Title – Optimizing Work Performance: The Role of the Physical Therapist

List of Abbreviations

ADA: Americans with Disabilities Act
AOPT: Academy of Orthopaedic Physical Therapy
APTA: American Physical Therapy Association
AUC: area under the curve
BDRQ: Back Disability Risk Questionnaire
BLS: Bureau of Labor Statistics
BMI: body mass index
CI: confidence interval
CPG: clinical practice guideline
CBT: cognitive behavioral therapy
COPSOQ: Copenhagen Psychosocial Questionnaire
DAFW: days away from work
DASH: Disabilities of the Arm, Shoulder and Hand
DJTR: days of job transfer or restriction
EATA: Ergonomic Assessment Tool for Arthritis
FCT: Function Centered Therapy
FABQ: Fear Avoidance Beliefs Questionnaire
FCE: functional capacity evaluation
FWA: future work ability
GDG: guideline development group
HR: hazard ratio
HRR: hazard rate ratio
ICD: International Classification of Diseases
ICF: International Classification of Functioning, Disability and Health
IQR: interquartile range
IRR: incidence rate ratio
IWS: Isernhagen Work Systems
JOSPT: *Journal of Orthopaedic & Sports Physical Therapy*
-LR: negative likelihood ratio
+LR: positive likelihood ratio
LBP: low back pain
M-SFS: Modified Spinal Function Sort
NHIS: National Health Interview Survey
ODI: Oswestry Disability Index
OMPQ: Örebro Musculoskeletal Pain Screening Questionnaire
OMSQ: Örebro Musculoskeletal Screening Questionnaire
OR: odds ratio
ORS: Occupational requirements Survey
OSHA: Occupational Safety and Health Administration
PCT: Pain Centered Treatment
PDI: Pain Disability Index
PDQ: Pain Disability Questionnaire
PEDro: Physiotherapy Evidence Database

PILE test: Progressive Isoinertial Lifting Evaluation
PPC: Pain Pattern Classification
QALY: quality of life years
QTFC: Quebec Task Force Classification
RCT: randomized controlled trial
RMQ: Roland Morris Disability Questionnaire
RRTW: Readiness for Return to Work
RTW: return to work
SD: standard deviation
SF-36: Medical Outcomes Study 36-Item Short Form Health Survey
SMET: Structured Multidisciplinary work Evaluation Tool
SMS: Symptom Magnification Syndrome
TSK: Tampa Scale of Kinesiophobia
TOPS: Treatment Outcomes in Pain Survey
TTD: Total Temporary Disability
VAS: visual analog scale
WAI: Work Ability Index
WALS: Work Activity Limitations Scale
WAS: Work Ability Score
WBOAS: Worker-Based Outcomes Assessment System
WHQ: Work and Health Questionnaire
WLQ: Work Limitations Questionnaire
WRF: Worker Role Function
WRI: Worker Role Interview
WRS: Worker Role Self-Assessment
WHO: World Health Organization

INTRODUCTION

AIM OF THE GUIDELINE

The Academy of Orthopaedic Physical Therapy (AOPT) and the American Physical Therapy Association (APTA), Inc. has an ongoing effort to create evidence-based clinical practice guidelines (CPGs) for physical therapy management of people with health-related impairments, limitations, or restrictions as described in the World Health Organization's *International Classification of Functioning, Disability and Health* (ICF).[165]

Objectives of this clinical guideline:

- Describe evidence-based physical therapy practice, including diagnosis, prognosis, intervention, risks, and assessment of outcome for individuals with work-limiting and work-restricting health conditions.
- Classify and define common work-related limitations using the World Health Organization's (WHO) terminology related to impairments of activity limitations and participation restrictions
- Identify factors impacting recovery, work ability, and return to work (RTW)

- Identify and compare RTW interventions supported by current best evidence that addresses activity limitations and participation restrictions, delivered in a clinical and/or workplace setting.
- Identify appropriate outcome measures to assess changes in work activity and participation of the individual resulting from physical therapy interventions.
- Provide a description to policy makers, using internationally accepted terminology, of the practice of physical therapists consulting with or treating individuals who have work limiting conditions.
- Provide information for payers and claims reviewers regarding the practice of physical therapy for individuals with work limiting conditions
- Create a reference publication for physical therapy clinicians, academic instructors, clinical instructors, students, interns, and residents, to inform best practice and decision making regarding the best current practice of physical therapy related to RTW.

