiple body parts.

Additional program processes implemented in the care pathway cohort included the introduction of the hybrid program in 2009. This type of program, enabled interventions to take place both at

the provider's facilities and within the workplace. For instance, this approach may have played a role in reducing the hours spent outside the work environment for treatment. Moreover, it may enhance communication among workers, employers, and healthcare providers, potentially facilitating the identification and implementation of necessary work modifications. A systematic review on efficacy of workplace interventions for decreasing shoulder pain among workers found weak evidence that a workplace exercise program and workstations modification decreased pain.(149) A more recent review showed that workplace interventions were effective in reducing shoulder pain.(23) Although findings from our analysis lacked information on specific workplace interventions, the results suggested that a hybrid program may be beneficial in expediting RTW.

Although our findings did not specially examine communication during the claim process, a Canadian study showed that among internal and external stakeholders involved in the rehabilitation and RTW of injured WCB workers, poor communication was a major barrier.(24) Barriers in interdisciplinary and cross-professional communication included philosophical differences regarding the timing and appropriateness of RTW and lack of clarity among healthcare providers regarding the workers' compensation system.(24) In this study, such barriers were potentially mitigated by the introduction of a care pathway. Care pathways represent an approach designed to standardize clinical practices, leveraging best-practice evidence to optimize patient outcomes.(9, 30, 150) Having a care pathway with streamlined communication processes can provide a clear expectation to all involved stakeholders regarding the RTW process, potentially leading to expedited treatment start, shorter claims and successful RTW. Furthermore, improved communication among stakeholders may have contributed to the enhanced availability of modified duties for workers within the care pathway. Meaningful

engagement among stakeholders increases trust and understanding of worker needs and potentially facilitate RTW planning including possible modified duties.(151)

Factors associated with RTW

Determining factors associated with RTW outcomes is crucial to identify effective interventions and streamline processes, thereby mitigating inefficiencies that may delay timely RTW. Current research on RTW in workers with shoulder injuries often focuses on a binary RTW versus non-RTW perspective, neglecting the nuanced consideration of varying RTW levels (from pre-accident to modified duties). The availability of modified duties presents significant advantages for both employees and employers.(143, 152) Employees can maintain a steady income, experience a sense of purpose, foster stronger connections with the company and co-workers, and decrease concerns about re-injury.(153) Employers, in turn, benefit from reduced absenteeism, decreased costs associated with compensation claims, increased productivity, and improved connection with their workforce.(152)

Findings from our analysis showed factors that increased the likelihood of RTW at modified rather than pre-accident levels. Non-modifiable factors, such as age increments and arthropathies diagnosis, were identified as significant contributors. Modifiable factors such as working in the healthcare sector, working at the start of the claim, receiving wage replacement, and availability of modified duties at treatment start had significant impact on the type of RTW. It is also important to emphasize that other modifiable factors such as longer claim durations and poor RTW program compliance increased the likelihood of either RTW at modified duties or not RTW at all, when compared to RTW at pre-accident levels.

Strengths and Limitations

This retrospective cohort study of provincial WCB data provided new evidence on the impact of a care pathway on RTW outcomes for workers with shoulder injuries. It included a substantial population-based sample and used a robust analytical approach, to identify both modifiable and non-modifiable factors predictive of with three outcomes for RTW. The utilization of administrative data streamlined the identification of relevant variables, offering the added benefit of utilizing real-life data that is both readily available and cost-effective, with systematic collection.

This study also has limitations. The absence of health-related clinical data such as shoulder pain, health-related quality of life and workers' expectations limited the understanding of the impact of the care pathway from the worker's perspective. Despite this limitation, both cohorts demonstrated a similarity in terms of wage receipt one year after claim closure, indicating successful longer-term RTW outcomes. The characteristics of the usual care and clinical pathway cohorts, however, were significantly different, which may have introduced potential confounding effects that could have affected the study results. To further enhance the study's depth, it would have been beneficial to include data on healthcare utilization. This additional information could have provided a deeper understanding as to whether the care pathway effectively reduced costs for workers, insurance, and the healthcare system.

Concluding Remarks

Introduction of a care pathway streamlined care for shoulder claimants and had positive effect in earlier and sustainable RTW. Shorter claims, expedited care and an increased in the availability of modified duties were seen with the care pathway as compared to usual care. These findings serve as a valuable guide for developing optimal strategies to facilitate RTW that aligns with the

interests of all stakeholders involved. Further studies including clinical data and healthcare utilization will be important for a comprehensive evaluation of the impact of a care pathway among workers with shoulder injuries

Table 3.1: Characteristics of study population and cohorts (care pathway versus usual care). Care pathway study, 2004-2018, N=5,075. [SD= Standard Deviation; * = Statistically significant (p<0.05); † = Analyzed with Mann–Whitney U; †† = Analyzed with independent t-test; ‡ = Analyzed with a chi-square test; N=Number of participants; %= Percentage]

	All (N=5,075)	Care Pathway (N= 2,482)	Usual Care (N=2,593)	P-Value
DEMOGRAPHICS				
Age, years (Mean ± SD)	53.7 ± 13.5	47.1 ± 12.2	60.0 ± 11.4	<0.0001*††
Sex (N, (%)) Male Female	 2,886 (56.9) 2,189 (43.1)	 1,335 (53.8) 1,147 (46.2)	 1,551 (59.8) 1,042 (40.2)	<0.001*‡
Used Interpreter (N, (%)) Yes No	 151(3) 4,924 (97)	 77 (3.1) 2,405 (96.9)	 74 (3) 2,519 (97)	0.6‡
INJURY FACTORS				
Injury Type (N, (%)) Traumatic Non-Traumatic	 4,688 (92.4) 387 (7.6)	 2,341 (94.3) 141 (5.7)	 2,347 (90.5) 246 (9.5)	<0.001*‡
Involved Part of Body (N, (%)) Shoulder Only Shoulder + Other	 3,821 (75.3) 1,254 (24.7)	 1,630 (65.7) 852 (34.3)	 2,191 (84.5) 402 (15.5)	<0.001*‡
Diagnosis (N, (%)) Sprain/Strain Arthropathies Other	 3,233 (63.7) 1,059 (20.9) 783 (15.4)	 1,677 (67.6) 317 (12.8) 488 (19.7)	 1,556 (60.0) 742 (28.6) 295 (11.4)	<0.001*‡ Sprain/Strain vs Arthropathies , p<0.001 Sprain/Strain vs Other, p<0.001 Arthropathies vs Other, p<0.001

OCCUPATIONAL FACTORS				
Type of Work (N, (%))				
Administration, Social and Scientific	652 (12.9)	359 (14.5)	293 (11.4)	<0.001*‡ Administration, Social and Scientific vs Technical and Industrial , p<0.001
Technical and Industrial	2,601 (51.4)	1,133 (45.7)	1,468 (56.9)	Technical and Industrial vs Health Services , p<0.001
Health Services	711 (14.1)	427 (17.2)	284 (11)	Technical and Industrial vs Sales & Service , p<0.001
Sales & Service	1,094 (21.6)	560 (22.6)	534 (20.7)	Health Services vs Sales & Service , p<0.001
Currently working at first RTW program admission (N, (%))				
Yes	2,579 (50.8)	1,472 (59.3)	1,107 (42.7)	<0.001*‡
No	2,496 (49.2)	1,010 (40.7)	1,486 (57.3)	
Receiving Benefits at Claim Start (N, (%))				
Yes	4,088 (80.6)	1,831 (73.8)	2,257 (87.0)	<0.001*‡
No	987 (19.5)	651 (26.2)	336 (13.0)	
Modified Duties Available at Claim Start				
Yes	2,293 (45.2)	1,551 (62.5)	742 (28.6)	<0.001*‡
No	2,782 (58.2)	931 (37.5)	1,851 (71.4)	
Number of Days Receiving Benefits in the year following last program admission to the shoulder program (Median (IQR))	0 (19)	0 (20)	0 (18)	0.8†

PROGRAM FACTORS				
Programs (N, (%)) Provider Work-Site Complex Hybrid	 3,970 (78.3) 114 (2.3) 243 (4.8) 746 (14.7)	 1,652 (66.6) 0 (0) 96 (3.9) 734 (29.6)	 2,318 (89.5) 114 (4.4) 147 (5.7) 12 (0.5)	<0.001*‡ (Bonferroni p<0.001) Provider vs Work-Site , p<0.001 Provider vs Hybrid , p<0.001 Work-Site vs Complex , p<0.001 Work-Site vs Hybrid , p<0.001 Complex vs Hybrid , p<0.001
Duration Claim, Days (Median; (IQR))	114 (140)	112 (90)	118 (197)	<0.0001*†
Time-to-First- Treatment, Days (Median (IQR))	78 (104)	74 (74)	84 (146)	<0.0001*†
Compliance – Number of unscheduled absences (Median (IQR))	0 (1)	0 (1)	0 (2)	0.02*†

Table 3.2: Personal, occupational and program factors and RTW outcomes at claim discharge in workers admitted to the shoulder program between 2004-2018. Relative risk ratios (RRR) and 95% confidence intervals (CI) from multinomial logistic regression analysis. N=5,075. (*= Statistically significant (p<0.05))

	Modified Duties		**Did not return to work**	
	N (Case/Exposed)	RRR (95%CI)	N (Case/Exposed)	RRR (95%CI)
Demographics				
Age in years	N/A	1.01 (1.004; 1.02)*	N/A	1.01 (1.0; 1.01)
Sex, Referent: Male	882/2,183(female) 857/2,875(male)	1.09 (0.9; 1.3)	373/2,183(female) 932/2,875(male)	1.1 (0.9; 1.4)
Use of Interpreter Referent: No	74/151(yes) 1,665/4,907(no)	2.4 (1.6; 3.6)*	42/151(yes) 1,263/4,907(no)	2.4 (1.4; 4.1)*
Injury Factors				
Diagnosis (Referent: = Sprain/Strain**)**	1,101/3,221		805/3,221	
Arthropathies	384/1,057	1.2 (1.01; 1.4)*	282/1,057	0.9 (0.8; 1.2)
Other	254/780	0.9 (0.8; 1.1)	218/780	1.05 (0.8; 1.3)
Occupational Factors				
Type of Work (Referent: =Administration, Social and Scientific)	229/652		145/652	
Technical and Industrial	757/2,601	1.0 (0.8; 1.3)	890/2,601	1.2 (0.9; 1.6)
Healthcare	343/711	1.3 (1.01; 1.7)*	56/711	0.3 (0.2; 0.4)*
Sales & Service	410/1,094	1.0 (0.8; 1.2)	214/1,094	0.8 (0.6; 1.1)
Currently working at first RTW program admission Referent: No	1,181/2,573(yes) 558/2,485(no)	1.5 (1.2; 1.9)*	108/2,573(yes) 1,197/2,485(no)	0.1 (0.05; 0 .1)*

Receiving Benefits at Claim Start Referent: No	1,402/4,075(yes) 337/983(no)	1.8 (1.5; 2.2)*	1,200/4,075(yes) 105/983(no)	1.3 (0.9; 1.7)
Modified Duties Available at Claim Start Referent: No	1,044/2,287(yes) 695/2,771(no)	1.8 (1.4; 2-3)*	194/2,287(yes) 1,111/2,771(no)	0.4 (0.3; 0.6)*
Program Factors				
Cohort (Referent=Usual Care)	806/2,579		702/2,579	
Care Pathway	933/2,479	1.8 (1.4; 2.3)*	603/2,479	1.9 (1.3; 2.6)*
Duration Claim in Days (Referent= 0-3 months)	556/1,688		261/1,688	
3–12 months	956/2,671	1.6 (1.3; 2.0)*	690/2,671	1.8 (1.4; 2.4)*
12+ months	227/699	3.9 (2.7; 5.8)*	354/699	8.7 (5.6; 13.5)*
Compliance				
Number of Unscheduled Absences	N/A	1.04 (1.01; 1.07)*	N/A	1.07 (1.03; 1.1)*
Time-to-treatment (Referent=0-3 Months)	1,019/2,891		562/2,891	
3-6 Months	359/1,074	0.8 (0.6; 0.9)*	273/1,074	1.1 (0.8; 1.4)
6+ Months	361/1,093	1.1 (0.9;1.4)	470/1,093	1.4 (1.03; 1.8)*
Interactions				
Cohort*Claim Duration (Referent=Usual Care and 0- 3 months)				
Care PathwayX 3–12 months	N/A	0.9 (0.7; 1.2)	N/A	1.4 (0.9; 2.0)
Care PathwayX 12+ months	N/A	0.5 (0.3; 0.8)*	N/A	0.6 (0.3; 1.1)
Modified Duties*Currently working	N/A	0.6 (0.4; 0.8)*	N/A	1.04 (0.6; 1.7)

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Chapter 4: Age-related differences in characteristics and predictive factors of shoulder injury claim duration: a retrospective cohort study

A version of this chapter has been prepared for submission at the **BMC Geriatrics as, "**Anelise Silveira, Lauren Beaupre, Donald Voaklander, Allyson Jones. **Age-related differences in characteristics and predictive factors of shoulder injury claim duration: a retrospective cohort study."** This work has been funded by Workers' Compensation Board in Alberta.

Abstract

Background: The impact of age on shoulder injury claim duration is poorly understood and highlights the urgent need to understand this relationship to guide tailored support for an aging workforce. This study determined the impact of age on claim duration among workers with work-related shoulder injuries treated under a standardized care pathway.

Methods: This retrospective cohort included 2,482 initial shoulder injury claimants treated under a care pathway between 2014-2018. The younger (18-49 years old) cohort comprised 1,307(53%) workers, while the older cohort (50+) comprised 1,175 (47%) workers. Descriptive statistics examined age-based cohorts' differences including demographics, injury, occupational, and program factors. A sensitivity analysis included self-reported factors. Cox regression determined the impact of age on claim duration.

Results: This whole cohort was characterized by traumatic injuries (94.3%), high prevalence of sprain/strains (67.6%), with 65.7% of the cohort having injuries restricted to the shoulder, without significant differences between age cohorts. The older cohort was 10 times less likely to have their claims closed compared to the younger cohort (Hazard Ratio (HR): 0.9, 95% Confidence Interval (CI): 0.8; 0.997). Longer time-to-treatment start was significantly correlated to longer claim durations (HR: 0.002, 95%CI: 0.0003; 0.01). In the sensitivity analysis including self-reported measures, age lost significance (HR: 0.9, 95%CI: 0.8; 1.03), but delayed treatment start remained as a large determinant of claim duration (HR: 0.003, 95%CI: 0.0004; 0.02). Workers aged 50 and older often encountered delays in treatment and prolonged claims duration than workers aged 18-49, even though standardized care pathways were used.

Conclusion: Expedited treatment start significantly decreased claim duration. While age alone did not have a large effect on the duration of the claim, workers aged 50 and older often experience delayed treatment despite being under an equitable care pathway. To ascertain whether older workers can achieve faster and enduring return-to-work outcomes with earlier intervention warrants additional investigation.

Keywords: shoulder injury, aging, claim duration, time-to-treatment, workforce

Introduction

The impact of an aging workforce on workers, workplaces, economy and sustainability of human resources is being discussed worldwide.(32-36) Between 2012-2022, an increase of 42% of adults 65+ years compared to a 7% increase between 18 to 64 years old was reported by Statistics Canada.(37) In 2022, 1 in 5 persons of working age were between 55-64 years old, marking the highest number of nearing retirement workers seen in the Canadian history.(38) Higher infertility rates, longer life expectation, and delayed workforce entry by younger population have been speculated as potential causes for the decrease in the younger population and raises the question about a potential shortage in the workforce.(34, 36, 38) Retirement policies are discussed globally, and policy makers are considering increasing the retirement age to 67 in order to help mitigate the problem.(39, 40) Near retirement workers are also considering staying longer in the workforce for different reasons, including the financial benefit and maintaining purpose in life.(40) However, one of the main barriers to extend work beyond retirement age include poor physical health and the perception of older people not being capable of performing their job.(41)

Older age is directly associated with high prevalence of occupational musculoskeletal conditions, including shoulder injuries.(2, 39, 42) Shoulder injuries have a detrimental impact on health status,(5-7) with greater pain and older age associated with poor health outcomes.(43) Workers over 65 years of age who sustained occupational injuries appear to face disadvantages in terms of vocational rehabilitation, including fewer opportunities for modified work, lower rates of rehabilitation referral, and delayed treatment start when compared to younger workers.(39)

Prolonged claim durations are associated with decreased workers' wellbeing, including poor physical and mental health, increased job dissatisfaction and economic burden.(45) Musculoskeletal conditions are strongly associated with longer claim durations, particularly in older workers.(44) A cohort study of 276 self-employed workers in the Netherlands found that age over 40, no previous similar symptoms, long-lasting symptoms, delayed return-to-work, and job dissatisfaction increased disability claim duration for non-specific musculoskeletal disorders.(44) Another cohort study examined work-related musculoskeletal disorders related to overexertion among 10,347 construction workers in Ohio reported that claims for workers who were 45 and older were more costly and had more days away from work compared to younger workers.(154) A Canadian study including 92,981 occupational claims across all disorders, including musculoskeletal disorders, showed older age was associated with long-term claim duration. Because they used categorized age per decade, there was no cut-point defining older age.(155) To our knowledge, no studies have specifically examined the impact of age on claim duration with occupational shoulder injuries.

The impact of age on claim duration among workers with shoulder injuries is still poorly understood. Other factors, including variability in care that can affect efficiency, effectiveness, and costs, can also prolong treatment duration.(30) Standardizing care delivery through evidence-based care pathways improves patient outcomes by guiding healthcare providers with the use of best-practice evidence.(9, 30, 31) Leveraging provincial data from the Workers Compensation Board Alberta (WCB-AB), the primary aim of this study was to determine the impact of age on claim duration among workers with work-related shoulder injuries treated using a standardized care pathway.

Methods

Study Design and Participants:

Alberta, has the fourth largest population in Canada with the youngest population.(156) It is comprised of a diverse workforce, encompassing various industries such as oil and gas, agriculture, construction, healthcare, and technology.(156) Between January 2014 and December 2018, Alberta's labor force varied between 19,098 to 20,068 persons, with approximately 92.63% of all workers in the province covered by WCB-AB.(156, 157) This retrospective cohort study used administrative data from WCB-AB, including all adult workers (18+ years of age) who filed their initial claim for a shoulder injury between 2014-2018.

Aging groupings were determined based on this cohort data distribution, Alberta definition of older worker and current literature. (39, 158) The young cohort comprised workers aged 18-50 years old, while the older cohort included workers aged 50+. Both cohorts were treated within a standardized care pathway, involving assessments by a shoulder specialized physician and physical therapist. Consensus between these professionals on diagnosis, the need for diagnostic imaging or surgical referral, and the prescribed return-to-work program was mandatory. Additionally, collaborative team meetings, including workers, healthcare providers, employers, and workers' compensation insurance representatives, were conducted to ensure uniform and effective return-to-work plans for all workers. This protocol underscores the commitment to equitable care provision across workers with shoulder injury claims.

This study was approved by the University of Alberta Health Research Ethics Board (Pro00096157). Given the nature of the study and the anonymization of data before released to the researchers, the ethics board exempted informed consent.