STATEMENT OF INTENT

These guidelines are not intended to be construed or to serve as a standard of medical care. Standards of care are determined on the basis of all clinical data available for an individual patient and are subject to change as scientific knowledge and technology advance and patterns of care evolve. These parameters of practice should be considered as guidelines only. Adherence to them will not ensure a successful outcome in every patient, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular clinical procedure or treatment plan must be made based on clinician experience and expertise in light of the clinical presentation of the patient, the available evidence, available diagnostic and treatment options, and the patient's values, expectation, and preferences. However, we suggest that significant departures from accepted guidelines should be documented in the patient's medical records at the time the relevant clinical decision is made.

SCOPE AND PURPOSE OF THE GUIDELINE

Work rehabilitation refers to the process of assisting workers to remain at work or RTW in a safe and productive manner, while limiting the negative impact of restricted work, unemployment, and work disability. Work rehabilitation is further defined, by Escorpizo et al[93] as "a multi-professional, evidence-based approach, provided in different settings, services, and activities to working-age individuals with health-related impairments, limitations, or restriction with work functioning, and whose primary aim is to optimize work participation." This conceptual definition is based on the WHO's ICF model and has been studied in relation to the role of the physical therapist in minimizing work disability. The definition is generalizable to concepts of work and vocation across multiple countries and professions.

The primary purpose of this CPG is to systematically review available scientific evidence and provide a set of evidence-based recommendations for the most effective physical therapist evaluation, treatment, and management of individuals who are experiencing work restrictions and limitations, to optimize work participation. This guideline is meant to be used in conjunction with other published guidelines that are based upon a pathoanatomic or other model of diagnosis

(eg, classification, impairment-based), to supplement physical therapist examination and management of patients aged 16-65 in their role as a "worker". Readers will note varied terminology related to work and vocation as the authors attempted to keep terminology consistent with specific study language when discussing individual articles.

METHODS

Content experts were appointed by the AOPT and APTA, Inc. to conduct a review of the literature and develop a CPG based on the best available evidence in the field. The composition of the Guideline Development Group (GDG) included members of the AOPT's Occupational Health Special Interest Group (OHSIG) who would ensure the GDG included sufficient and complementary clinical and research expertise across the spectrum of occupational injury including ICF, work disability prevention and management, clinical assessment and intervention of individuals with diverse work impacting injuries, outcome measurement, ergonomics, consultative services, knowledge transfer, work rehabilitation/vocational rehabilitation, workers compensation care management, and work related regulations such as the Americans with Disabilities Act.

The CPG development process was guided by the 2018 APTA Clinical Practice Guideline Process Manual. Throughout the CPG development process, the GDG received support through an APTA grant and sponsorship from the AOPT for travel, software, and expenses for CPG development. The funding bodies did not influence the recommendations, and the CPG development team maintained editorial independence.

To develop the aim of the guideline, qualitative feedback was solicited from external stakeholders regarding the role of the physical therapists in prevention of work disability and areas in need of more effective physical therapist practice. Stakeholders viewed the role of the physical therapist as facilitating an active rehabilitation process and assisting the injured worker in setting realistic expectations for recovery and return to work, home, and leisure activities. Feedback also included the need for physical therapist to foster a therapeutic alliance, wise use of ergonomic modifications, and job accommodations in RTW, meeting the needs of the worker. Physical therapists are viewed as appropriate to apply behaviorally based techniques to maximize outcomes. This feedback, in addition to quantitative scoring of physical therapist practice guidance statements, informed the literature review on which this CPG is based.

The authors declared relationships and developed a conflict management plan that included submitting a Conflict of Interest form to the AOPT. All GDG members completed training and 2 rounds of calibration screening prior to abstract screening (using relevant inclusion/exclusions). The GDG members also participated in online Physiotherapy Evidence Database (PEDro) training to improve critical appraisal skills through completion of online training and appraisal of standardized test articles. Studies that were authored by a reviewer were assigned to an alternate reviewer.

The recommendations provided in this CPG are based on scientific literature published in print (or as an electronic publication ahead of print) from January 1, 1999 to August 7, 2020. A 20-

year search window (based on the year of the primary literature search) was used to focus on contemporary research and practice. The GDG group worked with a librarian at the University of Vermont in the several phases of search strategies, including an initial clinical practice appraisal (which assisted the group in synthesizing risk, examination, and intervention areas that may be relevant to a CPG), and formal systematic search/update for the final CPG. An unpublished clinical practice appraisal conducted by the GDG facilitated understanding of the scope of physical therapist practice in the area of work rehabilitation, and development of topical categories to consider in the literature review. Feedback on the clinical practice appraisal was provided physical therapist and external stakeholders (medical doctor and chiropractic stakeholders, occupational therapists, educators, clinical practitioners, management/business administrators, researchers, and vocational rehabilitation stakeholder). Initial perceptions of the research and stakeholder feedback on the findings (via survey, evaluation, and discussion or informal communications) following educational presentations also guided the GDG in development of final CPG development.

Systematic search strategies for the CPG were employed for articles related to work rehabilitation and published since 1999 related to classification, examination, and intervention strategies, consistent with previous guideline development methods related to ICF classification. The following databases were searched from 01/01/1999 to 08/07/2020: Ovid MEDLINE, PsycINFO, CINAHL, PEDro, and Cochrane Library. Covidence, Drop Box, GoogleDocs, and EndNote were used to manage the literature searches, coordinate evidence selection, carry out extraction/appraisals, and store information about the evidence sources. Appendices A and B provide details about the search strategies, search results and PRISMA flow chart of articles.

Articles contributing to recommendations were reviewed based on specified inclusion and exclusion criteria (Appendix C), with the goal of identifying evidence relevant to physical therapist clinical decision making for people undergoing work rehabilitation. The scope of the CPG was intended to address optimization of work following work-related and non-work-related injuries and illnesses that may impact work participation outcomes.

The title and abstract of each article were imported into Covidence and reviewed independently by 2 members of the GDG to determine which ones appeared to have potential to inform physical therapist practice based on stakeholder feedback and the clinical practice appraisal previously noted. Full-text review and topical tagging was subsequently conducted by 2 GDG members using inclusion/exclusion criteria to obtain the final set of articles for contribution to the recommendations. In cases where screeners disagreed or where the information was not clear enough to make a determination, a third reviewer independently evaluated the title/abstract or full text.

Data Extraction & Quality Assessment

Key findings pertinent to determining the effectiveness of work rehabilitation were extracted from each of the included articles. Data extraction was performed using a standard extraction template to document study characteristics and key findings.

Based on variation in terminology found in the research relating to naming and content of work rehabilitation interventions, the CPG development team identified categories of interventions to optimize the ability to draw conclusions from the literature. For example, if an intervention included ergonomics education, but did not include actual worksite assessment or modification, the content was considered in the *education* category and not *ergonomics* category. The *communication and coordination of services* intervention category encompasses items such as interactive work accommodation and RTW communication or planning, worksite consultation, and supervisor/case manager/stakeholder communication. Multicomponent interventions were sorted into three broad intervention categories: *health-focused programs* (clinical interventions with general/non-specific exercise, education, and psychosocial or behavior based approach to care), *work-focused programs* which build on the health-focused interventions to include graded, work specific activities, and the third category, *workplace intervention* which includes an active workplace component as part of the intervention.

Determining Levels of Evidence

Individual clinical research articles were graded and appraised using the resources from the Centre for Evidence-Based Medicine,[246] Oxford, United Kingdom for diagnostic, prognostic, therapeutic, and exam/outcome studies (Appendices E and F) consistent with the APTA Clinical Practice Guideline manual. Each study was independently reviewed by 2 GDG members and assigned a level of evidence based on relevant study design and methodology, sampling/blinding/concealment, study limitations, outcomes, and applicability to practice. In the event of a disagreement between the two reviewers, a third reviewer was utilized to come to a consensus. An abbreviated version of the grading system follows in Table 1.