Case Ascertainment:

A data analyst from WCB-AB identified eligible workers based on the following International Classification of Diseases (ICD-9) diagnostic codes: First or second diagnosis with Part of Body (POB) = 21000 (Shoulder).

Measures

Outcome Measure (Dependent Variable):

Duration Claim: Number of days between accident date to discharge of last return-to-work program within the claim (claim closure).

Factors of Interest:

Demographics

Age: We incorporated categorical age as described above.

Sex: We used sex assigned at birth (male or female).

Injury Factors

Injury type: The nature of injury was determined based on the International Classification of Diseases, 9th Edition (ICD-9).(159) Injuries at time of the claim were categorized into two types based on ICD-9 codes: *Traumatic*, which resulted from physical injury or trauma, and *Non-Traumatic*, which were associated with no history of physical injury or trauma.

Involved body part: The database contained information regarding primary and secondary body parts used in the claim based on ICD-9 codes. We classified the body parts as:

- *Shoulder Only*: The body part listed was shoulder and there was no secondary body part involved in the claim.

- *Shoulder + Other*: The claim listed different body parts, one was shoulder and the other could be any body part other than shoulder.

Diagnosis: Each claim's diagnosis was categorized through the utilization of a maximum five-digit ICD-9-CM code provided by the healthcare provider.(159) Diagnoses were consolidated into three main groups: *sprains/strains* (soft tissue injuries to muscles, tendons, and/or ligaments), *arthropathies and related pathologies* (joints and surrounding structures), and *other* which included other diagnoses, unknown diagnosis.

Occupational Factors

Type of work: We used the National Occupational Classification (NOC) five digit code of the worker's pre-accident occupation type.(135) Each occupation was defined in terms of the type and level of skill required for the date of accident occupation. The type of skill was assigned based on the ten broad occupational areas (values are from 0 to 9).(135) Given the small number of workers in some categories, for the purpose of this study, pre-accident occupations were grouped as follows: ***Technical and Industrial Occupations*** combined Trades/Transport/Equipment, Primary Industry, and Processing/Manufacturing/Utilities. ***Administration, Social, and Scientific Occupations*** were formed by merging Management, Business/Finance/Administration, Social Science/Education/Government/Rel, Natural & Applied Science, and Art & Culture. ***Health Occupations*** remained separate, while ***Sales and Service*** jobs were grouped.

Work status at start of claim: The data included dichotomous data (yes/no) regarding whether workers were currently working at the start of their claim.

Availability of modified duties at claim start: The data set included dichotomous data (yes/no) indicating whether workers had modified duties available at the start of their claim. Modified duties involved adjusting tasks or responsibilities to accommodate health limitations, disabilities, or temporary conditions.

Wage replacement Benefits at Claim Start: The dataset contained dichotomous information (yes/no) indicating whether workers were receiving wage replacement benefits at the onset of their claim.

Program Factors

Programs: The rehabilitation program services supported workers to reintegrate into the worksite and job demands, taking into consideration workers' specific injury-related needs and circumstances. Rehabilitation program allocations were defined by a consensus between a shoulder specialize physician and a physical therapist after the assessment.

- *Provider Program* – Workers were provided with the services of an exercise therapist, physical therapist, and consulting occupational therapist to improve their strength and functionality. They received prescribed programs such as stretching, strength training (often involving work simulation), and physiotherapy exercises tailored to their injuries. Workers also received education on managing their injuries, symptoms, and pacing techniques. Educational workshops, individual psychology services were available if needed. Treatment interventions took place at the provider's site.
- *Hybrid Program* - Workers attended service interventions periodically throughout the week at both provider and work sites. Participants were expected to attend the program for 2.5 days per week, ensuring a minimum of 5 days of attendance over two

weeks. Each program day included activities such as functional restoration exercises, general conditioning, counseling, and/or educational workshops, each lasting at least two (2) hours.

- *Complex Program* - This program offered specialized interventions tailored to meet the medical, functional, musculoskeletal, psychosocial, and vocational needs of workers facing significant barriers to safe and sustainable RTW. To qualify for admission into the Complex Program, workers exhibited substantial limitations due to pain, along with three or more of the following criteria: high medication usage, significant sleep disturbances, frequent visits to healthcare providers, lack of improvement with previous interventions, history of prolonged claims, and notable psychological issues such as anxiety, depression, or kinesiophobia (fear of movement). Clinicians within the program focussed on addressing barriers to RTW while providing education on the injury and pain management techniques. They offered workers counseling and group psychoeducational sessions to assist them in better understanding and managing their injuries.

Time from Injury to when Treatment was initiated: The number of days between the date of accident and the date of first return-to-work program treatment was calculated. Considering the non-linear nature of this variable, we opted to categorize it into three groups: 0-3 months, 3-12 months, and 12+ months. This decision was informed by the clinical considerations in that a delay of treatment beyond 3 months can often lead to the injury becoming chronic. (137, 138) It also aligns with the expectation that the majority of shoulder injuries tend to resolve within a year from the time of injury.(137, 138)

Self-Reported Factors:

Short Form 36 Health Survey (SF-36): The SF-36 is a generic health measure consisting of 36 questions covering eight health concepts: physical functioning, role limitations due to physical health problems, bodily pain, general health perceptions, vitality, social functioning, role limitations due to emotional problems, and mental health. The Physical Component Summary (PCS) and Mental Component Summary (MCS), two summary measures derived from the SF-36 responses were used in this study with data collected at the initial assessment. The PCS summarizes the physical aspects of health, including physical functioning, role limitations due to physical health, bodily pain, and general health perceptions. It provides an overall assessment of an individual's physical well-being. The MCS focuses on mental health aspects, combining items related to vitality, social functioning, role limitations due to emotional problems, and mental health. It offers an overall evaluation of an individual's mental well-being. Component Summaries are scored between 0 (no disability) and 100 (very disabled).(160, 161) The minimal important change is not defined for patients with upper extremity injuries. (160, 161)

Visual Analogue rating of Pain: Pain, measured on a Visual Analogue Scale (VAS) where 0 equals no pain and 100 the worst possible pain, was collected at initial assessment. The VAS is a reliable and valid method of measuring patient-reported pain; a minimal difference of 20 cm (20%) is considered clinically important.(162) To distinguish among mild, moderate and severe pain, we used the following cut-off points: VAS scores ≤ 3.4 were classified as none to mild pain, between 3.5 and 7.4 as moderate pain, and ≥ 7.5 as severe pain.(163)

Statistical Analysis:

Descriptive statistics included Mann–Whitney U (continuous, not normally distributed), and chi-square tests (categorical variables) to examine cohort differences for outcomes of interest at study entry. Post-hoc tests with Bonferroni adjustments were performed for significant different

variables with more than 2 categories. Cox logistic proportional hazards regressions determined the impact of age on claim duration. Variables included in the model were guided by the Readiness for RTW following injury or illness framework. (134) In the main model, we included demographics, injury, occupational and program factors. In the sensitivity analysis, we included self-reported measurements in addition to the previous described factors.

For the SF-36, a significant portion of the data was missing (45%); and an analysis was performed to examined non-participant bias. Workers with and without self-reported measures were compared using descriptive statistics. Because significant statistical differences between workers with and without SF-36 overall scores were seen, we reported two cox models to determine the impact of age on claim duration: 1. Not including self-reported measures and 2. Including self-reported measures.

We used a purposeful model-building approach for the Cox regression, including variables deemed statistically significant according to model rules, as well as variables that, although not statistically significant, were considered clinically important based on current literature.(139) Initially, we examined the correlation among all independent variables to detect multicollinearity, which occurs when two or more independent variables measure the same underlying concept. The next step included a univariate analysis between claim duration (outcome) and each independent variable including both cohorts (younger and older). Independent variables significant at $p<0.20$ and clinically important variables moved to the multivariable model step. At the Multivariable Model step**,** independent variables significant at $p<0.05$ and clinically important variables were included in the main effect model. We assessed

the impact of excluded variables in the multivariable model step by assessing changes in regression coefficients (β) of remaining independent variables, retaining removed variables if any coefficient changed by 15% or more. We tested the linearity assumption for continuous variables using fractional polynomials and categorized variables that were not linear according to the current literature (i.e. time to first treatment). We tested plausible interactions and did not identify statistically significant ones at $p<0.05$. We tested the proportional hazard (PH) assumption using LML plots and proportional hazard test based on Schoenfeld residuals. Time-variable covariates (TVC) were included in the final model with a time cut-off time decided on the common cut-off among variables that violated the PH assumption. Cut-off points were selected based on LML plots. We used likelihood test to test the final model fitting. Analyses were performed using STATA/BE version 18.(140) For all analyses a p-value of < 0.05 was considered as statistically significant.

Results

Among the 2,482 workers included in the analysis; the mean age was 47.1 years (95% CI: 46.6, 47.6). The younger cohort had a mean age of 37.5 years (95% CI: 37.1, 38.0), whereas the older cohort had a mean age of 57.7 years (95% CI: 57.4, 58.0). The majority experienced traumatic injuries (94.3%), predominantly confined to the shoulder region (65.7%), with a high prevalence of sprain and strain diagnosis (67.6%), with no significant difference between cohorts. The younger cohort started treatments earlier and had shorter claim durations than the older group ($p<0.0001$) (Table 4.1).

In both, the univariate (unadjusted) and the multivariate (adjusted) analysis, age was a determinant of claim duration; however, the impact was small, with the older cohort being 10% **less** likely to have their claim closed compared to the younger cohort (HR: 0.9, 95% CI: 0.80, 0.99). Having a diagnosis of arthropathy (HR: 0.9, 95% CI: 0.8, 0.97) and being in the complex program (HR: 0.07, 95% CI: 0.02, 0.30) were associated to longer claims, while having modified duties availability at claim start was correlated with shorter claims (HR: 1.2, 95% CI: 1.1, 1.3). Time-to-treatment start was largely correlated with claim duration, with workers starting treatment between 3-6 months 99.5% **less** likely to have their claim closed compared to workers starting treatment between 0-3 months (HR: 0.005, 95% CI: 0.002, 0.01) (Table 4.2).

It is important to notice that time-to-treatment start, program, modified duties, working at claim start and sex were considered as time-variant covariates (TVC), meaning that their hazards were not constant throughout the study. Based on LML plots, a time cut-off time of 110 days was selected as common point for hazard change among variables. After controlling for TVCs, workers starting treatment at 6+ months were 70% **less** likely to have their claim closed

compared to workers starting treatment between 0-3 months (HR: 0.3, 95% CI: 0.2, 0.3) (Table 4.2).

Workers who had SF-36 overall scores were significantly different from workers without SF-36 scores for age ($p=0.05$), diagnosis ($p<0.001$), type of work ($p=0.04$), time from injury to treatment start ($p<0.0001$), RTW program ($p=0.01$), claim duration ($p<0.0001$), and pain ($p<0.001$). Workers with SF-36 scores were slightly younger (54% between 18-49), exhibiting a higher prevalence of sprains and strains (71%), with 19% engaged in the technical and industrial field, and 65% participating in the provider-based RTW program. Conversely, workers without SF-36 scores were slightly older (50% being 50+), presenting a lower prevalence of sprains and strains (63%), with 15% involved in the technical and industrial field, and 69% enrolled in the provider-based RTW program. Workers with SF-36 scores has longer claims and delayed treatment start compared to workers without SF-36 scores ($p<0.0001$) (Table 4.3). Finally, workers with SF-36 scores had a smaller percentage of severe pain (84.2%) compared to workers without SF-36 scores (98%).

Sensitivity analysis including SF-36 overall scores and pain in the model showed that in the univariate analysis (unadjusted), the older cohort was 20% **less** likely to have their claim closed compared to the younger cohort (HR: 0.8, 95% CI: 0.7, 0.9), which is similar to the full model without these measures. When adjusted for SF-36 overall scores and pain with the multivariate analysis, age lost its significance in determining claim duration (HR:0.9, 95% CI:0.8, 1.03), being different from the model without these measures. Time-to-treatment start was still strongly associated with claim duration, with workers starting treatment between 3-6 months 99.7% **less** likely to have their claim closed compared to workers starting treatment between 0-3 months (HR: 0.003, 95% CI: 0.0004, 0.02) (Table 4.4).

Discussion

Age alone was not a determinant of claim duration in workers with work-related shoulder injuries. Although age had a small effect in determining claim duration in the analysis without self-reported measures, its effect disappeared in the analysis including self-reported measures. Time-to-treatment emerged as significant determinant of claim duration. While age alone did not have a large effect determining claim duration, workers aged 50 and older often experience delayed treatment and longer claims despite being under the same care pathway as the younger cohort

Unlike earlier research that found older age as a determinant of claim duration among workers with diverse musculoskeletal conditions (44, 154, 155), we found that age had a small effect in determining claim duration for workers with shoulder injuries. A cohort study of 276 self-employed workers in the Netherlands found that age over 40 increased claim duration for non-specific musculoskeletal disorders.(44) Their findings were based on self-employed workers in terms of financial factors such as "hiring extra work since claim start" and "perceived financial situation of the company" as potential determinants that were not included in our study.(44) Another cohort study including 10,347 construction workers in Ohio with work-related musculoskeletal disorders showed workers 45 and older had more days away from work compared to younger workers.(154) They also examined the number of claims, number of lost work days, diagnosis, and costs in their analysis, yet they did not use a multivariate modeling to control for other factors that may have affected the number of days absent from work.(154) A Canadian study including 92,981 occupational claims across all disorders, including

musculoskeletal disorders, showed older age is associated with long-term claim duration.(155) Differences seen with the results may have been related to different definitions of claim closure. Our study defined claim durations as number of days from injury to claim closure, and they defined claim duration as number of days receiving wage-replacement benefits which has a slightly different connotation. None of these studies included time-to-treatment, all included diverse musculoskeletal conditions, and all occurred in different jurisdictions, potentially explaining the different findings.

Findings from this analysis found that treatment initiation time had a large effect on claim duration irrespective of age. A recent scoping review including 31 studies from Canada and United States showed the impact of time-to-treatment on outcomes among workers with musculoskeletal claims.(164) Expedited access to physical therapy and interdisciplinary biopsychosocial interventions following an occupational musculoskeletal injury led to favorable outcomes, including decreased pain, quicker return-to-work, decreased healthcare utilization, improved functional capacity, and decreased costs.(164) In a cohort of 76,067 workers with musculoskeletal disorders or fractures, initiating treatment closer to time of injury was associated with shorter claim durations.(165) This was particularly observed on workers with musculoskeletal disorders.(165) While these studies may not specifically targeted shoulder injuries, their results were consistent with our findings, indicating that a reduced time-to-treatment initiation was an important factor in enhancing outcomes, including shorter claim duration, for workers with musculoskeletal injuries, regardless of age.

A notable finding of this analysis is that while age may not have a large effect on claim duration, workers aged 50 and older often experienced delays in treatment and prolonged claims, despite following a standardized care pathway. A streamlined delivery of care, guided by evidence-based

protocols for managing work-related shoulder injuries, should ensure equitable access to care for all workers, regardless of their age at time of injury. Both young and older workers had similar prognostic characteristics including injury type, involved part of the body, and diagnosis. This similarity should mitigate confounding effects, highlighting the unequal access to care between the age-defined cohorts. While the older cohort had a marginally higher number of workers enrolled in the complex program (4.5%) compared to the younger cohort (2.5%), this slight disparity in percentages is unlikely to account for the observed difference in claim duration. A potential explanation may be related to age-related bias also known as ageism. A systematic review looking at the global impact of ageism on older persons' health, including information on individual and structural levels, showed that ageism led to significantly worse health outcomes in 95.5% of the 422 studies included.(166) Particularly, 84.6% of the 141 studies looking specifically at care access showed that clinicians had a tendency to deny access to health services to older patients compared to their younger counterparts, regardless of equal potential benefits.(166) A longitudinal study on 6,017 American adults aged 50 and over showed that one out five older adults experience discrimination in healthcare settings, with 29% reporting healthcare discrimination linked to worse health outcomes in a period of 4 years.(167). Although these studies did not focus on occupational health or musculoskeletal diseases, and were conducted in different jurisdictions, they still shed light on how ageism affects healthcare systems worldwide. A cross-sectional study involving 8,003 WCB-AB workers, aged 65 and above, with work-related musculoskeletal injuries, highlighted their disadvantaged status.(39) Older workers were less likely to receive rehabilitation services even with more severe injuries.(39) Although our study focused on workers aged 50 and older, and their injuries were

not as severe as those in the cross-sectional study, it suggests that ageism or unconscious bias related to age might impact access to care and lead to worse outcomes.

Strengths and Limitations

This study is unique in its inclusion of time-to-treatment data in an adjusted model looking at determinants of claim duration. Furthermore, it included a well-defined provincial population of workers with shoulder injuries that received standardized care. By leveraging administrative data, we identified personal, medical, program-related factors, capitalizing on real-life data.

While the inclusion of self-reported data provided valuable insights, its impact in this study should be considered with caution due to the substantial missing data. Although there were systematic differences, consistent findings were that delayed treatments lead to longer claim durations. We cannot discount the "healthy worker effect", since we are looking at the effect of age on claim duration. The older population still working are often healthier than the ones that are out of the workforce.

Conclusion

Timely treatment for work-related shoulder injuries is critical regardless of age. Initiating treatment promptly significantly reduces the duration of claims. While age had a small effect in determining claim duration, individuals aged 50 and older frequently encountered delays in treatment initiation, even when provided with standardized care pathways. Additional research is needed to determine if older workers can achieve faster RTW rates and shorter claim durations compared to their younger counterparts by receiving early intervention.

Table 4.1: Characteristics of study population and cohorts (aged 18-49 and aged 50+).

	Entire cohort (N=2,482)	Younger (aged 18-49) (N=1,307)	Older (aged 50+) (N=1,175)	P-Value
Age in year Mean (95%CI)	47.1 (46.6 – 47.6)	37.5 (37.1 – 38.0)	57.7 (57.4 – 58.0)	N/A
Sex (N, (%))				
Male	1,335 (54)	679 (52)	656 (56)	**0.05***‡
Female	1,147 (46)	628 (48)	519 (44)	
INJURY FACTORS				
Injury Type (N, (%))				
Traumatic	2,341 (94)	1,239 (95)	1,102 (94)	0.3‡
Non-Traumatic	141 (6)	68 (5)	73 (6)	
Involved Part of Body (N, (%))				
Shoulder Only	1,630 (65.7)	860 (65.8)	770 (65.5)	0.9‡
Shoulder + Other Body Part	852 (34.3)	447 (34.2)	405 (34.5)	
Diagnosis (N, (%))				
Sprain/Strain	1,677 (67.6)	893 (68.3)	784 (66.7)	0.2‡
Arthropathies	317 (12.8)	151 (11.6)	166 (14.1)	
Other	488 (19.7)	263 (20.1)	225 (19.2)	
OCCUPATIONAL FACTORS				
Working at Claim Start (N, (%))				
Yes	1,472 (59.3)	772 (59.1)	700 (59.6)	0.8‡
No	1,010 (40.7)	535 (40.9)	475 (40.4)	
Type of Work (N, (%))				
Administration, Social and Scientific	359 (14.5)	201 (15.4)	158 (13.5)	**<0.001*‡** Administration, Social and Scientific **vs** Health **<0.001** Health **vs** Sales & Service **<0.001**
Technical and Industrial	1,133 (45.7)	575 (44.0)	558 (47.6)	
Health	427 (17.2)	270 (20.7)	157 (13.4)	
Sales & Service	560 (22.6)	260 (19.9)	300 (25.6)	
Modified Duties (N, (%))				
Yes	1,551 (62.5)	823 (63)	728 (62)	0.6‡
No	931 (37.5)	484 (37.0)	447 (38.0)	
Receiving Wage-Replacement Benefits at Claim Start (N, (%))				
Yes	1,831 (73.8)	965 (73.8)	866 (73.7)	0.9‡

No	651 (26.2)	342 (26.2)	309 (26.3)	
PROGRAM FACTORS				
Program (N, (%))				
Provider	1,662 (67.0)	888 (67.9)	774 (66.0)	**0.02***‡ Provider **vs** Complex **=0.004** Hybrid **vs** Complex **=0.01**
Hybrid	733 (29.6)	387 (29.6)	346 (29.5)	
Complex	85 (3.4)	32 (2.5)	53 (4.5)	
Time-to-treatment – Median (IQR)	74 (74)	69 (61)	84 (94)	**0.0001***
Claim Duration – Median (IQR)	112 (90)	103 (77)	120 (113)	**0.0001***

Legend: N/A= Not applicable; 95%CI= 95% Confidence Interval; * = Statistically significant ($p<0.05$); † = Analyzed with a 2-tailed independent t-test; ‡ = Analyzed with a chi-square test; ¶= Analyzed with Mann–Whitney U; N=Number of participants; %= Percentage; SF-36= Short Form 36 Health Survey

Table 4.2. Determinants of claim duration among workers filing initial claims for shoulder injuries.