TABLE 1. Levels of Evidence

Level	Descriptor
I	Evidence obtained from high-quality diagnostic studies, prospective studies, randomized controlled trials, or systematic reviews
II	Evidence obtained from lesser-quality diagnostic studies, prospective studies, systematic reviews, or randomized controlled trials (eg, weaker diagnostic criteria and reference standards, improper randomization, no blinding, less than 80% follow-up)
III	Case-control studies or retrospective studies
IV	Case series
V	Expert opinion

Development and Grading of Recommendation

The GDG developed a summary of the evidence that considered the strengths and limitations of the body of evidence to develop recommendations. The GDG used BRIDGE-Wiz Version 3.0 (Yale University, New Haven, CT) to ensure consideration of potential benefits, harms, costs, and values, as well as the assumptions or judgements and rationale for any intentional vagueness of the recommendations. Grades for each recommendation were assigned through a consensus-based process based on the key findings extracted from articles, strength of the evidence supporting the recommendation, and recommended grades/definitions provided below. Each

member of the GPG reviewed the supporting evidence for each recommendation and completed a Delphi process requiring at least 85% consensus of all GDG members.

TABLE 2. Grades of Recommendation

Grade	Strength of Evidence
A – Strong Evidence	A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study
B – Moderate Evidence	A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation
C – Weak Evidence	A single level II study or a preponderance of Level III and IV studies, including statements of consensus by content experts, support the recommendation
D – Conflicting Evidence	Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies
E – Theoretical/ Foundational Evidence	A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic science/bench research supports this recommendation
F – Expert Opinion	Best practice based on the clinical experience of the guidelines development team supports this recommendation

DESCRIPTION OF GUIDELINE REVIEW PROCESS AND VALIDATION

Guideline development methods policies, and implementation processes are reviewed at least yearly by the AOPT's CPG Advisory Panel, including consumer/patient representatives, external stakeholders, and experts in physical therapy guideline methodology. This CPG underwent multiple formal reviews.

The complete CPG draft was reviewed by invited stakeholders representing CPG methodology and a variety of clinical perspectives, including physical therapists, occupational therapists, physicians, psychologists, self-insured stakeholders, and insurance/case management stakeholders. Acknowledgements for invited reviewers are provided at the end of the CPG. The draft was posted for public comment and review on www.orthopt.org and a notification of this posting was sent to the members of the AOPT of the APTA, Inc. Notices encouraging contributions to the request for public comment were sent via email and electronic newsletter to members. All comments, suggestions, and feedback from the expert reviewers, public, and

consumer/patient representatives were provided to the authors and editors for consideration and revisions, and were used to develop the final recommendations.

This CPG was issued in 2021 based on publications in the scientific literature between January 1999 and August 2020. It will be considered for review in 2025, or sooner if clinically significant new evidence becomes available. Annual literature search and abstract reviews will be completed by the Occupational Health Special Interest Group Research Committee with GDG reformation/planning beginning no later than 2023 for methodology updates and timeline development.

DISSEMINATION AND IMPLEMENTATION

In addition to publishing this guideline in the *Journal of Orthopaedic & Sports Physical Therapy* (*JOSPT*), it will be highlighted and posted on the CPG webpage of the *JOSPT* and the AOPT of the APTA websites. These webpages have unrestricted public access. The CPG has been submitted for inclusion on the ECRI Guidelines Trust (guidelines.ecri.org). Implementation tools and associated implementation strategies to be made available for employers, patients, physicians, surgeons, clinicians, educators, payors, policy makers, and researchers include:

TABLE 3. Planned strategies and tools to support the dissemination and implementation of this Clinical Practice Guideline

Tool	Strategy
JOSPT's "Perspectives for Patients" and/or "Perspectives for Practice" articles	Patient-oriented, consumer group and clinician-oriented summaries available on www.jospt.org
Clinician's Algorithm and Quick-Reference Guide (Figures 1 and 2)	Summary or guideline recommendations with guidance for stakeholders available on www.orthopt.org and included in professional development modules
Clinician Chart Review Checklist (Figure 3)	Available at www.orthopt.org and included in professional development modules. Promote via AOPT member news. Content available for inclusion in electronic health records.
CPG+ analysis, translational aid for applying CPG in practice.	APTA review process. Appraisal of Guidelines for Research and Evaluation II (AGREE II) conducted by a team of experts.
JOSPT's Read for Credit continuing education units	Continuing Education Units available on www.jospt.org