	Univariate (Unadjusted)	**Multivariable** (Adjusted)	
	Hazard Ratio (95% CI); N=2,482	Hazard Ratio (95% CI) up to 110 days; N=2,477	Hazard Ratio (95% CI) after to 110 days; N=2,477
Age in years Referent:18-49			
50+	**0.8 (0.7 - 0.8)***	**0.9 (0.8 – 0.997)***	
Sex Referent: Male			
Female	**1.2 (1.1 - 1.3)***	0.9 (0.8 – 1.1)	1.1 (0.9 – 1.2)
INJURY FACTORS			
Injury Type Referent: Non-Traumatic			
Traumatic	1.0 (0.8 - 1.2)		
Involved Part of Body Referent: Shoulder + Other			
Shoulder Only	**1.2 (1.1 - 1.3)***	1.1 (1.0 – 1.2)	
Diagnosis – Referent: Sprain/Strain			
Arthropathies	**0.7 (0.6 – 0.8)***	**0.9 (0.8 – 0.9)***	
Other	1.0 (0.9 – 1.1)	1.0 (0.9 – 1.1)	
OCCUPATIONAL FACTORS			
Working at Claim Start Referent: No			
Yes	**1.3 (1.2 - 1.5)***	1.0 (0.8 – 1.1)	0.9 (0.8 – 1.1)
Type of Work Referent: Administration, Social and Scientific			
Technical and Industrial	0.9 (0.8 - 1.1)	1.0 (0.9 – 1.1)	
Health	1.1 (1.0 - 1.3)	1.1 (0.9 – 1.3)	
Sales & Service	1.1 (0.9 - 1.2)	1.1 (0.997 – 1.3)	
Modified Duties Referent: No			
Yes	**1.4 (1.3 - 1.5)***	**1.2 (1.1 – 1.3)***	**1.3 (1.03 – 1.6)***
Receiving Benefits at Claim Start Referent: No			

Yes	1.0 (0.9 - 1.1)		
PROGRAM FACTORS			
Rehabilitation Program Referent: Provider			
Hybrid	**1.1 (1.01 - 1.2)***	0.96 (0.8 – 1.1)	1.1 (0.9 – 1.2)
Complex	**0.3 (0.2 - 0.4)***	**0.07 (0.02 – 0.3)***	**0.4 (0.3 – 0.5)***
Time-to-treatment Start	**0.995 (0.994 - 0.996)***		
Categorical Time-to-treatment Start Referent: 0-3 months			
3-6 months		**0.005 (0.002 – 0.010)***	0.9 (0.8 – 1.1)
6+ months		**0.002 (0.0003 – 0.010)***	**0.3 (0.2 – 0.3)***

Legend: Hazard ratios (HR) and 95% confidence intervals (CI) from cox regression analysis with time-varying covariates (TVC). (*= Statistically significant ($p<0.05$))

Table 4.3: Sensitivity Analysis comparing workers with and without SF-36 scores

	Valid SF-36 overall score (N=1,367)	Missing SF-36 overall score (N=1,115)	P-Value
Age (N, (%)) 18-49 50+	 744(54) 623(46)	 563(51) 552(50)	 **0.05***‡
Sex (N, (%)) Male Female	 735 (54) 632 (46)	 600 (54) 515 (46)	 0.98‡
INJURY FACTORS			
Injury Type (N, (%)) Traumatic Non-Traumatic	 1,291 (94) 72 (5)	 1,050 (94) 60 (5)	 0.8‡
Involved Part of Body (N, (%)) Shoulder Only Shoulder + Other	 890 (65) 477 (35)	 740 (66) 375 (34)	 0.5‡
Diagnosis (N, (%)) Sprain/Strain Arthropathies Other	 976 (71) 193 (14) 198 (15)	 701 (63) 124 (11) 290 (26)	**<0.001***‡ Sprain/Strain **vs** Other**, <0.001** Arthropathies **vs** Other**, <0.001**
OCCUPATIONAL FACTORS			
Working at Claim Start (N, (%)) Yes	 820 (60)	 652 (59)	 0.4‡
Type of Work (N, (%)) Administration, Social and Scientific Technical and Industrial Health Sales & Service	 195 (14) 605 (44) 262 (19) 302 (22)	 164 (15) 528 (47) 165 (15) 258 (23)	**0.04***‡ Technical and Industrial **vs** Health **, 0.005**
PROGRAM FACTORS			
Modified Duties (N, (%)) Yes	 859 (63)	 692 (62)	 0.7‡
Time Injury to treatment in days Median (IQR)	 83 (92)	 65 (58)	 **<0.0001***¶
Rehabilitation Program (N, (%)) Provider Based Hybrid Complex	 882 (65) 440 (32) 45 (3)	 770 (69) 294 (26) 51 (5)	**0.01***‡ Provider Based **vs** Hybrid **, 0.003**

Receiving Benefits at Claim Start (N, (%)) Yes	993 (73)	838 (75)	0.2‡
Claim Duration – Median (IQR)	119 (110)	102 (75)	**<0.0001*¶**
SELF-REPORTED MEASUREMENTS			
Pain - Categorical - Claim Start (N, (%))			
None to Mild	82 (6.0?)	17 (1.5)	**<0.001*‡** None to Mild **vs** Moderate **, <0.001** None to Mild **vs** Severe **, <0.001** Moderate **vs** Severe **, <0.001**
Moderate	134 (9.8)	5 (0.5)	
Severe	1,151 (84)	1,093 (98)	

Legend: 95%CI= 95% Confidence Interval; *= Statistically significant (p<0.05); ‡ = Analyzed with a chi-square test; ¶= Analyzed with Mann–Whitney U; N=Number of participants; %= Percentage; SF-36= Short Form 36 Health Survey

Table 4.4. Determinants of claim duration among workers filing initial claims for shoulder injuries including self-reported factors.

	Univariate (Unadjusted)	**Multivariable (Adjusted)**	
	Hazard Ratio (95% CI); N=1,367	**Hazard Ratio (95% CI) up to 110 days; N=1,367**	**Hazard Ratio (95% CI) after to 110 days; N=1,367**
Age in years Referent:18-49			
50+	**0.8 (0.7 - 0.9)***	0.9 (0.8 – 1.0)	
Sex Referent: Male			
Female	1.1 (1.0 - 1.2)	1.05 (0.9 – 1.2)	
INJURY FACTORS			
Injury Type Referent: Non-Traumatic			
Traumatic	0.8 (0.6 - 1.03)		
Involved Part of Body Referent: Shoulder + Other			
Shoulder Only	**1.2 (1.1 - 1.4)***	**1.1 (1.03 – 1.3)***	
Diagnosis – Referent: Sprain/Strain			
Arthropathies	**0.7 (0.6 – 0.8)***	**0.7 (0.5 – 0.9)***	
Other	**0.8 (0.7 – 0.9)***	0.8 (0.7 – 1.1)	
OCCUPATIONAL FACTORS			
Working at Claim Start Referent: No			
Yes	**1.3 (1.2 - 1.5)***	0.97 (0.7 – 1.3)	
Type of Work Referent: Administration, Social and Scientific			
Technical and Industrial	1.0 (0.8 - 1.1)		
Health	1.1 (0.9 - 1.3)		
Sales & Service	1.0 (0.8 - 1.2)		
Modified Duties Referent: No			
Yes	**1.3 (1.2 - 1.5)***	1.1 (0.8 – 1.4)	**1.3 (1.0 – 1.6)***

Receiving Benefits at Claim Start Referent: No			
Yes	1.0 (0.9 - 1.1)		
PROGRAM FACTORS			
Rehabilitation Program Referent: Provider			
Hybrid	**1.2 (1.1 - 1.4)***	0.98 (0.8 – 1.2)	
Complex	**0.3 (0.2 - 0.4)***	**0.07 (0.01 – 0.5)***	**0.4 (0.3 – 0.5)***
Time-to-treatment Start	0.995 (0.994 - 0.996)*		
Categorical Time-to-treatment Start Referent: 0-3 months			
3-6 months		**0.003 (0.001 – 0.010)***	
6+ months		**0.003 (0.0004 – 0.0200)***	**0.2 (0.18 – 0.3)***
SELF-REPORTED HEALTH FACTORS			
SF-36 - PCS - Claim Start	1.0 (1.000 - 1.003)		
SF-36 - MCS - Claim Start	**1.01 (1.002 - 1.008)***		
Pain - Claim Start Referent: None-Mild			
Moderate	1.2 (0.9 - 1.6)		
Severe	0.8 (0.6 - 1.01)		

Legend: Hazard ratios (HR) and 95% confidence intervals (CI) from cox regression analysis with time-varying covariates (TVC). (*= Statistically significant ($p<0.05$); SF-36 – PCS= Short Form 36 Health Survey - Physical Component Summary; SF-36 – MCS= Short Form 36 Health Survey - Mental Component Summary)

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Chapter 5: Conclusion and future directions

Among musculoskeletal conditions, shoulder pain is the third most common presentation in primary care, with significant personal, societal and economic impacts.(1-3, 9, 168) Within the working population, over fifty percent are expected to experience nonspecific musculoskeletal symptoms within a one-year period, with shoulder pain being one of the most common conditions.(4) Shoulder pain can have significant impacts on workers, workplaces, and healthcare systems. For workers, it can cause discomfort, difficulty performing tasks, and reduced productivity, leading to absenteeism and lower job satisfaction.(169, 170) In workplaces, shoulder pain can result in decreased efficiency, increased risk of accidents, and higher healthcare costs due to workers' compensation claims and medical expenses.(171) Healthcare systems are burdened with the treatment of shoulder pain, including doctor visits, medications, physical therapy, and sometimes surgery, placing strain on resources and affecting overall healthcare expenditures.(1-3, 9, 168)

Understanding how shoulder pain impacts the working population is complex and requires a multifaceted approach to understand its implications and enhance outcomes. From a clinical perspective, there is a need to understand not only the best treatments approaches, but also consider how care is delivered in this population. Considering an aging workforce and concerns regarding the sustainability of human resources, it is important to identify factors that can guide policymakers and employers in developing targeted interventions to support older workers during rehabilitation and recovery after a shoulder injury. With the aim of reducing the knowledge gap regarding such factors in the working population with shoulder injuries, three

separate studies were completed leading to recommendations for workers, worker compensation boards and healthcare providers.

Best Treatment Approaches

Exercise therapy (ET) is commonly considered as an initial treatment for shoulder pain; however, the evidence regarding its effectiveness in expediting recovery remains inconclusive.(16, 17) An important concern in the current literature is the tendency to treat ET as a singular approach, despite ET encompassing various approaches. These approaches range from shoulder-specific strengthening and range of motion (ROM) exercises, whether combined with scapular exercises or not, to more generalized shoulder exercises like postural and functional exercises. Additionally, the benefit of incorporating adjunct therapies (such as injections, manual therapy, and electrotherapy) alongside ET remains uncertain.(16, 17) Through a network meta-analysis, **Study 1** integrated both direct and indirect evidence from 54 studies involving 3,893 participants to assess the efficacy of ET with or without adjunct therapies compared to usual medical care for adults with chronic shoulder pain. This study showed that when compared to usual care, shoulder-specific ET with scapular exercises demonstrates greater effectiveness in reducing pain and sustaining pain relief for up to 52 weeks. The addition of adjunct therapies to ET showed minimal pain relief compared to shoulder-specific ET and usual care. While augmenting ET with manual therapy yielded clinically significant improvements in health outcomes, these effects were not observed when low-quality studies were excluded. It is important to note that when comparing the addition of adjunct therapy to exercise therapy, the exercise therapy group was heterogeneous and may have minimized the effect of adjunct therapy. While these findings aren't specifically tailored to the working population, it remains the standard of care to initiate treatment for individuals experiencing shoulder pain with a

conservative approach that incorporates exercises, with or without adjunct therapy.(16, 17) By recognizing that adjunct therapy offers minimal clinical benefit and that ET with scapular exercises notably reduces pain, it is advisable to prioritize ET as the primary treatment for this demographic. Additionally, ET is a convenient approach, requiring minimal equipment and can be performed virtually anywhere, including workplaces.

Delivery of Care

The optimal approach to delivering treatment for shoulder injuries among workers remains uncertain and requires further investigation for identification. Understanding if a care pathway compared to usual care is able to expedite RTW of workers sustaining shoulder injuries is important and can provide guidance on optimal management. **Study 2** determined the effect of care delivery on RTW levels and identified factors among workers filing their first shoulder injury claim. This retrospective cohort study including 5,075 workers with a first claim for shoulder injury demonstrated that the implementation of the care pathway led to shorter claim durations, faster initiation of treatment, and increased availability of modified duties. Notably, workers in the care pathway RTW at modified duties, unlike the usual care cohort where claims took longer, but workers RTW at pre-accident levels. Prolonged claims and poor RTW program compliance were linked to higher likelihood of not RTW. These findings emphasize that delivery of care impacts RTW outcomes and should be considered when treating workers with work-related shoulder pain. The care pathway seems to streamline claim processes by expediting treatments and promoting modified duties, and ultimately facilitating a smoother transition back to work for workers with work-related injuries.

Aging Workforce

Global discussions on aging workforce's impact on workers, workplaces, economy, and human resources sustainability are ongoing.(32-36) Older age correlates with increased musculoskeletal issues, notably shoulder conditions. Shoulder pain adversely affects health, with older age and higher pain levels indicating poorer prognosis.(2, 39, 42) Workers over 65 years of agewith work-related injuries encounter vocational rehabilitation challenges, including limited modified work options, lower rehabilitation recommendations, and delayed treatment compared to younger peers.(39) Understanding the impact of age on claim duration for shoulder conditions remains a challenge due to care variability. Standardizing care practices could mitigate biases in analyzing determinants of claim duration.(9, 30, 31) Findings from **Study 3** showed that early intervention for work-related shoulder injuries is crucial regardless of age. Although age did not have a large effect on claim duration, workers aged 50 and above frequently encounter delayed treatment, potentially influenced by age-related biases, even when following an equitable care pathway. These findings underscored the importance of prioritizing timely treatment initiation over solely considering age as a determinant factor. It is crucial for all stakeholders to recognize and mitigate potential ageism, ensuring equitable care for workers aged 50 and above.

Clinical Implications

The combination of findings from the three studies included in this dissertation provides valuable insights into the clinical management of shoulder pain, particularly in the context of workplace injuries. Integrating these studies suggests several important clinical implications:

1. **Prioritizing Exercise Therapy (ET) with Scapular Exercises**: Study 1 highlighted the effectiveness of ET, including scapular exercises, in reducing shoulder pain. Healthcare providers should prioritize this approach as a first-line treatment option due to its efficacy, minimal equipment requirements, and versatility in various settings. Implementing ET early in

the rehabilitation process can lead to improved outcomes for individuals with shoulder pain.

2. **Adherence to Evidence-Based Care Pathways:** Study 2 emphasized the benefits of following evidence-based care pathways in managing shoulder injuries in the workplace. Proactive intervention guided by structured pathways can lead to shorter claim durations and expedited RTW processes. Healthcare providers should integrate evidence-based guidelines into practice to optimize rehabilitation outcomes and minimize prolonged disability among workers with shoulder injuries.

3. **Importance of Early Intervention Regardless of Age:** Study 3 highlighted the critical role of early intervention in reducing claim durations for work-related shoulder injuries, irrespective of age. Healthcare providers should prioritize timely treatment initiation to mitigate the risk of prolonged disability and facilitate quicker RTW. Additionally, efforts should be made to address age-related biases in healthcare delivery to ensure equitable access to timely treatment for all age groups.

In summary, the combined findings from this dissertation underscores the importance of early intervention, evidence-based care pathways, and the using ET with scapular exercises in managing shoulder pain among the working population. By incorporating these strategies into clinical practice, healthcare providers can optimize outcomes and promote sustained employment participation while mitigating the risk of long-term disability associated with shoulder injuries.

Compensation Boards Implications

The combination of these three studies within the context of this dissertation yielded significant implications for work compensation boards regarding the management of shoulder injuries among workers.

Starting with Study 1, which highlights the effectiveness of exercise therapy in reducing shoulder

pain, the implications are clear: compensation boards should prioritize evidence-based exercise regimens as a primary intervention for shoulder injuries among workers. This promotes proactive management of injuries, potentially leading to quicker RTW outcomes. By emphasizing exercise-based interventions and streamlining rehabilitation protocols, compensation boards can minimize unnecessary expenses and foster better outcomes for both injured workers and employers.

Study 2 reinforced the importance of proactive intervention strategies in the workplace, particularly through the implementation of care pathways. These pathways optimize rehabilitation outcomes, facilitate prompt returns to modified duties, and ultimately reduce long-term disability. By embracing care pathways, employers can effectively support injured workers, promote faster recovery, and mitigate the negative impact of injuries on productivity and employee well-being. This proactive approach not only benefits individual workers but also contributes to a healthier and more efficient workforce overall.

Finally, Study 3 emphasizes the critical importance of early treatment for work-related shoulder injuries, regardless of the injured worker's age. Despite the lack of a definitive correlation between age and claim duration, this study highlighted a concerning trend: delays in treatment initiation, particularly among older workers (50+). Compensation boards must address age-related biases and ensure equitable access to timely treatment for all injured workers. By prioritizing early treatment, compensation boards can reduce the burden of long claim for all involved stakeholders, benefiting both older and younger workers alike.

In summary, the combination of these studies underscores the importance of evidence-based, proactive interventions, early treatment, and equitable access to rehabilitation services for managing shoulder injuries in the workplace. By incorporating these findings into their policies

and practices, work compensation boards can enhance the effectiveness of their interventions, improve outcomes for injured workers, and promote a healthier and more productive workforce.