Presentation of CPG at interdisciplinary meetings and symposium presentations	Develop abstract/core presentation materials based on stakeholder reference guide
Webinars: educational offering for health care providers	Guideline-based instruction available for practitioners on www.orthopt.org or in collaboration with other APTA component organizations
Develop core competencies for entry level/advanced practice	Provide CPG to program directors and faculty. Collaboration between OHSIG, Education Committee of the AOPT, and APTA Academy of Physical Therapist Education, resources such as slide deck for faculty.
Non-English versions of the guidelines and guideline implementation tools	Development and distribution of translated guidelines and tools for JOSPT's international partners and global audience
Development of a clinical research agenda	Collaboration of OHSIG and AOPT, available at www.orthopt.org
Executive review of best practices for advocacy, policymakers, legislators	Collaboration of OHSIG, the AOPT, and APTA, available at www.orthopt.org. Development of presentation for APTA Component engagement with state departments of labor and other local stakeholders.

Barriers, Facilitators, and Resources Impacting Implementation

A potential barrier to implementation of this CPG is that physical therapist management of individuals who have experienced work limitations or participation restrictions may require evaluation and treatment strategies that are typically provided by clinicians with expertise across different areas of physical therapist practice. For example, an individual with an uncomplicated musculoskeletal problem may RTW following a short treatment episode by a physical therapist working in an outpatient clinical facility with a practice emphasis in orthopedics, while an individual with a complicated brain injury or a cardiopulmonary condition typically requires multiple specialists in those clinical areas in addition to those who focus on worker rehabilitation and work-related functional performance. Clinical integration and collaboration based on clinical strengths is needed to ensure patients receive the necessary care.

Physical therapists who work with patients to achieve RTW goals should ensure they have the training and skills to navigate the multifactorial nature of the RTW process discussed in this CPG. Monetary, time, and personnel resource demands may pose an implementation barrier. In addition, time and personnel necessary for communication and coordination with employer and

other stakeholders involved in navigating the workers' compensation system may be perceived as barriers to implementation. Physical therapists are encouraged to use this CPG to guide collaboration with the other stakeholders including external case administrators. Use of the algorithm and audit will improve efficiency and effectiveness, limiting the cited barriers to implementation.

While clinical practice changes are a key part of successful guideline adoption, systems factors such as availability of job demand information, employer communication, availability of transitional work policies, and payment conventions can also be facilitators or barriers. Future efforts to optimize work participation may be influenced by shared efforts to optimize communication and development of systems that incorporate work rehabilitation interventions within the workplace. This CPG may serve as a catalyst for discussion and inform collaborative dialog among employers, insurers, employment stakeholders and healthcare policymakers in an effort to address practices or policies that create barriers to RTW or stay at work. The CPG can also be used in discussion with local, state or national medical, rehabilitation and case management groups as well as policy makers and insurers for multi-stakeholder problem solving, systems review, process improvement and efforts to develop continuous improvement initiatives.

This CPG can guide clinicians and facilitate cost effective and efficient rehabilitation of the worker. The adoption of clinical pathways in local practices to support optimal patient referral and treatment has been gaining popularity with the care of injured workers. Another facilitator to implementation may be a commitment to pursue implementation across a network of health care providers working together to manage patients with a high risk of prolonged recovery from a work-related injury. The recommendations in this CPG provide a framework for integration of best practice into local settings.