Future directions

The culmination of the three studies conducted in this PhD dissertation sheds light on various critical aspects in the context of work-related shoulder injuries and sets the stage for future research directions in this field.

Study 1 identified several barriers in research on ET for shoulder pain. Many studies lacked published protocols, making it hard to judge their findings and increasing risk of bias. Details on study methodology were often lacking, hindering replication in real-life settings. Strength outcomes were poorly reported, although it is an important outcome measurement when assessing effect of ET. There's also a big gap in understanding how ET affects the working population with shoulder pain, as studies rarely address occupational outcomes such as RTW and claim duration for example. Future research should address these gaps to improve confidence in findings and better understand ET's effectiveness, particularly in the workplace.

Even though Study 2 showed positive results and emphasized the importance of considering the delivery of care for workers with work-related shoulder injuries, it had limitations. Specifically, it did not include measurements of health-related quality of life. From an insurance standpoint, simply RTW, regardless of the outcome, is considered a success. However, this perspective may not necessarily reflect the worker's own viewpoint. In future studies, it would be beneficial to assess the impact of care delivery from the worker’s perspective and to identify the factors that facilitate or hinder care delivery. Additionally, while not addressed in this dissertation, examining healthcare utilization and associated costs for workers, workplaces, healthcare systems, and workers' compensation boards would provide valuable insights for implementing

care pathways.

Based on Study 3 findings, further investigation is needed to understand the specific mechanisms by which timing of treatment initiation impacts claim duration and rehabilitation outcomes for workers with work-related shoulder injuries. Furthermore, research efforts should be directed towards identifying and mitigating age-related biases or ageism within healthcare systems to ensure equitable access to timely and appropriate care for all workers, regardless of age. Longitudinal studies tracking outcomes over time could provide valuable insights into the long-term impacts of expedited access to treatment and equitable healthcare provision on claim duration and overall well-being of workers with work-related shoulder injuries. Interdisciplinary collaborations between healthcare providers, insurers, policymakers, and researchers are paramount for advancing interventions and reducing disparities in care for workers with work-related shoulder injuries. By fostering collaborative efforts, future research endeavors can effectively translate findings into practice, ultimately improving outcomes and promoting equity in healthcare delivery.

Conclusion

In conclusion, the multifaceted nature of shoulder pain among the working population needs a comprehensive understanding of its impact and effective management strategies. The findings from the three studies in this dissertation emphasized the importance of prioritizing evidence-based interventions, such as exercise therapy with scapular exercises, for reducing pain and expediting recovery. Implementing structured care pathways significantly enhanced rehabilitation outcomes and promoted timely return-to-work, highlighting the importance of care deliver in the final outcomes. Furthermore, addressing age-related biases in healthcare delivery is

essential to ensure equitable access to treatment and optimize outcomes for all workers, regardless of age. Future research should focus on addressing existing gaps in knowledge, including the effect of ET exclusively in workers with shoulder injuries, the impact of care delivery from the worker's perspective, and strategies to mitigate age-related biases within healthcare systems. Collaborative efforts across disciplines will be crucial in developing tailored interventions and promoting equitable access to care for workers with work-related shoulder injuries, ultimately improving outcomes and reducing disparities in healthcare delivery.

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Appendix 1 – Data Dictionary

Variable	Description	Variable Name
Demographics		
Study ID	**Description:** The WCB eight (8) digit worker identification number (i.e., 11000440).	StudyID
Claim ID	**Description:** The WCB eight (8) digit claim identification number (i.e., 54290500).	ClaimID
Accident Date	**Description:** Date of the accident (format: yyyy/mm/dd or 2017/10/01) **Interpretative Guideline:** **E**ach claim had a different accident date	Accident Date
Age in years	**Description:** Age in years. **Interpretative Guideline:** It was calculated using worker date of birth and first admission date to the first return-to-work program in each claim	Age
Age in years Categorical	**Description:** Age in years, by category **Interpretative Guideline:** Worker was classified in the following categories based on their age at admission date on first return-to-work program for each claim: 18-49 – Younger Workers 50 + - Older Workers	Categorical Age
Sex	Female and Male	Sex
Interpreter Required	An interpreter is required because English is not the first language of the worker and communicating in English is a barrier to the success of the program and to a return-to-work outcome	Interpreter
Group	**Description:** 2004_2008: Workers that had the accident date between 2004-01-01 to 2008-12-31 2014_2018: Workers that had the accident date between 2014-01-01 to 2018-12-31	Group

Working at RTW program admission	**Description:** Indicates whether the worker is working at the time of admission to the assessment: Yes: the worker is currently working with their pre-accident employer or their current employer (if different from pre-accident employer) at the time of admission to program. No: the worker is not currently working with their pre-accident employer or their current employer (if different from pre-accident employer) at the time of admission to program. **Interpretive Guideline:** • The worker is working at some capacity (full or modified, self-employed, seasonal) at time of admission to the program (i.e., with either pre-accident employer or current employer). • If a worker is not job attached to the pre-accident employer then the worker would not be working with the pre-accident employer.	Currently Working at Admission
Injury Type	**Description:** The Nature of Injury was determined for each claim the individual worker had based on the International Classification of Diseases, 9th Edition (ICD-9). ICD-9 codes provided by WCB-AB. **Interpretative Guideline:** The following labels were used for this specific thesis: Traumatic; Systemic Disease; Other (Infectious or parasitic diseases; Other disease or condition; symptom, sign or ill-defined); Unknown. For Aging paper we used: Traumatic; and Non-Traumatic (Systemic Disease; Other (Infectious or parasitic diseases; Other disease or condition; symptom, sign or ill-defined); Unknown.)	Nature of Injury_Claim 1, 2 or 3
Primary Diagnosis	**Description:** Primary diagnosis at the time of the program start for each claim as classified using a maximum five (5) digit ICD-9-CM code. **Interpretive Guideline:** Primary diagnosis in relation to the worker's date of accident injury and the main purpose for treatment for each claim.	Primary Diagnosis_Claim 1, 2 or 3
Secondary Diagnosis	**Description:** Secondary diagnosis at the time of the program for each claim as classified using a maximum five (5) digit ICD.9.CW code. **Interpretive Guideline:** Any other significant diagnoses as a result of the worker's injury.	Secondary Diagnosis_Claim 1, 2 or 3

Shoulder Diagnosis	**Description:** Used the Primary or Secondary diagnosis at the time of the program for each claim referent to shoulder as classified using a maximum five (5) digit ICD.9.CW code. **Interpretive Guideline:** Shoulder diagnosis.	
Involved Part of Body	**Description:** WCB provided information regarding primary and secondary part of body used in the claim. **Interpretative Guideline:** We classified part of the body (POB) as: Shoulder Only: The POB listed was only shoulder and there were no secondary POB involved in the claim. Shoulder + Other: The claim was done based in two POB, one was shoulder and the other could be any POB other than shoulder.	Combined POB
Type of Work	**Description:** National Occupational Classification (NOC) five (5) digit code of the worker's pre-accident occupation type. The NOC is the nationally accepted reference on occupations in Canada. It organizes over 40,000 job titles into 500 occupational group descriptions. The NOC relates to the work performed at the date of accident. Each occupation is defined in terms of the type and level of skill required for the date of accident occupation. The type of skill is assigned based on the ten broad occupational areas (values are from 0 to 10). Use the NOC code book published by Employment and Immigration Canada to determine the NOC code. The initial source of the pre-accident NOC comes from the claim owner; the verification of the NOC Code resides with the assessing staff. **Interpretative Guidelines:** Management= 0 Business/Finance/Admin= 1 Natural & Applied Science= 2 Health Occupations= 3 Soc Science/Educ/Govt/Rel= 4 Art & Culture= 5 Sales & Service= 6 Trades/Transport/Equip= 7 Primary Industry= 8 Processing/Manufacturing/Utilities= 9 Unknown= 10 We combined categories as:	Pre-accident national occupational code

	Technical and Industrial Occupations: Trades/Transport/Equipment (7), Primary Industry (8), Processing/Manufacturing/Utilities (9) **Administration, Social and Scientific Occupations:** Management (0), Business/Finance/Administration (1), Social Science/Education/Government/Rel (4), Natural & Applied Science (2), Art & Culture (5) **Health:** Health Occupations (3) **Sales & Service:** Sales & Service (6)	
Modified Work Available at Start of Claim	**Description:** • Is modified work available? **Interpretive Guideline:** • Modified work is available as per FM733A. • Modified work is either part time or full time. This is indicated on the FM733A referral form.	Modified Work Availability

Program Type	**Description:** Program that worker was allocated after assessment and/or re-assessments **Interpretative Guidelines:** Provider Based Program - For workers where the majority of the treatment interventions occur at the provider site. Worksite Based Program - A treatment Program wherein all the Service interventions, with the exception of an initial team Assessment, occur at the Employer's work premises. Based on the Medical Examination and BFCE, along with the initial team Assessment, the Contractor will determine what worksite Service interventions are required, and which Program team member(s) will provide the Service interventions. Hybrid Program - A combination of a provider and worksite Program wherein the Worker attends Service interventions periodically throughout the week. Complex Program - Suited for workers that have significant pain issues in addition to other significant barriers to return-to-work. Interventions are designed to address the medical, functional, musculoskeletal, psychosocial and vocational needs of the worker to facilitate safe, sustainable return-to-work and claim closure. Suited to long-term more complex conditions (moderate to severe anxiety or depression)	Return-to-work Program
Assessment Date	**Description:** Date of the assessment (format: yyyy/mm/dd or 2017/10/01) **Interpretative Guideline:** Each claim had a different assessment date before each return-to-work program	Assessment Date
Admission Date	**Description:** Date of the admission to the first return-to-work program within each individual claim (format: yyyy/mm/dd or 2017/10/01) **Interpretative Guideline:** Each claim had a different admission date based on the worker return-to-work assigned at assessment	Admission Date

Treatment Start Date	**Description:** Date that the return-to-work program treatment started (format: yyyy/mm/dd or 2017/10/01) **Interpretative Guideline:** Each claim had different treatment starts based on the number od return-to-work programs workers had within each claim.	Treatment Start Date
Treatment End Date	**Description:** Date that the return-to-work program treatment started (format: yyyy/mm/dd or 2017/10/01) **Interpretative Guideline:** Each claim had different treatment starts based on the number of return-to-work programs workers had within each claim.	Treatment Start Date
Discharge Date from Last RTW Program	**Description:** • The date of the last treatment service provided to the worker (format: yyyy/mm/dd or 2017/10/01). **Interpretive Guideline:** • The worker must be physically present at the return-to-work provider's site or the employer's site to indicate the last day of service. With WSB or Hybrid programs the clinician would also be present at the worksite on the last day of service. • A C743 must be completed and faxed to the WCB. • The provider cannot adapt the initial (C741) or the progress report (C742), but must complete the discharge report (C743). • The discharge date for Complex workers is the end date of the last completed phase. If the date in the discharge date field does not match with the end date of the last completed phase, the date in the discharge date field will be used to calculate the length of stay. • A C743 must be on file when the provider bills for the program. If there is no C743, the invoice will be returned to the provider unpaid. § Scenario 1: The worker last attended on January 1, but had unscheduled absences from January 2 to 7 – the discharge date was January 1. § Scenario 2: The worker attended on January 1, was not scheduled to attend on January 2 thru 7 because of medical reasons, but was expected to attend on January 8. The worker did not attend on January 8 – the discharge date is January 1.	Last Discharge Date

RTW Date	**Description:** • The date of the RTW after last RTW program within the claim (format: yyyy/mm/dd or 2017/10/01).	RTW Date
RTW Level (Main Outcome)	**Description:** • Level at which the worker is returning to work: Pre-accident level. Modified level. Not Back to work. **Interpretive Guideline:** • Pre-accident level – indicates whether the worker is capable of returning to pre-accident level (i.e., no restrictions – return to pre-accident work day duration and job duties). • Modified level – indicates whether the worker is capable of returning to a modified level, (i.e., restrictions are recommended to either the workday duration and/or job duties). • Not back to work – worker is not back to work	RTW Level
Time to First RTW program treatment in Days	**Description:** Number of days between the date of accident (ACCDATE) and the date of first RTW program treatment (TxStart)	Time to First RTW program treatment
Claim Duration	**Description:** Number of days between accident day (ACCDATE) to discharge of last RTW program within the claim (DISDATE)	Claim Duration
Compliance	**Description:** Unscheduled absences: the number of working days the worker was physically absent from the program but the worker did not notify program staff prior to the absence (i.e., sick time, non-attendance) and did not receive authorization from claim owner. **Interpretive Guideline:** • A worker is absent when they do not attend for any of the scheduled clinical hours on their scheduled days and did not notify.	Compliance
Total number of Claims	Sum of all claims an individual had between 01-jan-2004 until 31-dec-2018	Total Number of Claims
Benefits		
Receiving benefits at start of first RTW program	**Description:** TD 01 and TD02 status at start od first RTW program within the claim.	Receiving benefits at start of first RTW program
Receiving TD benefits 1 year after last RTW program	**Description:** Number of days receiving TD 01 AND TD02 after 1-year post-discharge from the last RTW program within the claim.	Receiving benefits 1 year after last RTW program

Short Form-36 Health Survey (SF-36)	**Description:** Values of each question at fist claim assessment (SF36-1a-SF36-36a)	Raw values to each SF-36 question at assessment
SF-36 Physical Component Summary (PCS) score	**Description:** PCS score provides a summary measure of physical health status based on the responses to the questionnaire items related to physical functioning, role limitations due to physical health, bodily pain, and general health perceptions **Calculation:** **Score Transformation**: The raw scores for each subscale are transformed into a 0-100 scale, with higher scores indicating better health status. **Subscale Weighting**: Each of the four subscales (physical functioning, role-physical, bodily pain, and general health) is weighted based on factor analysis results from a large, representative sample of the population. These weights reflect the relative importance of each subscale in contributing to overall physical health. **Summation**: The weighted scores for each subscale are summed to generate the PCS score. The formula used for the calculation is: PCS = (PF * 0.353) + (RP * 0.314) + (BP * 0.227) + (GH * 0.136) Where: PF = Physical Functioning RP = Role-Physical BP = Bodily Pain GH = General Health	SF36_PCS_a
SF-36 Mental Component Summary (MCS) score	**Description:** MCS score provides a summary measure of mental health status based on the responses to the questionnaire items related vitality, social functioning, role-emotional, and mental health **Calculation:** **Score Transformation**: The raw scores for each of the mental health-related subscales (vitality, social functioning, role-emotional, and mental health) are transformed into a 0-100 scale. **Subscale Weighting**: Each of these four subscales is weighted based on factor analysis results, reflecting their relative importance in contributing to overall mental health. **Summation**: The weighted scores for each mental health-related subscale are summed to	SF36_MCS_a

	generate the MCS score. The formula used for the calculation is similar to the PCS calculation but includes the mental health-related subscales: MCS = (VT * 0.362) + (SF * 0.226) + (RE * 0.357) + (MH * 0.055) Where: VT = Vitality SF = Social Functioning RE = Role-Emotional MH = Mental Health	
Pain (VAS)	**Description:** Raw pain data was measured on a Visual Analogue Scale (VAS) where 0 equals no pain and 100 the worst possible pain. This measure was collected at initial assessment. **Categories:** To distinguish among mild, moderate and severe pain, we used the following cut-off points: VAS scores $\leq$ 3.4 were classified as none to mild pain, between 3.5 and 7.4 as moderate pain, and $\geq$ 7.5 as severe pain	Pain

Appendix 2 – Nature of Injury Codes (Source: WCB-AB)

Primary Nature of Injury	Primary Nature of Injury Description	Primary Nature of Injury Division	Primary Nature of Injury Division Description	Primary Nature of Injury Major Group	Primary Nature of Injury Major Group Description	Primary Nature of Injury Minor Group	Primary Nature of Injury Minor Group Description
	Not Yet		NOT YET		Not Yet		Not Yet
00000	Traumatic injury/disorder, UNS	0	TRAUMATIC INJURY/DISORDER	00	Traumatic injury/disorder, UNS	000	Traumatic injury/disorder, UNS
01000	Traumatic injury to bone/nerve,	0	TRAUMATIC INJURY/DISORDER	01	Traumatic injury to bone/nerve	010	Traumatic injury to bone/nerve, UNS
01100	Dislocation	0	TRAUMATIC INJURY/DISORDER	01	Traumatic injury to bone/nerve	011	Dislocation
01200	Fracture	0	TRAUMATIC INJURY/DISORDER	01	Traumatic injury to bone/nerve	012	Fracture
01300	Traumatic injury to spinal cord	0	TRAUMATIC INJURY/DISORDER	01	Traumatic injury to bone/nerve	013	Traumatic injury to spinal cord
01400	Trauma inj to nerve-exc spinal	0	TRAUMATIC INJURY/DISORDER	01	Traumatic injury to bone/nerve	014	Trauma inj to nerve-exc spinal cord
01800	Mult traumatic injury to bone/n	0	TRAUMATIC INJURY/DISORDER	01	Traumatic injury to bone/nerve	018	Mult traumatic injury to bone/nerve
03500	Enucleation	0	TRAUMATIC INJURY/DISORDER	03	Open wound	035	Enucleation
03600	Gunshot wound	0	TRAUMATIC INJURY/DISORDER	03	Open wound	036	Gunshot wound
03700	Puncture except bite	0	TRAUMATIC INJURY/DISORDER	03	Open wound	037	Puncture except bite
03800	Multiple open wounds	0	TRAUMATIC INJURY/DISORDER	03	Open wound	038	Multiple open wounds
03900	Open wound, NEC	0	TRAUMATIC INJURY/DISORDER	03	Open wound	039	Open wound, NEC
04000	Surface wound/bruise, UNS	0	TRAUMATIC INJURY/DISORDER	04	Surface wound/bruise	040	Surface wound/bruise, UNS
04100	Abrasion/scratch	0	TRAUMATIC INJURY/DISORDER	04	Surface wound/bruise	041	Abrasion/scratch
04200	Blister	0	TRAUMATIC INJURY/DISORDER	04	Surface wound/bruise	042	Blister
05300	Heat burn/scald, UNS	0	TRAUMATIC INJURY/DISORDER	05	Burn	053	Heat burn/scald
05301	First-degree heat burn/scald	0	TRAUMATIC INJURY/DISORDER	05	Burn	053	Heat burn/scald

05302	Second-degree heat burn/scald	0	TRAUMATIC INJURY/DISORDER	05	Burn	053	Heat burn/scald
05303	Third-degree heat burn/scald	0	TRAUMATIC INJURY/DISORDER	05	Burn	053	Heat burn/scald
05390	Heat burn/scald, NEC	0	TRAUMATIC INJURY/DISORDER	05	Burn	053	Heat burn/scald
02901	Traumatic bursitis	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
02902	Traumatic tendonitis	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
02903	Traumatic epicondylitis	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
02904	Traumatic capsulitis	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
02905	Traumatic ganglion	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
02906	Traumatic synovitis	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
02907	Traumatic tenosynovitis	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
02908	Traumatic myositis	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
05102	Second-degree chemical burn	0	TRAUMATIC INJURY/DISORDER	05	Burn	051	Chemical burn
05103	Third-degree chemical burn	0	TRAUMATIC INJURY/DISORDER	05	Burn	051	Chemical burn
05190	Chemical burn, NEC	0	TRAUMATIC INJURY/DISORDER	05	Burn	051	Chemical burn
05200	Electrical burn, UNS	0	TRAUMATIC INJURY/DISORDER	05	Burn	052	Electrical burn
05201	First-degree electrical burn	0	TRAUMATIC INJURY/DISORDER	05	Burn	052	Electrical burn
05202	Second-degree electrical burn	0	TRAUMATIC INJURY/DISORDER	05	Burn	052	Electrical burn
05203	Third-degree electrical burn	0	TRAUMATIC INJURY/DISORDER	05	Burn	052	Electrical burn
05290	Electrical burn, NEC	0	TRAUMATIC INJURY/DISORDER	05	Burn	052	Electrical burn
07280	Multiple effects of heat/light	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	072	Effect of heat/light
07290	Effect of heat/light, NEC	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	072	Effect of heat/light

07300	Effect of air pressure, UNS	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	073	Effect of air pressure
07310	Aero-otitis media	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	073	Effect of air pressure
07320	Aerosinusitis	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	073	Effect of air pressure
01900	Traumatic injury to bone/nerve,	0	TRAUMATIC INJURY/DISORDER	01	Traumatic injury to bone/nerve	019	Traumatic injury to bone/nerve, NEC
02000	Trauma injury to muscle/joint,	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	020	Trauma injury to muscle/joint, UNS
02001	Soft tissue injury - traumatic	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	020	Trauma injury to muscle/joint, UNS
02100	Sprain/strain/tear, UNS	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	021	Sprain/strain/tear
02101	Rotator cuff tear	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	021	Sprain/strain/tear
02102	Meniscal tear	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	021	Sprain/strain/tear
02190	Sprain/strain/tear, NEC	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	021	Sprain/strain/tear
02900	Traum inflam of mus,tend,liga,joint	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
04300	Bruise/contusion	0	TRAUMATIC INJURY/DISORDER	04	Surface wound/bruise	043	Bruise/contusion
04400	Foreign body	0	TRAUMATIC INJURY/DISORDER	04	Surface wound/bruise	044	Foreign body
04500	Friction burn	0	TRAUMATIC INJURY/DISORDER	04	Surface wound/bruise	045	Friction burn
04800	Multiple surface wounds/bruises	0	TRAUMATIC INJURY/DISORDER	04	Surface wound/bruise	048	Multiple surface wounds/bruises
04900	Surface wound/bruise, NEC	0	TRAUMATIC INJURY/DISORDER	04	Surface wound/bruise	049	Surface wound/bruise, NEC
05000	Burn, UNS	0	TRAUMATIC INJURY/DISORDER	05	Burn	050	Burn, UNS
05100	Chemical burn, UNS	0	TRAUMATIC INJURY/DISORDER	05	Burn	051	Chemical burn
05101	First-degree chemical burn	0	TRAUMATIC INJURY/DISORDER	05	Burn	051	Chemical burn
07130	Trench foot	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	071	Effect of reduced

							temperature
07180	Mult effects of reduced tempera	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	071	Effect of reduced temperature
07190	Effect of reduced temperature,	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	071	Effect of reduced temperature
07200	Effect of heat/light, UNS	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	072	Effect of heat/light
07210	Heat stroke	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	072	Effect of heat/light
02909	Traum inflam of mus,tend,liga,joint	0	TRAUMATIC INJURY/DISORDER	02	Traumatic injury to muscle/joint	029	Traumatic inflammation of muscles,
03000	Open wound, UNS	0	TRAUMATIC INJURY/DISORDER	03	Open wound	030	Open wound, UNS
03100	Amputation, UNS	0	TRAUMATIC INJURY/DISORDER	03	Open wound	031	Amputation
03110	Amputation-fingertip	0	TRAUMATIC INJURY/DISORDER	03	Open wound	031	Amputation
03190	Amputation, NEC	0	TRAUMATIC INJURY/DISORDER	03	Open wound	031	Amputation
03200	Animal/insect bite	0	TRAUMATIC INJURY/DISORDER	03	Open wound	032	Animal/insect bite
03300	Avulsion	0	TRAUMATIC INJURY/DISORDER	03	Open wound	033	Avulsion
03400	Cut/laceration	0	TRAUMATIC INJURY/DISORDER	03	Open wound	034	Cut/laceration
06100	Cerebral hemorrhage	0	TRAUMATIC INJURY/DISORDER	06	Intracranial injury	061	Cerebral hemorrhage
06200	Concussion	0	TRAUMATIC INJURY/DISORDER	06	Intracranial injury	062	Concussion
06800	Multiple intracranial injuries	0	TRAUMATIC INJURY/DISORDER	06	Intracranial injury	068	Multiple intracranial injuries
06900	Intracranial injury, NEC	0	TRAUMATIC INJURY/DISORDER	06	Intracranial injury	069	Intracranial injury, NEC
07000	Effect of environment, UNS	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	070	Effect of environment, UNS
07100	Effect of reduced temperature,	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	071	Effect of reduced temperature
07110	Frostbite	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	071	Effect of reduced temperature

07120	Hypothermia	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	071	Effect of reduced temperature
08600	Intracranial/internal organ inj	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	086	Intracranial/internal organ injury
08900	Other comb of trauma injury, NE	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	089	Other combinations of trauma injury
08901	Obsolete (Code as 08400)	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	089	Other combinations of trauma injury
08902	Obsolete (Code as 08900)	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	089	Other combinations of trauma injury
09000	Other traumatic injury, UNS	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	090	Other traumatic injury, UNS
05800	Multiple burns	0	TRAUMATIC INJURY/DISORDER	05	Burn	058	Multiple burns
05900	Burn, NEC	0	TRAUMATIC INJURY/DISORDER	05	Burn	059	Burn, NEC
06000	Intracranial injury, UNS	0	TRAUMATIC INJURY/DISORDER	06	Intracranial injury	060	Intracranial injury, UNS
07800	Multiple effects of environment	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	078	Multiple effects of environment
07900	Effect of environment, NEC	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	079	Effect of environment, NEC
08000	Multiple traumatic injuries, UN	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	080	Multiple traumatic injuries, UNS
08100	Cuts/abrasions/bruises	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	081	Cuts/abrasions/bruises
08200	Sprains or strains and bruises	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	082	Sprains or strains and bruises
08300	Fractures and burns	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	083	Fractures and burns
08400	Fractures and other injuries	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	084	Fractures and other injuries
08500	Burns and other injuries	0	TRAUMATIC INJURY/DISORDER	08	Multiple traumatic injury	085	Burns and other injuries
09900	Other traumatic injury, NEC	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	099	Other traumatic injury, NEC
10000	Systemic disease/disorder, UNS	1	SYSTEMIC DISEASE/DISORDER	10	Systemic disease, UNS	100	Systemic disease, UNS

11000	Disease of blood, UNS	1	SYSTEMIC DISEASE/DISORDER	11	Disease of blood	110	Disease of blood, UNS
11100	Hemolytic anemia-non-autoimmune	1	SYSTEMIC DISEASE/DISORDER	11	Disease of blood	111	Hemolytic anemia
11200	Aplastic anemia	1	SYSTEMIC DISEASE/DISORDER	11	Disease of blood	112	Aplastic anemia
11300	Agranulocytosis/neutropenia	1	SYSTEMIC DISEASE/DISORDER	11	Disease of blood	113	Agranulocytosis/neutropenia
11400	Methemoglobinemia	1	SYSTEMIC DISEASE/DISORDER	11	Disease of blood	114	Methemoglobinemia
11500	Purpura/other hemorrhagic condi	1	SYSTEMIC DISEASE/DISORDER	11	Disease of blood	115	Other hemorrhagic condition
12530	Inflam of eye except conjunctiv	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12540	Cataract	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
07330	Caisson disease/bends/diver's p	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	073	Effect of air pressure
07380	Multiple effects of air pressur	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	073	Effect of air pressure
07390	Effect of air pressure, NEC	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	073	Effect of air pressure
09400	Internal injury to trunk	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	094	Internal injury to trunk
09500	Other poisoning/toxic effect, U	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	095	Other poisoning/toxic effect
09510	Animal/insect bite-venomous	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	095	Other poisoning/toxic effect
09520	Radiation sickness	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	095	Other poisoning/toxic effect
09590	Other poisoning/toxic effect, N	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	095	Other poisoning/toxic effect
09600	Traumatic complication, UNS	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	096	Traumatic complication
09610	Traumatic shock	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	096	Traumatic complication
09620	Embolism-air/fat	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	096	Traumatic complication
12220	Reye's syndrome	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	122	Degeneration-central nervous system

12290	Degeneration-central nervous, N	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	122	Degeneration-central nervous system
12300	Other disorder-central nervous,	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	123	Oth disorder-central nervous system
12310	Anoxic brain damage	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	123	Oth disorder-central nervous system
12320	Migraine	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	123	Oth disorder-central nervous system
12390	Other disorder-central nervous,	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	123	Oth disorder-central nervous system
12400	Disorder-peripheral nervous, UN	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	124	Disorder-peripheral nervous system
12410	Carpal tunnel syndrome	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	124	Disorder-peripheral nervous system
13100	Rheumatic fever w/ heart involv	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	131	Rheumatic fever-heart
13200	Hypertensive disease	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	132	Hypertensive disease
07220	Heat syncope	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	072	Effect of heat/light
07230	Heat fatigue	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	072	Effect of heat/light
07240	Heat edema	0	TRAUMATIC INJURY/DISORDER	07	Effect of environmental condition	072	Effect of heat/light
09680	Multiple traumatic complication	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	096	Traumatic complication
09690	Traumatic complication, NEC	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	096	Traumatic complication
09700	Nonspecific injury/disorder, UN	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	097	Nonspecific injury/disorder
09710	Crushing injury	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	097	Nonspecific injury/disorder
09720	Back pain/hurt back	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	097	Nonspecific injury/disorder
09730	Soreness/pain/hurt-except back	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	097	Nonspecific injury/disorder

09780	Mult nonspecific injuries/disor	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	097	Nonspecific injury/disorder
09790	Nonspecific injury/disorder, NE	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	097	Nonspecific injury/disorder
12420	Inflammatory/ toxic neuropathy	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	124	Disorder-peripheral nervous system
12430	Toxic myoneural disorder	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	124	Disorder-peripheral nervous system
12490	Disorder-peripheral nervous, NE	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	124	Disorder-peripheral nervous system
12491	Bells palsy	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	124	Disorder-peripheral nervous system
12500	Disorder of eye/adnexa/vision,	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12510	Solar retinopathy	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12520	Conjunctivitis-non-viral	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12521	Eye ulcer/corneal erosion	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
13490	Disease-pulmonary circulation,	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	134	Disease of pulmonary circulation
13500	Other form of heart disease , U	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	135	Other form of heart disease
09100	Asphyxiation/strangulation	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	091	Asphyxiation/strangulation
09200	Drowning	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	092	Drowning
09300	Electrocution/electric shock	0	TRAUMATIC INJURY/DISORDER	09	Other traumatic injury	093	Electrocution/electric shock
11900	Disease of blood, NEC	1	SYSTEMIC DISEASE/DISORDER	11	Disease of blood	119	Disease-blood, NEC
12000	Nervous system/sense disease, U	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	120	Nerve/sense disease, UNS
12100	Inflam disease-central nervous,	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	121	Inflammation-central nervous system
12110	Encephalitis	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	121	Inflammation-central nervous system

12120	Meningitis	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	121	Inflammation-central nervous system
12190	Inflam disease-central nervous,	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	121	Inflammation-central nervous system
12200	Degeneration-central nervous, U	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	122	Degeneration-central nervous system
12210	Cerebellar ataxia	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	122	Degeneration-central nervous system
12610	Deafness/hearing loss or impair	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	126	Disorder of ear/hearing
12620	Tinnitis	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	126	Disorder of ear/hearing
12630	Otalgia	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	126	Disorder of ear/hearing
12640	Mastoiditis	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	126	Disorder of ear/hearing
12650	Otitis media-except aero-otitis	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	126	Disorder of ear/hearing
12690	Disorder of ear/hearing, NEC	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	126	Disorder of ear/hearing
12900	Nervous system/sense disease, N	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	129	Nerve/sense disease, NEC
13000	Circulatory system disease, UNS	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	130	Circulatory disease, UNS
13820	Hemorrhoids	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	138	Disease of veins/lymphatics
13830	Phlebitis	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	138	Disease of veins/lymphatics
12550	Blindness/low vision	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12560	Welder's flash	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12570	Glaucoma	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12580	Visual disturbance	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12590	Disorder of eye/adnexa/vision,	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	125	Disorder of eye/vision
12600	Disorder of ear/hearing, UNS	1	SYSTEMIC DISEASE/DISORDER	12	Nerve/sense disease	126	Disorder of ear/hearing

13620	Transient ischemic attack	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	136	Cerebrovascular disease
13690	Cerebrovascular disease, NEC	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	136	Cerebrovascular disease
13700	Disease-arteries/capillaries, U	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	137	Disease of arteries/capillaries
13710	Raynaud's syndrome or phenomeno	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	137	Disease of arteries/capillaries
13720	Aneurysm-nontraumatic	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	137	Disease of arteries/capillaries
13790	Disease-arteries/capillaries, N	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	137	Disease of arteries/capillaries
13800	Disease of veins/lymphatics, UN	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	138	Disease of veins/lymphatics
13810	Varicose veins	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	138	Disease of veins/lymphatics
14390	Pneumonia/influenza, NEC	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	143	Pneumonia/influenza
14400	Chronic obstructive pulmonary,	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	144	Chronic obstruction of lung
14410	Bronchitis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	144	Chronic obstruction of lung
14420	Emphysema	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	144	Chronic obstruction of lung
14430	Extrinsic asthma	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	144	Chronic obstruction of lung
14431	Crab athma	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	144	Chronic obstruction of lung
14440	Pneumonitis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	144	Chronic obstruction of lung
13300	Ischemic heart disease, UNS	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	133	Heart attack/angina
13310	Heart attack	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	133	Heart attack/angina
13320	Angina	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	133	Heart attack/angina
13390	Ischemic heart disease, NEC	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	133	Heart attack/angina
13400	Disease-pulmonary circulation,	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	134	Disease of pulmonary circulation
13410	Pulmonary heart	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	134	Disease of pulmonary circulation

	disease						
14210	Allergic rhinitis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	142	Upper respiratory disease
14220	Chronic condition-upper respira	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	142	Upper respiratory disease
14290	Oth disease-upper respiratory,	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	142	Upper respiratory disease
14300	Pneumonia/influenza, UNS	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	143	Pneumonia/influenza
14310	Pneumonia	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	143	Pneumonia/influenza
14320	Influenza	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	143	Pneumonia/influenza
14330	Legionnaires' disease	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	143	Pneumonia/influenza
14340	Severe Acute Respiratory Synd(SARS)	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	143	Pneumonia/influenza
14910	Humidifier fever	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	149	Other respiratory disease
14920	Pneumonitis, NEC	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	149	Other respiratory disease
14930	Pulmonary edema	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	149	Other respiratory disease
14940	Pulmonary fibrosis, NEC	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	149	Other respiratory disease
14950	Atelectasis/collapsed lung	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	149	Other respiratory disease
14990	Other respiratory disease, NEC	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	149	Other respiratory disease
14991	React airway dysfunction syndro	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	149	Other respiratory disease
13510	Toxic myocarditis	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	135	Other form of heart disease
13520	Heart failure	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	135	Other form of heart disease
13530	Ill-defined descript-heart dise	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	135	Other form of heart disease
13590	Other form of heart disease, NE	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	135	Other form of heart disease
13600	Cerebrovascular disease, UNS	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	136	Cerebrovascular disease

13610	Stroke	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	136	Cerebrovascular disease
14491	Chronic obstructive lung diseas	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	144	Chronic obstruction of lung
14500	Pneumoconiosis, UNS	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14510	Coal worker's pneumoconiosis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14520	Asbestosis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14530	Silicosis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14540	Talcosis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14550	Aluminosis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14560	Berylliosis	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
15500	Other disease of intestines	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	155	Other disease of intestines
15600	Toxic hepatitis-noninfective	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	156	Toxic hepatitis-noninfective
15900	Digestive disease/disorder, NEC	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	159	Digestive disease, NEC
16000	Genitourinary disease/disorder,	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	160	Genitourinary disease, UNS
16100	Nephritis/nephrosis, UNS	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	161	Nephritis/nephrosis
16110	Nephritis	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	161	Nephritis/nephrosis
16120	Nephrotic syndrome	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	161	Nephritis/nephrosis
13890	Disease of veins/lymphatics, NE	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	138	Disease of veins/lymphatics
13900	Circulatory system disease, NEC	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	139	Circulatory disease, NEC
13901	Telangiectasis	1	SYSTEMIC DISEASE/DISORDER	13	Circulatory disease	139	Circulatory disease, NEC
14000	Respiratory system	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	140	Respiratory disease, UNS

	disease, UNS						
14100	Acute respiratory infection	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	141	Acute respiratory infection
14200	Oth disease-upper respiratory,	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	142	Upper respiratory disease
14570	Siderosis (to lung)	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14580	Pneumoconiosis with tuberculosi	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14590	Pneumoconiosis, NEC	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	145	Pneumoconiosis
14600	Pneumonopathy, UNS	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	146	Pneumonopathy
14610	Byssinosis, Mill fever	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	146	Pneumonopathy
14620	Metal fume fever	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	146	Pneumonopathy
14690	Pneumonopathy, NEC	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	146	Pneumonopathy
14900	Other respiratory disease, UNS	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	149	Other respiratory disease
16190	Nephritis/nephrosis, NEC	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	161	Nephritis/nephrosis
16200	Other disease-urinary system, U	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	162	Other disease-urinary system
16210	Cystitis	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	162	Other disease-urinary system
16230	Renal failure	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	162	Other disease-urinary system
16290	Oth disease of urinary system,	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	162	Other disease-urinary system
16300	Disorder of genital tract, UNS	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	163	Disease of genital tract
16310	Infertility	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	163	Disease of genital tract
14490	Chronic obstructive pulmonary,	1	SYSTEMIC DISEASE/DISORDER	14	Respiratory disease	144	Chronic obstruction of lung
15100	Disease of oral cavity/jaws	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	151	Disease of oral cavity

15200	Disease of esophagus/stomach	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	152	Disease of esophagus/stomach
15300	Hernia, UNS	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	153	Hernia
15310	Inguinal hernia	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	153	Hernia
15320	Hiatal hernia	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	153	Hernia
15330	Ventral hernia	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	153	Hernia
15390	Hernia, NEC	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	153	Hernia
15400	Noninfectious enteritis/colitis	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	154	Noninfectious colitis
17210	Sciatica	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17220	Lumbago	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17230	Disc disorder, UNS	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17231	Herniated disc	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17232	Intervertebral disc syndrome	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17233	Diskarthrosis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17239	Disc disorder, NEC	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17290	Dorsopathy, NEC	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
18120	Cellulitis/abscess	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	181	Infection of skin
18130	Acute lymphadenitis	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	181	Infection of skin
18140	Impetigo	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	181	Infection of skin
18150	Pilonidal cyst	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	181	Infection of skin

15000	Digestive disease/disorder, UNS	1	SYSTEMIC DISEASE/DISORDER	15	Digestive disease	150	Digestive disease, UNS
16390	Disorder of genital tract, NEC	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	163	Disease of genital tract
16400	Disorder of breast	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	164	Disorder of breast
16900	Genitourinary disease/disorder,	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	169	Genitourinary disease, NEC
17000	Musculoskeletal disorder, UNS	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	170	Musculoskeletal disease, UNS
17100	Arthritis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	171	Arthropathy/related disorder
17200	Dorsopathy, UNS	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17201	Dorsalgia	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17202	Cervicalgia	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17400	Osteopathy/acquired deformity,	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	174	Osteopathy/acquired deformity
17410	Curvature of spine	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	174	Osteopathy/acquired deformity
17490	Osteopathy/acquired deformity,	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	174	Osteopathy/acquired deformity
17900	Musculoskeletal disorder, NEC	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	179	Musculoskeletal disease, NEC
17901	Fibromyalgia/ myofasciitis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	179	Musculoskeletal disease, NEC
18000	Disorder of skin, UNS	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	180	Disorder of skin, UNS
18100	Infection of skin, UNS	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	181	Infection of skin
18110	Carbuncle and furuncle	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	181	Infection of skin
18410	Acne	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	184	Disease of sebaceous gland

18420	Sebaceous cyst	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	184	Disease of sebaceous gland
18490	Disease of sebaceous glands, NE	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	184	Disease of sebaceous gland
18900	Other disease/disorder of skin,	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
16130	Nephrosis	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	161	Nephritis/nephrosis
17291	Minor intervertebral disorder	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17292	Facett syndrome	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17293	Radiculitis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	172	Dorsopathy
17300	Inflammation of joint/muscle, U	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17310	Bursitis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17320	Synovitis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17330	Tendonitis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17340	Tenosynovitis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
18220	Contact dermatitis and other ec	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	182	Dermatitis
18230	Allergic dermatitis	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	182	Dermatitis
18240	Irritant dermatitis	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	182	Dermatitis
18250	Other contact dermatitis	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	182	Dermatitis
18260	Dermatitis-substance taken inte	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	182	Dermatitis
18290	Dermatitis, NEC	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	182	Dermatitis
18300	Other inflam condition of skin,	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin

18310	Erythematosquamous dermatosis	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin
19120	Disorder of other endocrine gla	1	SYSTEMIC DISEASE/DISORDER	19	Other systemic disease	191	Endocrine/blood disorder
19190	Endocrine/immunity disorder, NE	1	SYSTEMIC DISEASE/DISORDER	19	Other systemic disease	191	Endocrine/blood disorder
19900	Systemic disease/disorder, NEC	1	SYSTEMIC DISEASE/DISORDER	19	Other systemic disease	199	Systemic disease, NEC
19901	Scleroderma	1	SYSTEMIC DISEASE/DISORDER	19	Other systemic disease	199	Systemic disease, NEC
33100	Bone tumor-unknown properties	3	NEOPLASM/TUMOR/CANCER	33	Tumor-unknown	331	Bone tumor-unknown
33200	Soft tissue tumor-unknown prope	3	NEOPLASM/TUMOR/CANCER	33	Tumor-unknown	332	Soft tissue tumor-unknown
33300	Skin tumor-unknown properties	3	NEOPLASM/TUMOR/CANCER	33	Tumor-unknown	333	Skin tumor-unknown
33800	Multiple tumors-unknown propert	3	NEOPLASM/TUMOR/CANCER	33	Tumor-unknown	338	Mult tumor-unknown
33900	Tumor of other site-unknown, NE	3	NEOPLASM/TUMOR/CANCER	33	Tumor-unknown	339	Other tumor-unknown, NEC
39900	Neoplasm/tumor/cancer, NEC	3	NEOPLASM/TUMOR/CANCER	39	Neoplasm/tumor/cancer, NEC	399	Neoplasm/tumor/cancer, NEC
40000	Symptoms/signs, UNS	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	40	Symptom/condition, UNS	400	Symptoms/signs, UNS
41000	Symptoms, UNS	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	410	Symptoms, UNS
41600	Symptoms of respiratory/chest,	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	416	Symptoms of respiratory/chest
41610	Hyperventilation	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	416	Symptoms of respiratory/chest
41620	Hemoptysis/cough with hemorrhag	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	416	Symptoms of respiratory/chest
41630	Abnormal sputum	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	416	Symptoms of respiratory/chest

41640	Chest pain	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	416	Symptoms of respiratory/chest
41680	Mult symptoms of respiratory/ch	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	416	Symptoms of respiratory/chest
41690	Symptoms of respiratory/chest,	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	416	Symptoms of respiratory/chest
41700	Symptoms of digestive/urinary,	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	417	Symptoms of digestive/urinary
48900	Multiple symptoms/signs, NEC	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	48	Multiple symptoms/conditions	489	Multiple symptoms/conditions, NEC
49000	Symptoms/signs, NEC	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	490	Symptoms/signs, NEC
49001	Obsolete (Code as 49101)	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	490	Symptoms/signs, NEC
49002	Obsolete (Code as 49102)	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	490	Symptoms/signs, NEC
49003	Obsolete (Code as 49103)	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	490	Symptoms/signs, NEC
16320	Spontaneous abortion/miscarriag	1	SYSTEMIC DISEASE/DISORDER	16	Genitourinary disease	163	Disease of genital tract
17350	Ganglion/cystic tumor	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17360	Myositis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17390	Oth inflammation joint/muscle,	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17391	Rotator cuff syndrome	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17392	Dupuytren's contracture	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17393	Epicondylitis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle

17394	Capsulitis	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
17395	Trigger finger	1	SYSTEMIC DISEASE/DISORDER	17	Musculoskeletal disease	173	Inflammation of joint/muscle
18320	Bullous dermatosis	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin
18330	Rosacea	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin
18340	Other erythematous condition	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin
18350	Psoriasis/similar disorder	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin
18360	Lichen	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin
18370	Pruritus/related condition	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin
18390	Other inflammatory condition, N	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	183	Other inflammation-skin
18400	Disease of sebaceous glands, UN	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	184	Disease of sebaceous gland
21120	Pulmonary tuberculosis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	211	Tuberculosis
21130	Miliary tuberculosis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	211	Tuberculosis
21190	Tuberculosis, NEC	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	211	Tuberculosis
21200	Zoonotic bacterial disease, UNS	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease
18160	Pyoderma	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	181	Infection of skin
18190	Infection of skin, NEC	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	181	Infection of skin
18200	Dermatitis, UNS	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	182	Dermatitis
18210	Atopic dermatitis/related condi	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	182	Dermatitis
18950	Disorder of sweat glands	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
18960	Vitiligo	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin

18970	Chronic skin ulcers	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
18980	Urticaria/hives	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
18990	Other disease/disorder of skin,	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
19000	Oth systemic disease/disorder,	1	SYSTEMIC DISEASE/DISORDER	19	Other systemic disease	190	Other systemic disease, UNS
19100	Endocrine/immunity disorder, UN	1	SYSTEMIC DISEASE/DISORDER	19	Other systemic disease	191	Endocrine/blood disorder
19110	Disease/disorder of thyroid gla	1	SYSTEMIC DISEASE/DISORDER	19	Other systemic disease	191	Endocrine/blood disorder
21340	Gonorrhea/oth gonococcal infect	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	213	Syphilis/venereal disease
21390	Syphilis/oth venereal disease,	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	213	Syphilis/venereal disease
21400	Other spirochetal disease, UNS	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	214	Other spirochetal disease
21410	Leptospirosis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	214	Other spirochetal disease
21420	Vincent's angina	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	214	Other spirochetal disease
21430	Yaws	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	214	Other spirochetal disease
21440	Pinta	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	214	Other spirochetal disease
21490	Other spirochetal disease, NEC	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	214	Other spirochetal disease
22290	Non-arthropod virus-nervous, NE	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	222	Non-arthropod virus-nerve
18910	Corns/callosities	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
18920	Oth hypertrophic/atrophic condi	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
18930	Disease of nail/ingrowing nail	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
18940	Disease of hair and hair follic	1	SYSTEMIC DISEASE/DISORDER	18	Disorder of skin	189	Other disorder of skin
21250	Glanders	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease

21260	Melioidosis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease
21270	Rat-bite fever	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease
21290	Zoonotic bacterial disease, NEC	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease
21300	Syphilis/oth venereal disease,	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	213	Syphilis/venereal disease
21310	Early syphilis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	213	Syphilis/venereal disease
21320	Cardiovascular syphilis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	213	Syphilis/venereal disease
21330	Neurosyphilis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	213	Syphilis/venereal disease
22191	Contact w/ fluid contaminate by	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	221	HIV infection
22192	Contact w/ HIV caused by aggres	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	221	HIV infection
22193	HIV positive-NOT confirmed AIDS	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	221	HIV infection
22200	Non-arthropod virus-nervous, UN	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	222	Non-arthropod virus-nerve
22210	Acute poliomyelitis	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	222	Non-arthropod virus-nerve
22220	Slow virus infect-central nervo	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	222	Non-arthropod virus-nerve
22230	Meningitis due to enterovirus	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	222	Non-arthropod virus-nerve
22240	Other enterovirus diseases	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	222	Non-arthropod virus-nerve
22620	Viral conjunctivitis/ ophthalmia	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	226	Viral disease-conjunctiva
20000	Infectious/parasitic disease, U	2	INFECTIOUS/PARASITIC DISEASE	20	Infectious disease, UNS	200	Infectious disease, UNS
21000	Bacterial disease, UNS	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	210	Bacterial disease, UNS
21100	Tuberculosis, UNS	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	211	Tuberculosis
21110	Primary tuberculous infection	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	211	Tuberculosis

21900	Other bacterial disease, UNS	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21910	Leprosy	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21920	Diphtheria/whooping cough	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21930	Streptococcal sore throat	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21940	Erysipelas	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21950	Meningococcal infection	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21960	Tetanus	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21970	Septicemia	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
22490	Arthropod-borne viral disease,	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	224	Arthropod viral disease
22500	Viral hepatitis, UNS	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	225	Viral hepatitis
22510	Type A viral hepatitis	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	225	Viral hepatitis
22520	Type B viral hepatitis	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	225	Viral hepatitis
22530	Type C viral hepatitis	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	225	Viral hepatitis
22590	Viral hepatitis, NEC	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	225	Viral hepatitis
22600	Viral disease of conjunctiva, U	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	226	Viral disease-conjunctiva
22610	Trachoma	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	226	Viral disease-conjunctiva
23700	Lyme disease	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	237	Lyme disease
49009	Obsolete (Code as 49109)	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	490	Symptoms/signs, NEC
49100	Contact with/carrier-disease, U	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	491	Contact with carrier of disease
49101	Contact with/carrier-tuberculos	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	491	Contact with carrier of disease

99990	Unknown	9	UNKNOWN	99	Unknown	999	Unknown
21210	Plague	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease
21220	Tularemia	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease
21230	Anthrax	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease
21240	Brucellosis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	212	Zoonotic bacterial disease
21980	Actinomycotic infection	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21990	Other bacterial disease, NEC	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
21991	Necrotizing fascitis	2	INFECTIOUS/PARASITIC DISEASE	21	Bacterial disease	219	Other bacterial disease
22000	Viral disease, UNS	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	220	Viral disease, UNS
22100	HIV infection, UNS	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	221	HIV infection
22110	AIDS	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	221	HIV infection
22120	AIDS-related complex	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	221	HIV infection
22190	HIV infection, NEC	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	221	HIV infection
22370	Rubella/German measles	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22390	Viral disease with exanthem, NE	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22400	Arthropod-borne viral disease,	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	224	Arthropod viral disease
22410	Yellow fever	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	224	Arthropod viral disease
22420	Dengue	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	224	Arthropod viral disease
22430	Viral encephalitis	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	224	Arthropod viral disease
22440	Hemorrhagic fever	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	224	Arthropod viral disease
22450	West Nile viral disease	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	224	Arthropod viral disease

23130	Tick typhus	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	231	Rickettsioses disease
22300	Viral diseases with exanthem, U	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22310	Smallpox	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22320	Cowpox and paravaccinia	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22330	Chickenpox	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22340	Herpes zoster	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22350	Herpes simplex	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22360	Measles	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	223	Viral disease with exanthem
22960	Cat scratch disease	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
22970	Foot and mouth disease	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
22990	Other disease-virus/Chlamydiae,	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
22991	Wart	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
23000	Other arthropod-borne disease,	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	230	Other arthropod disease, UNS
23100	Rickettsioses disease, UNS	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	231	Rickettsioses disease
23110	Spotted fever	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	231	Rickettsioses disease
23120	Q fever	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	231	Rickettsioses disease
25600	Filarial infection/dracontiasis	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	256	Filarial infection

25700	Ancylostomiasis/necatoriasis	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	257	Ancylostomiasis/necatoriasis
25800	Unspecified intestinal parasiti	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	258	Unspecified intestinal parasitism
25900	Helminthiasis, NEC	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	259	Helminthiasis, NEC
26000	Infectious disease-intestines,	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	260	Infection-intestine, UNS
26100	Cholera	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	261	Cholera
22690	Viral disease of conjunctiva, N	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	226	Viral disease-conjunctiva
22900	Other disease-virus/Chlamydiae,	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
22910	Rabies	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
22920	Mumps	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
22930	Ornithosis	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
22940	Specific disease-Coxsackie viru	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
22950	Infectious mononucleosis	2	INFECTIOUS/PARASITIC DISEASE	22	Viral disease	229	Other disease due to virus
24600	Blastomycotic infection	2	INFECTIOUS/PARASITIC DISEASE	24	Mycosis	246	Blastomycotic infection
24900	Mycosis, NEC	2	INFECTIOUS/PARASITIC DISEASE	24	Mycosis	249	Mycosis, NEC
25000	Helminthiasis, UNS	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	250	Helminthiasis, UNS
25100	Schistosomiasis	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	251	Schistosomiasis
25200	Other trematode infection	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	252	Other trematode infection
25300	Echinococcosis	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	253	Echinococcosis
25400	Other cestode infection	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	254	Other cestode infection
25500	Trichinosis	2	INFECTIOUS/PARASITIC DISEASE	25	Helminthiasis	255	Trichinosis
31100	Malignant tumor-bone, UNS	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	311	Malignant tumor of bone

31110	Malignant tumor-bone/cartilage	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	311	Malignant tumor of bone
31120	Malignant tumor-soft tissue	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	311	Malignant tumor of bone
31180	Multiple malignant tumors of bo	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	311	Malignant tumor of bone
31190	Malignant tumor of bone, NEC	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	311	Malignant tumor of bone
31200	Malignant tumor of skin, UNS	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	312	Malignant tumor of skin
23900	Other arthropod-borne disease,	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	239	Other arthropod disease, NEC
24000	Mycosis, UNS	2	INFECTIOUS/PARASITIC DISEASE	24	Mycosis	240	Mycosis, UNS
24100	Dermatophytosis	2	INFECTIOUS/PARASITIC DISEASE	24	Mycosis	241	Dermatophytosis
24200	Dermatomycosis	2	INFECTIOUS/PARASITIC DISEASE	24	Mycosis	242	Dermatomycosis
24300	Candidiasis	2	INFECTIOUS/PARASITIC DISEASE	24	Mycosis	243	Candidiasis
24400	Coccidioidomycosis	2	INFECTIOUS/PARASITIC DISEASE	24	Mycosis	244	Coccidioidomycosis
24500	Histoplasmosis	2	INFECTIOUS/PARASITIC DISEASE	24	Mycosis	245	Histoplasmosis
29200	Trichomoniasis	2	INFECTIOUS/PARASITIC DISEASE	29	Other infectious disease	292	Trichomoniasis
29300	Lice	2	INFECTIOUS/PARASITIC DISEASE	29	Other infectious disease	293	Phthirus infestation
29400	Acariasis-including scabies	2	INFECTIOUS/PARASITIC DISEASE	29	Other infectious disease	294	Acariasis
29500	Other infestation-including mag	2	INFECTIOUS/PARASITIC DISEASE	29	Other infectious disease	295	Other infestation
29600	Sarcoidosis	2	INFECTIOUS/PARASITIC DISEASE	29	Other infectious disease	296	Sarcoidosis
29900	Other infect/parasitic disease,	2	INFECTIOUS/PARASITIC DISEASE	29	Other infectious disease	299	Other infectious disease, NEC

30000	Neoplasm/tumor/cancer, UNS	3	NEOPLASM/TUMOR/CANCER	30	Neoplasm/tumor/cancer, UNS	300	Neoplasm/tumor/cancer, UNS
31000	Malignant neoplasm/tumor, UNS	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	310	Malignant tumor, UNS
31390	Malignant tumor of lymphatic, N	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	313	Malignant tumor of blood
31900	Malignant tumor of other site,	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	319	Malignant tumor of other site
31901	Mesothelioma	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	319	Malignant tumor of other site
32000	Benign neoplasm/tumor, UNS	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	320	Benign tumor, UNS
32100	Benign neoplasm of bone/skin, U	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	321	Benign tumor of bone/skin
32110	Benign neoplasm of bone/cartila	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	321	Benign tumor of bone/skin
23140	Trench fever	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	231	Rickettsioses disease
23190	Rickettsioses disease, NEC	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	231	Rickettsioses disease
23200	Typhus	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	232	Typhus
23300	Malaria	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	233	Malaria
23400	Leishmaniasis	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	234	Leishmaniasis
23500	Trypanosomiasis	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	235	Trypanosomiasis
23600	Relapsing fever	2	INFECTIOUS/PARASITIC DISEASE	23	Other arthropod disease	236	Relapsing fever
26400	Shigellosis	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	264	Shigellosis
26500	Other bacteria food poison/botu	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	265	Other bacteria food poisoning
26600	Amebiasis	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	266	Amebiasis

26700	Colitis	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	267	Colitis
26800	Dysentery	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	268	Dysentery
26900	Infectious disease-intestines,	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	269	Infection-intestine, NEC
29000	Other infect/parasitic disease,	2	INFECTIOUS/PARASITIC DISEASE	29	Other infectious disease	290	Other infectious disease, UNS
29100	Toxoplasmosis	2	INFECTIOUS/PARASITIC DISEASE	29	Other infectious disease	291	Toxoplasmosis
31280	Multiple malignant tumors of sk	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	312	Malignant tumor of skin
31290	Malignant tumor of skin, NEC	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	312	Malignant tumor of skin
31300	Malignant tumor of lymphatic, U	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	313	Malignant tumor of blood
31310	Lymphosarcoma/reticulosarcoma	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	313	Malignant tumor of blood
31320	Hodgkin's disease	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	313	Malignant tumor of blood
31330	Multiple myeloma	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	313	Malignant tumor of blood
26200	Typhoid/paratyphoid fever	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	262	Typhoid/paratyphoid fever
26300	Other salmonella infection	2	INFECTIOUS/PARASITIC DISEASE	26	Infection of intestine	263	Other salmonella infection
32140	Oth benign neoplasm of soft tis	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	321	Benign tumor of bone/skin
32180	Mult benign neoplasms of bone/s	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	321	Benign tumor of bone/skin
32190	Benign neoplasm of bone/skin, N	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	321	Benign tumor of bone/skin
32900	Benign tumor of other site, UNS	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	329	Benign tumor of other site
32910	Hemangioma/lymphangioma-any sit	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	329	Benign tumor of other site
32980	Mult benign tumors of other sit	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	329	Benign tumor of other site

32990	Benign tumor of other site, NEC	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	329	Benign tumor of other site
33000	Tumor-unknown properties, UNS	3	NEOPLASM/TUMOR/CANCER	33	Tumor-unknown	330	Tumor-unknown, UNS
41310	Edema-including dropsy	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	413	Symptoms of skin
41320	Cyanosis	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	413	Symptoms of skin
41330	Pallor and flushing	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	413	Symptoms of skin
41380	Multiple symptoms involving ski	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	413	Symptoms of skin
41390	Symptoms involving skin, NEC	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	413	Symptoms of skin
41400	Symptoms involving head/neck, U	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	414	Symptoms of head/neck
41410	Headache-except migraine	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	414	Symptoms of head/neck
41420	Loss of voice/voice disturbance	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	414	Symptoms of head/neck
41710	Nausea or vomiting	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	417	Symptoms of digestive/urinary
41720	Heartburn	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	417	Symptoms of digestive/urinary
41730	Frequency of urination/polyuria	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	417	Symptoms of digestive/urinary
31210	Melanoma of skin	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	312	Malignant tumor of skin
31220	Non-melanoma skin cancer	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	312	Malignant tumor of skin
41100	General symptoms, UNS	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	411	General symptoms
41110	Loss of conscious-not heat rela	4	SYMPTOM/SIGN/ILL-	41	Symptom	411	General symptoms

			DEFINED CONDITION				
41120	Convulsions, seizures	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	411	General symptoms
41130	Malaise/fatigue	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	411	General symptoms
41140	Dizziness	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	411	General symptoms
41150	Non-specific allergic reaction	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	411	General symptoms
41151	Sick Building Syndrome	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	411	General symptoms
41180	Multiple general symptoms	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	411	General symptoms
41480	Mult symptoms involving head/ne	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	414	Symptoms of head/neck
41490	Symptoms involving head/neck, N	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	414	Symptoms of head/neck
41500	Symptoms of cardiovascular, UNS	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	415	Symptoms of cardiovascular
41510	Unspecified tachycardia	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	415	Symptoms of cardiovascular
41520	Gangrene	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	415	Symptoms of cardiovascular
41530	Enlargement of lymph nodes	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	415	Symptoms of cardiovascular
41580	Multiple symptoms of cardiovasc	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	415	Symptoms of cardiovascular
41590	Symptoms of cardiovascular, NEC	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	415	Symptoms of cardiovascular
42300	Abnormal findings-other substan	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	423	Abnormal findings of other
42400	Abnormal finding-	4	SYMPTOM/SIGN/ILL-	42	Abnormal finding	424	Abnormal findings of other exam

	radiological/o		DEFINED CONDITION				
42500	Abnormal findings-function stud	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	425	Abnormal findings of function
32120	Lipoma	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	321	Benign tumor of bone/skin
32130	Benign neoplasm of skin	3	NEOPLASM/TUMOR/CANCER	32	Benign tumor	321	Benign tumor of bone/skin
41190	General symptoms, NEC	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	411	General symptoms
41200	Symptoms of musculoskeletal, UN	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	412	Symptoms of nervous/muscle/bone
41210	Spasms/tremors, NEC	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	412	Symptoms of nervous/muscle/bone
41220	Earache	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	412	Symptoms of nervous/muscle/bone
41230	Eye strain	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	412	Symptoms of nervous/muscle/bone
41280	Multiple symptom of musculoskel	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	412	Symptoms of nervous/muscle/bone
41290	Symptoms of musculoskeletal, NE	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	412	Symptoms of nervous/muscle/bone
41300	Symptoms involving skin, UNS	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	413	Symptoms of skin
41801	Motion Sickness	4	SYMPTON/SIGN/ILL-DEFINED CONDITION	41	Symptom	418	Multiple symptoms
41900	Other symptoms, NEC	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	419	Other symptom, NEC
42000	Abnormal findings, UNS	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	420	Abnormal findings, UNS
42100	Abnormal findings-blood exam, U	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	421	Abnormal findings of blood
42110	Abnormal blood levels-lead	4	SYMPTOM/SIGN/ILL-	42	Abnormal finding	421	Abnormal findings of blood

			DEFINED CONDITION				
42120	Abnormal blood levels-except le	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	421	Abnormal findings of blood
42190	Abnormal findings-blood exam, N	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	421	Abnormal findings of blood
42200	Abnormal findings-urine exam	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	422	Abnormal findings of urine
52100	Anxiety/neurotic disorder, UNS	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	521	Anxiety/stress
52110	Post-traumatic stress	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	521	Anxiety/stress
52130	Panic disorder	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	521	Anxiety/stress
31340	Leukemia	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	313	Malignant tumor of blood
31380	Mult malignant tumors of lympha	3	NEOPLASM/TUMOR/CANCER	31	Malignant tumor	313	Malignant tumor of blood
41740	Oliguria/anuria	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	417	Symptoms of digestive/urinary
41750	Abdominal pain, UNS	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	417	Symptoms of digestive/urinary
41780	Mult symptoms of digestive/urin	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	417	Symptoms of digestive/urinary
41790	Symptoms of digestive/urinary,	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	417	Symptoms of digestive/urinary
41800	Multiple symptoms	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	41	Symptom	418	Multiple symptoms
49102	Contact with/carrier-poliomyeli	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	491	Contact with carrier of disease
49103	Contacts with or carriers of ra	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	491	Contact with carrier of disease
49104	Contacts with or carries of SARS	4	SYMPTON/SIGN/ILL-DEFINED CONDITION	49	Sympton/sign, NEC	491	Contact with carrier of disease

49109	Contact with/carrier-parasite	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	491	Contact with carrier of disease
49190	Contact with/carrier-disease, N	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	49	Symptom/sign, NEC	491	Contact with carrier of disease
50000	Other disease/disorder, UNS	5	OTHER DISEASE/CONDITION/DISORDER	50	Other disease/disorder, UNS	500	Other disease/disorder, UNS
51000	Damage to/loss of prosthetic de	5	OTHER DISEASE/CONDITION/DISORDER	51	Damage to/loss of prosthetic device	510	Damage to/loss of prosthetic device
52000	Mental disorder/syndrome, UNS	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	520	Mental disorder, UNS
42600	Abnormal findings-histological	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	426	Abnormal findings of histological
42700	Multiple abnormal findings	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	427	Multiple abnormal findings
42900	Other abnormal findings	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	42	Abnormal finding	429	Other abnormal findings
48000	Multiple symptoms/signs, UNS	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	48	Multiple symptoms/conditions	480	Multiple symptoms/conditions, UNS
48100	Multiple chemical sensitivity	4	SYMPTOM/SIGN/ILL-DEFINED CONDITION	48	Multiple symptoms/conditions	481	Multiple chemical sensitivities
52200	Organic mental disorder, UNS	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	522	Organic mental disorder
52210	Substance-induced mental disord	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	522	Organic mental disorder
52220	Organic affective syndrome	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	522	Organic mental disorder
52280	Multiple organic mental disorde	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	522	Organic mental disorder
52290	Organic mental disorder, NEC	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	522	Organic mental disorder
52900	Mental disorder/syndrome, NEC	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	529	Mental disorder, NEC

59000	Other disease/disorder, NEC	5	OTHER DISEASE/CONDITION/DISORDER	59	Other disease/disorder, NEC	590	Other disease/disorder, NEC
80000	Multiple diseases/disorders	8	MULTIPLE DISEASE/CONDITION/DISORDER	80	Multiple diseases/disorders	800	Multiple diseases/disorders
52190	Anxiety/neurotic disorder, NEC	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	521	Anxiety/stress
52191	Depressive state	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	521	Anxiety/stress
52192	Burn out	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	521	Anxiety/stress
52193	Adjustment disorder	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	521	Anxiety/stress
52194	Psychological decompensation	5	OTHER DISEASE/CONDITION/DISORDER	52	Mental disorder/syndrome	521	Anxiety/stress

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Appendix 3 – Part of Body (POB) Codes (Provided by WCB-AB)

Pob Div Cd	Pob Div Desc	Pob Mjr Grp Cd	Pob Mjr Grp Desc	Pob Mnr Grp Cd	Pob Mnr Grp Desc	Pob Cd	Pob Desc	Prt Of Bdy Grp Dsc
	NOT YET		Not Yet		Not Yet		Not Yet	NOT YET
0	HEAD	00	Head, UNS	000	Head, UNS	00000	Head, UNS	Head
		01	Cranial region/skull	010	Cranial region, UNS	01000	Cranial region, UNS	Head
				011	Brain	01100	Brain	Head
				012	Scalp	01200	Scalp	Head
				013	Skull	01300	Skull	Head
				018	Multiple cranial regions	01800	Multiple cranial region locatio	Head
				019	Cranial region, NEC	01900	Cranial region, NEC	Head
		02	Ear	020	Ear	02000	Ear, UNS	Ear(s)
						02001	Outer ear	Ear(s)
						02002	Middle ear	Ear(s)
						02003	Inner ear	Ear(s)
						02090	Ear, NEC	Ear(s)
		03	Face	030	Face, UNS	03000	Face, UNS	Head
				031	Forehead	03100	Forehead	Head
				032	Eye	03200	Eye, UNS	Eye(s)
						03201	External eye	Eye(s)
						03202	Internal eye	Eye(s)

						03290	Eye, NEC	Eye(s)
				033	Nose/nasal cavity	03300	Nose-except internal disorder	Head
						03309	Nose, UNS	Head
						03310	Internal nasal location, UNS	Head
						03320	Nasopharynx	Head
						03330	Nasal passage	Head
						03340	Sinus/nasal cavity	Head
						03380	Multiple internal nasal locatio	Head
						03390	Internal nasal location, NEC	Head
				034	Cheek	03400	Cheek	Head
				035	Jaw/chin	03500	Jaw/chin	Head
				036	Mouth	03600	Mouth, UNS	Head
						03610	Lip	Head
						03620	Tongue	Head
						03630	Tooth/teeth	Head
						03640	Gum	Head
						03680	Multiple mouth locations	Head
						03690	Mouth, NEC	Head
				038	Multiple face locations	03800	Multiple face locations	Head
				039	Face, NEC	03900	Face, NEC	Head

		08	Multiple head locations	080	Multiple head locations	08000	Multiple head locations	Head
		09	Head, NEC	090	Head, NEC	09000	Head, NEC	Head
1	NECK INCLUDING THROAT	10	Neck except internal	100	Neck except internal location	10000	Neck-except internal disorder,	Neck
						10001	Cervical region/cervical verteb	Neck
						10009	Neck, NEC	Neck
		11	Internal neck, UNS	110	Internal neck, UNS	11000	Internal neck location, UNS	Neck
		12	Vocal cord	120	Vocal cord	12000	Vocal cords	Neck
		13	Larynx	130	Larynx	13000	Larynx	Neck
		14	Laryngopharynx	140	Laryngopharynx	14000	Laryngopharynx	Neck
		15	Pharynx	150	Pharynx	15000	Pharynx	Neck
		16	Trachea	160	Trachea	16000	Trachea	Neck
		18	Multiple internal neck locations	180	Multiple internal neck locations	18000	Multiple internal neck location	Neck
		19	Internal neck, NEC	190	Internal neck, NEC	19000	Internal neck location, NEC	Neck
2	TRUNK	20	Trunk, unspecified	200	Trunk, unspecified	20000	Trunk unspecified	Trunk
		21	Shoulder, including clavicle, scapu	210	Shoulder,including clavicle,scapula	21000	Shoulder,including clavicle,scapula	Trunk
		22	Chest,including ribs,internal organ	220	Chest,including ribs,internal organ	22000	Chest,except internal location of d	Trunk
						22009	Chest, unspecified	Trunk
				221	Chest,including ribs,internal organ	22100	Internal chest location,unspecified	Trunk
				222	Chest,including ribs,internal organ	22200	Esophagus	Trunk

				223	Chest,including ribs,internal organ	22300	Heart	Trunk
				224	Chest,including ribs,internal organ	22400	Lungs Includes:bronchus	Trunk
				225	Chest,including ribs,internal organ	22500	Pleura	Trunk
				226	Chest,including ribs,internal organ	22600	Breast(s)-internal	Trunk
				228	Chest,including ribs,internal organ	22800	Multiple internal chest locations	Trunk
				229	Chest,including ribs,internal organ	22900	Internal chest location,n.e.c.	Trunk
		23	Back/spine	230	Back/spine, UNS	23000	Back-incl spine/spinal cord, UN	Back
				231	Lumbar region	23100	Lumbar region	Back
				232	Thoracic region	23200	Thoracic region, UNS	Back
						23201	Cervico-thoracic region	Back
						23202	Thoraco-lumbar region	Back
						23290	Thoracic region, NEC	Back
				233	Sacral region	23300	Sacral region, UNS	Back
						23301	Lumbo-sacral region	Back
						23390	Sacral region, UNS	Back
				234	Coccygeal region	23400	Coccygeal region	Back
				238	Multiple back regions	23800	Multiple back regions	Back

				239	Back/spine, NEC	23900	Back-incl spine/spinal cord, NE	Back
						23901	Lower back, unspecified locatio	Back
		24	Abdomen	240	Abdomen except internal locations	24000	Abdomen-except internal disorde	Abdomen
						24009	Abdomen, UNS	Abdomen
				241	Internal abdomen, UNS	24100	Internal abdominal location, UN	Abdomen
				242	Stomach organ	24200	Stomach organ	Abdomen
				243	Spleen	24300	Spleen	Abdomen
				244	Urinary organ	24400	Urinary organ, UNS	Abdomen
						24410	Bladder	Abdomen
						24420	Kidney	Abdomen
						24480	Multiple urinary organs	Abdomen
						24490	Urinary organ, NEC	Abdomen
						24491	Ureter	Abdomen
						24492	Renal pelvis	Abdomen
				245	Intestine/peritoneum	24500	Intestines, peritoneum, UNS	Abdomen
						24510	Peritoneum	Abdomen
						24520	Small intestine	Abdomen
						24530	Large intestine/colon/rectum	Abdomen
						24580	Multiple intestinal locations	Abdomen

						24590	Intestines, NEC	Abdomen
				246	Other digestive	24600	Other digestive structure, UNS	Abdomen
						24610	Liver	Abdomen
						24620	Gallbladder	Abdomen
						24630	Pancreas	Abdomen
						24680	Multiple other digestive struct	Abdomen
						24690	Other digestive structure, NEC	Abdomen
				248	Multiple internal abdomen	24800	Mult internal abdominal locatio	Abdomen
				249	Internal abdomen NEC	24900	Internal abdominal location, NE	Abdomen
		25	Pelvic region	250	Pelvic region, UNS	25000	Pelvic region, UNS	Hip/Pelvis
				251	Hip	25100	Hip	Hip/Pelvis
				252	Pelvis	25200	Pelvis	Hip/Pelvis
				253	Buttock	25300	Buttock	Hip/Pelvis
				254	Groin	25400	Groin	Hip/Pelvis
				255	External reproductive tract	25500	External reproductive tract, UN	Hip/Pelvis
						25510	Scrotum	Hip/Pelvis
						25520	Penis	Hip/Pelvis
						25530	External female genital region	Hip/Pelvis
						25580	Mult external reproductive trac	Hip/Pelvis

						25590	External reproductive tract, NE	Hip/Pelvis
				256	Internal reproductive tract	25600	Internal reproductive tract, UN	Hip/Pelvis
						25610	Prostate	Hip/Pelvis
						25620	Testis	Hip/Pelvis
						25630	Ovary	Hip/Pelvis
						25640	Uterus	Hip/Pelvis
						25650	Female genitals, NEC	Hip/Pelvis
						25680	Mult internal reproductive trac	Hip/Pelvis
						25690	Internal reproductive tract, NE	Hip/Pelvis
				258	Multiple pelvic regions	25800	Multiple pelvic region location	Hip/Pelvis
				259	Pelvic region, NEC	25900	Pelvic region, NEC	Hip/Pelvis
		28	Multiple trunk locations	280	Multiple trunk locations	28000	Multiple trunk locations	Chest/Shoulder(s)
		29	Trunk, NEC	290	Trunk, NEC	29000	Trunk, NEC	Chest/Shoulder(s)
3	UPPER EXTREMITY	30	Upper extremity, UNS	300	Upper extremity, UNS	30000	Upper extremity, UNS	Arms
		31	Arm	310	Arm, UNS	31000	Arm, UNS	Arms
				311	Upper arm	31100	Upper arm(s) (includes humerus	Arms
				312	Elbow	31200	Elbow	Arms
				313	Forearm	31300	Forearm	Arms
				318	Multiple arm locations	31800	Multiple arm locations	Arms

				319	Arm, NEC	31900	Arm, NEC	Arms
		32	Wrist	320	Wrist	32000	Wrist	Hand(s)/Wrist(s)
		33	Hand except fingers	330	Hand except fingers	33000	Hand-except fingers	Hand(s)/Wrist(s)
		34	Fingers/fingernails	340	Fingers/fingernails	34000	Fingers/fingernails, UNS	Fingers
						34001	Thumb/thumb and other fingers	Fingers
						34002	Fingers-except thumb	Fingers
						34090	Fingers/fingernails, NEC	Fingers
		38	Multiple upper extremity locations	380	Multiple upper limb, UNS	38000	Mult upper extremity locations,	Arms
				381	Hand/fingers	38100	Hands and fingers or thumbs	Arms
				382	Hand/wrist	38200	Hand and wrist	Arms
				383	Hand/arm	38300	Hand and arm	Arms
				389	Multiple upper limb, NEC	38900	Mult upper extremity locations,	Arms
		39	Upper extremity, NEC	390	Upper extremity, NEC	39000	Upper extremity, NEC	Arms
4	LOWER EXTREMITY	40	Lower extremity, UNS	400	Lower extremity, UNS	40000	Lower extremity, UNS	Legs
		41	Leg	410	Leg, UNS	41000	Leg, UNS	Legs
				411	Thigh	41100	Thigh	Legs
				412	Knee	41200	Knee	Knee(s)
				413	Lower leg	41300	Lower leg	Legs
				418	Multiple leg locations	41800	Multiple leg locations	Legs
				419	Leg, NEC	41900	Leg, NEC	Legs

		42	Ankle	420	Ankle	42000	Ankle	Foot(Feet)/Ank(s)/Toe(s)
		43	Foot except toes	430	Foot except toe, UNS	43000	Foot-except toes, UNS	Foot(Feet)/Ank(s)/Toe(s)
				431	Instep	43100	Instep	Foot(Feet)/Ank(s)/Toe(s)
				432	Sole	43200	Sole, UNS	Foot(Feet)/Ank(s)/Toe(s)
						43210	Ball of foot	Foot(Feet)/Ank(s)/Toe(s)
						43220	Arch	Foot(Feet)/Ank(s)/Toe(s)
						43230	Heels	Foot(Feet)/Ank(s)/Toe(s)
						43280	Multiple sole locations	Foot(Feet)/Ank(s)/Toe(s)
						43290	Sole, NEC	Foot(Feet)/Ank(s)/Toe(s)
				438	Multiple foot locations	43800	Multiple foot locations	Foot(Feet)/Ank(s)/Toe(s)
				439	Foot, NEC	43900	Foot-except toes, NEC	Foot(Feet)/Ank(s)/Toe(s)
		44	Toes/toenails	440	Toes/toenails	44000	Toes/toenails	Foot(Feet)/Ank(s)/Toe(s)
		48	Multiple lower extremity locations	480	Multiple lower limb, UNS	48000	Mult lower extremity locations,	Legs
				481	Foot/leg	48100	Foot and leg	Legs
				482	Foot/ankle	48200	Foot and ankle	Legs
				483	Foot/toe	48300	Foot and toes	Legs
				489	Multiple lower limb, NEC	48900	Mult lower extremity locations,	Legs
		49	Lower extremity, NEC	490	Lower extremity, NEC	49000	Lower extremity, NEC	Legs
5	BODY SYSTEM	50	Body system	500	Body system	50000	Body system, UNS	Body System(s)
						50001	Circulatory system	Body System(s)

						50002	Digestive system	Body System(s)
						50004	Genito-urinary system	Body System(s)
						50005	Musculoskeletal system	Body System(s)
						50006	Nervous system	Body System(s)
						50007	Respiratory system	Body System(s)
						50090	Body system, NEC	Body System(s)
8	MULTIPLE BODY PARTS	80	Multiple body parts	800	Multiple body parts	80000	Multiple body parts, UNS	Multiple Parts
						80001	Neck and shoulder	Multiple Parts
						80090	Multiple body parts, NEC	Multiple Parts
9	OTHER BODY PART	91	Prosthetic device	910	Prosthetic device	91000	Prosthetic device, UNS	Non-Personal Damage
						91001	Artificial arm	Non-Personal Damage
						91002	Artificial leg	Non-Personal Damage
						91003	Dentures	Non-Personal Damage
						91004	Hearing aid	Non-Personal Damage
						91005	Eye glasses/corrective lenses	Non-Personal Damage
						91008	Multiple prosthetic devices	Non-Personal Damage
						91090	Prosthetic device, NEC	Non-Personal Damage

		98	Other body part, NEC	980	Other body part, NEC	98000	Other body part, NEC	Unclassified
		99	Unknown	999	Unknown	99990	Unknown	Unclassified

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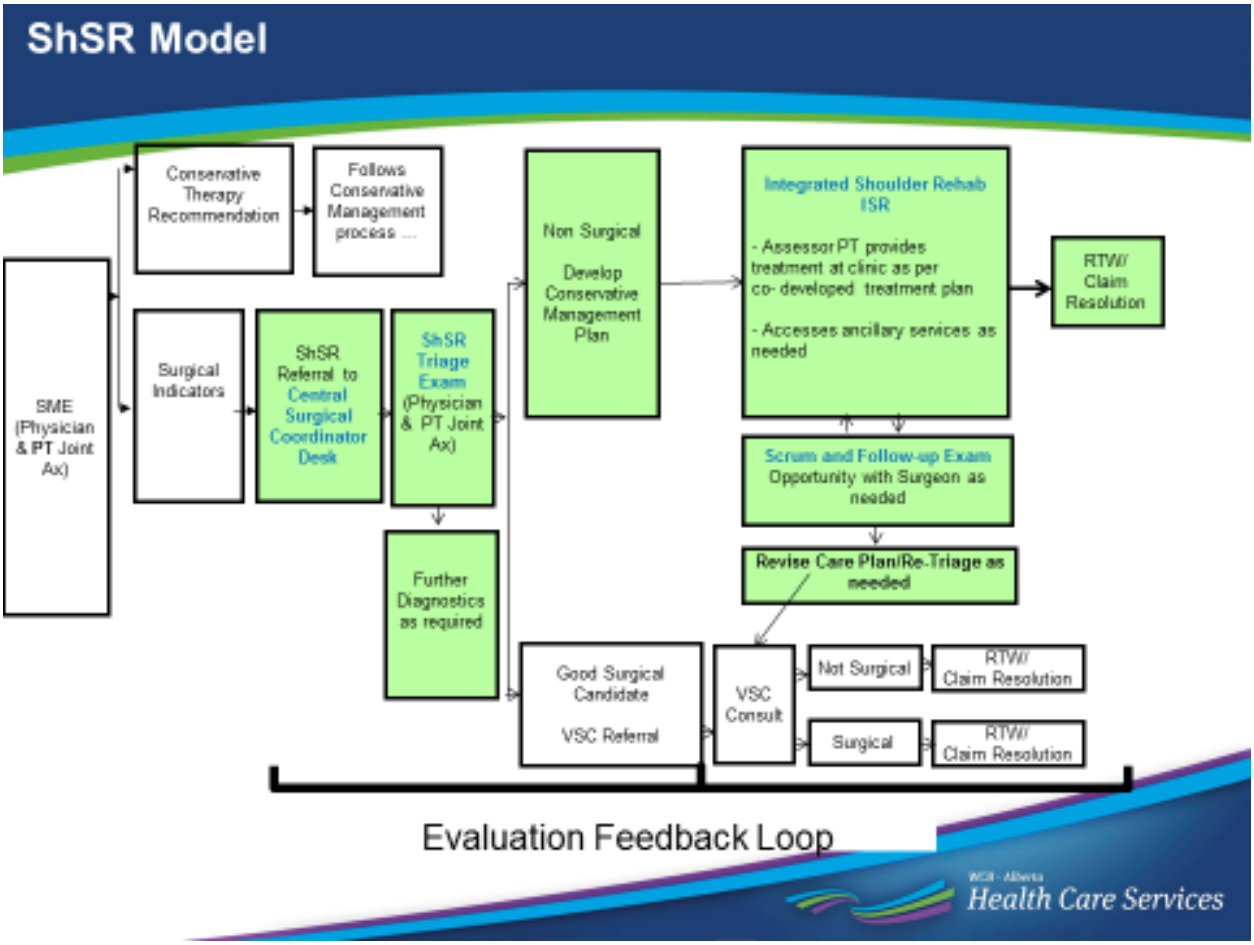
Appendix 4 – Claim Primary Diagnosis Classification

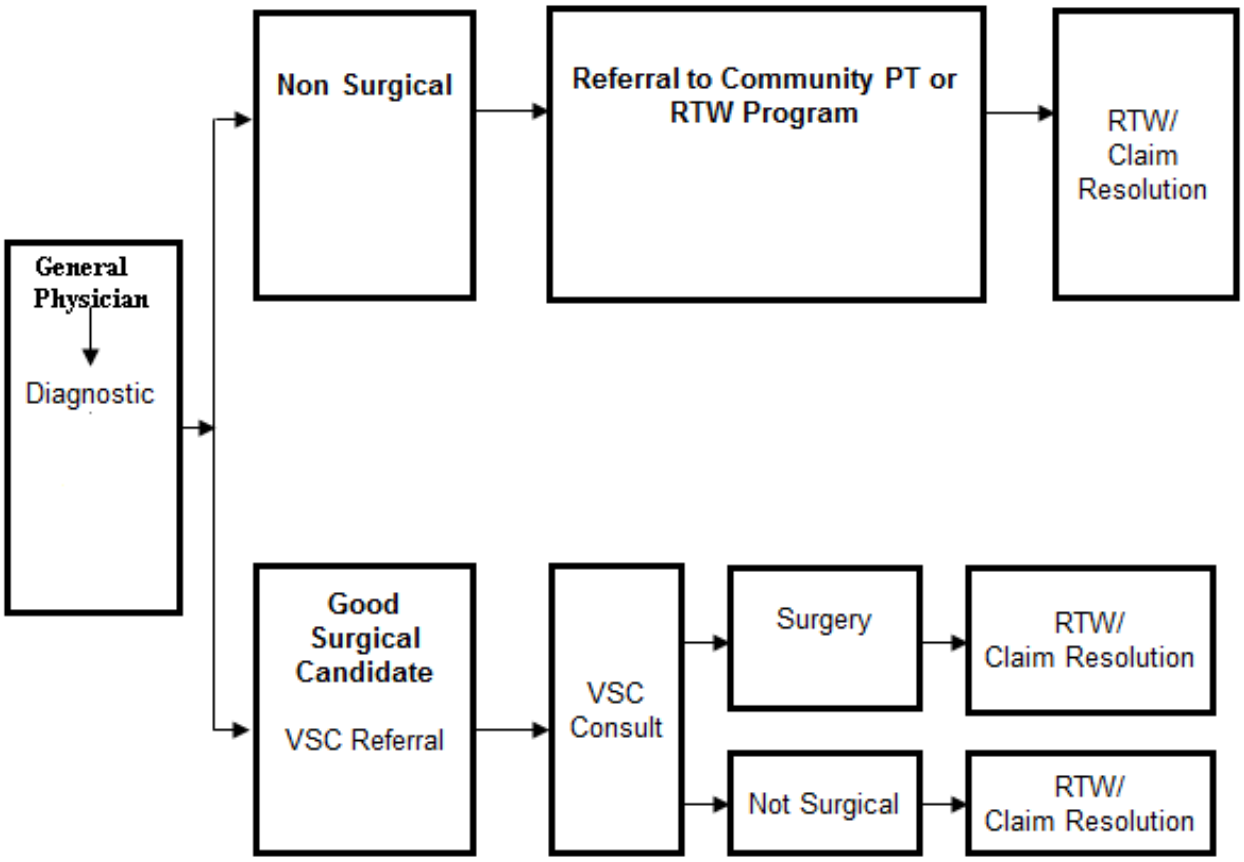
Thesis Diagnosis	Number of Cases	Original Diagnosis
Sprains and Strains	3,233	Sprains and Strains
Arthropathies and Related Disorders	184	Arthropathies and Related Disorders
	875	Rheumatism
Other	129	Contusion
	136	Dislocation
	338	Other
	180	Unspecified

Appendix 5: Care Pathway



Legends: **SME -** Shoulder Medical Exam; **PT** – Physiotherapist, **AX** – Assessment, **ShSR -** Shoulder Surgical Review, **VSC -** Visiting Specialist Clinic, **RTW –** return-to-work.

Appendix 6 – Usual Care Pathway



Legends: **PT** – Physiotherapist, **VSC -** Visiting Specialist Clinic, **RTW –** return-to-work

Appendix 7 – Ethics Approval

Approval Form

Date:	November 26, 2019
Study ID:	Pro00096157
Principal Investigator:	Catherine Jones
Study Title:	The Impact of Using a Specific Shoulder Clinical Pathway Among WCB Patients with Rotator Cuff Related Pathology: A Cohort Study
Approval Expiry Date:	Wednesday, November 25, 2020

Thank you for submitting the above study to the Health Research Ethics Board - Health Panel. Your application, including the following, has been reviewed and approved on behalf of the committee;

- Protocol (11/15/2019)
- WCB Data Request (11/26/2019)

The Health Research Ethics Board assessed all matters required by section 50(1)(a) of the Health Information Act. It has been determined that the research described in the ethics application is a secondary analysis of anonymized WCB data for which subject consent for access to personally identifiable health information would not be reasonable, feasible or practical. Subject consent therefore is not required for access to personally identifiable health information described in the ethics application.

In order to comply with the Health Information Act, a copy of the approval form is being sent to the Office of the Information and Privacy Commissioner.

Any proposed changes to the study must be submitted to the REB for approval prior to implementation. A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date (Wednesday, November 25, 2020), you will have to re-submit an ethics application.

Approval by the Health Research Ethics Board does not encompass authorization to access the patients, staff or resources of Alberta Health Services or other local health care institutions for the purposes of the research. Enquiries regarding Alberta Health approvals should be directed to (780) 407-6041. Enquiries regarding Covenant Health approvals should be directed to (780) 735-2274.

Sincerely,

Anthony S. Joyce, PhD.
Chair, Health Research Ethics Board - Health Panel

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Notification of Approval (Renewal)

Date:	August 8, 2023
Renewal ID:	Pro00096157_REN4
Principal Investigator:	Catherine Jones
Study ID:	Pro00096157
Study Title:	The Impact of Using a Specific Shoulder Clinical Pathway Among WCB Patients with Rotator Cuff Related Pathology: A Cohort Study
Sponsor/Funding Agency:	Workers' Compensation Board - Alberta WCB

RSO-Managed Funding:

	Project ID	Title	Grant Status	Sponsor	Project Start Date	Project End Date	Purpose	Other Information
View	RES0055814	The Impact of Using an Evidence-Based Shoulder Clinical Pathway for WCB Patients with Rotator Cuff Related Pathology	Awarded	Research Program	2021-10-01	2023-11-01	Grant	

Approval Expiry Date: August 6, 2024

Thank you for submitting this renewal application. Your application has been reviewed and approved.

This re-approval is valid for another year. If your study continues past the expiration date as noted above, you will be required to complete another renewal request. Beginning at 30 days prior to the expiration date, you will receive notices that the study is about to expire. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

All study related documents should be retained so as to be available to the Health REB upon request. They should be kept for the duration of the project and for at least 5 years following study completion.

Approval by the REB does not constitute authorization to initiate the conduct of this research. The Principal Investigator is responsible for ensuring required approvals from other involved organizations (e.g., Alberta Health Services, Covenant Health, community organizations, school boards) are obtained, before the research begins.

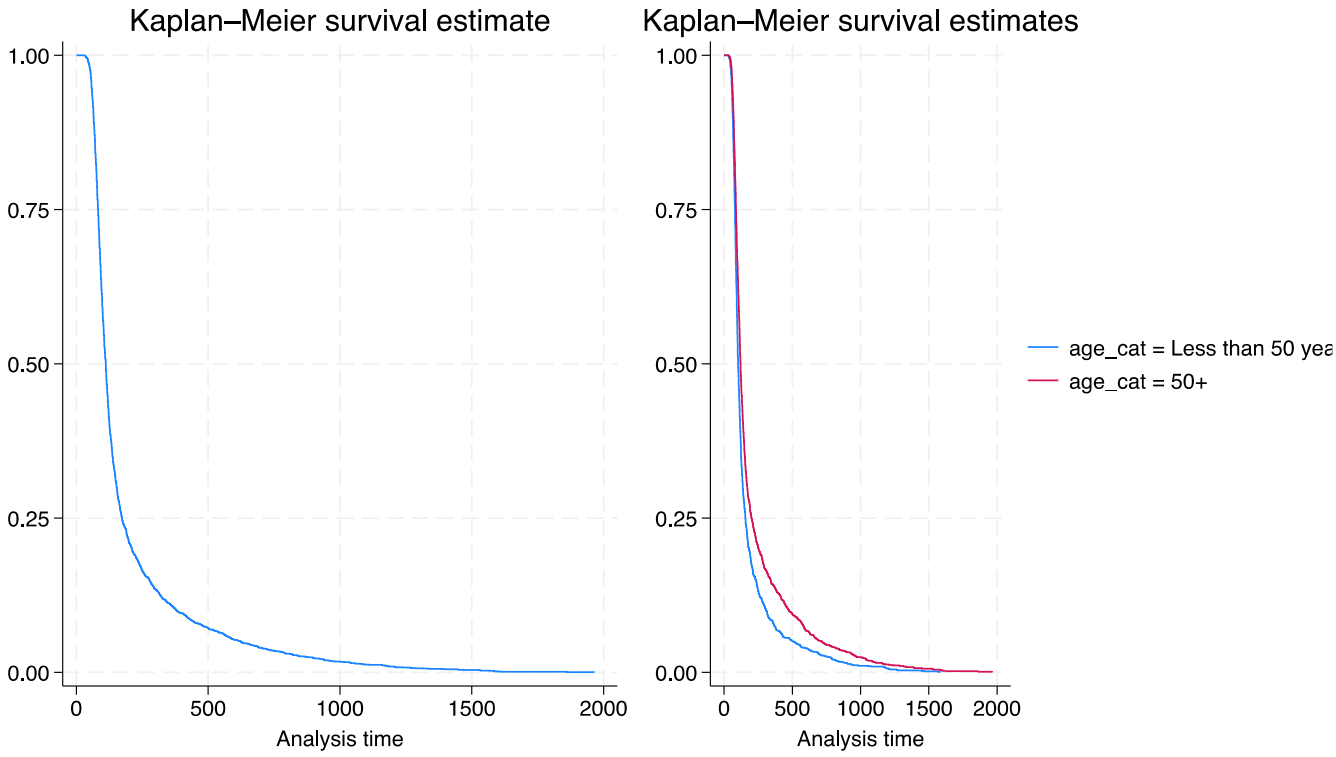
Sincerely,

Emily Nolan
REB Specialist

On behalf of
Anthony S. Joyce, Ph.D.
Chair, Health Research Ethics Board - Health Panel

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix 8 – Claim Duration Plots



Appendix 9 – Strengths and Limitations of methodological approaches used

Study 1 used a network meta-analysis (NMA) approach to address the effect of ET in shoulder injuries. NMA strengths include incorporation of both direct and indirect evidence, allowing for a comprehensive assessment of treatment effects. This integration increases statistical power by pooling data from multiple studies, enabling more precise estimates and the ranking of interventions based on effectiveness. NMA techniques also facilitate the exploration of heterogeneity and inconsistency across studies, providing insights into variations in treatment effects and the consistency of evidence. Additionally, NMAs can accommodate multiple treatment options, making them suitable for comparing diverse ETs with adjunct treatments. However, methodological limitations of NMA include the assumption of transitivity, which may lead to biased estimates if violated, and the complexity of analysis, particularly with large networks. Study 1 used CINeMA to assess consistency though the design-by-treatment test and by separating indirect from direct evidence (SIDE test) using the R netmeta package™. For the transitivity assumption, CINeMA considered indirectness through the distribution of potential effect modifiers, and statistical incoherence through the SIDE test. Apart from DASH scores raising concerns through the SIDE test, all other outcomes. Inconsistency between direct and indirect comparisons, dependency on available evidence quality and quantity, and potential biases in included studies are also important considerations that can impact the reliability and validity of NMA results and were rigorously tested in this NMA.

Retrospective cohort studies offer several methodological strengths, as evidenced in both Study 2 and Study 3. These studies leveraged existing data, which allowed the inclusion of large sample sizes and reduced the cost and time associated with data collection. Additionally, the utilization of administrative data in both studies provided a wealth of information on various variables in a

real-life setting, enhancing the reliability and generalizability of the findings. The robust analytical approaches employed in these studies further bolster the validity of the results, ensuring that appropriate statistical methods were used to analyze the data and control for potential confounding variables. Moreover, for study 3 in particular, the inclusion of time-to-treatment and using a population that underwent standardized care guided by evidence-based guidelines, enriched the depth of understanding of factors determining claim duration. However, despite these strengths, retrospective cohort studies also come with limitations. One notable limitation is the lack of control over data collection, leading to potential biases and missing data, as seen in both studies due to the absence of health-related clinical data or incomplete self-measured data. This limitation may hinder a thorough understanding of the outcomes from the workers' perspective and restrict the analysis to subsets of the population with available data, potentially introducing selection bias. Additionally, retrospective cohort studies are susceptible to various biases, including measurement bias and confounding, which can distort the associations between exposures and outcomes over time. Despite efforts to address these biases through rigorous analytical methods, such as the MLR method utilized in Study 2 and Cox analyses conducted in Study 3, residual biases may still influence the study results. Furthermore, while administrative data provided valuable insights, they may lack certain detailed information, such as healthcare utilization data, which could further elucidate the effectiveness and cost implications of care pathways.