INCIDENCE AND PREVALENCE

Workplace Injuries

According to data from the Bureau of Labor Statistics (BLS), workplace injuries and ongoing lost days from active claims and injuries during 2018 totaled 103 million days.[232] The leading type of injury or illness was sprain, strain, or tear, with 308 630 days-away-from-work accounting for 34% of total cases.[303] The distribution of injuries and illness in 2018, categorized by body part was upper extremities 32%, lower extremities 24%, trunk 22%, multiple body parts 10%, head and neck 10%, and body systems 2%. Falls, slips, and trips accounted for 27% of the private occupational injuries and illnesses in 2018.[298] Fractures accounted for 8.5% of injuries, with a median of 31 days away from work. Reported work injuries likely underestimate the magnitude of the problem. Disability following work injury is generally temporary with a duration of less than 1 month (see Clinical Course section for more details), although there is often long term incapacity in cases where work absence extends more than 3-6 months.[49] Identification of those at risk for long term work disability continues to be challenge as many extended or high cost claims are often not identified during initial examination *(pending Rosenblum 2015 reference*), or early stages of care. This CPG has therefore emphasized early identification of risks for delayed RTW (specific risks discussed below). (*pending references Rosenblum 2015, Walls 2012, Galusha 2017)*

A number of studies have found that work-related problems may not be reported because of administrative barriers, regulatory non-compliance, data entry errors, fear of reprisal/job security, or pressure to use personal insurance to address problems that may stem from the workplace.[75,97,201,202]

Work Disability

In 2018, there were 8.5 million workers with disabilities receiving disability insurance through Social Security. While estimates show about 10 percent of recipients previously qualified for Workers Compensation, the remainder have severe conditions prevent individuals from performing substantial amounts of work. Both the musculoskeletal system and connective tissue diagnostic grouping, and mental disorders independently accounted for approximately 30% of conditions impacting disabled workers.[15]

The Social Security Administration estimates that more than one in four individuals currently age 20 will have a disability prohibiting work before they reach retirement age (*pending 2019 SSA reference)*. Data from the National Health Interview Survey (NHIS) reported that approximately 5% of individuals between 18-44 years describe themselves as limited or unable to work, and this number increased to approximately 15% of individuals aged 45 to 64 (*pending NHIS 2018 reference)* when questions related to physical, mental, or emotional problems that kept individual family members from working were included. The NHIS data also found a total of 171 million lost workdays attributed to illness or injury in the past 12 months; while 58% of working age individuals missed no work, 19% missed 1-2 days of work, 13% missed 3-5 days, and 10% missed more than 6 days. (*pending NHIS 2018 reference)*

ECONOMIC BURDEN

The total cost of work injuries in the United States in 2018 was $170.8 billion, which included direct and indirect costs related to wages/productivity (31%), medical expenses (20%), administrative expenses (34%), and the remainder composed of employers uninsured costs (such as investigation, reporting, and property damage).[232] The costliest causes of workplace injuries are overexertion, falls, and being struck by object or equipment.[1] Costs per injured worker averages $1100 and can increase to $41 000 when requiring medical consultation.[232] Using a musculoskeletal problem as an example, the reported direct/medical costs for sprain/strain injury range from approximately $16 000(National Safety Council) to $32 000(Occupational Safety and Health Administration, Safety Pays Program).[232] Indirect costs (replacement worker, productivity loss costs, training, etc.) are generally more expensive than the direct medical costs.

While only .5 percent of individuals who experience injuries at work will be considered permanently and totally disabled under workers compensation, data from the Social Security Administration shows individuals experiencing work absence had double the risk of receiving disability benefits.[242] After ten years 6% of individuals with medical only claims received Social Security Disability Insurance (SSDI) payments, compared to 12% of those with work absence.[242] Ten percent of SSDI recipients are estimated to receive workers' compensation benefits.[78] SSDI beneficiaries include individuals who are disabled and unable to work, even if the disability is

not related to a work injury. In 2018, workers receiving disability payments through Social Security, cost $143.7 billion overall, which accounted for almost 75% of disability insurance payments.[15]

RISK FACTORS FOR DELAYED RETURN TO WORK

Work disability and delayed RTW can be influenced by multiple factors including physical determinants, personal coping, workplace considerations, health care and regulatory systems.[203] Risk factors for delayed RTW can be barriers to RTW, and we use these terms as synonyms in this CPG.[281] The Psychosocial Flags Framework[50] is one approach that has been used in musculoskeletal literature to identify and address obstacles to working.[250] Three commonly discussed categories or obstacles impacting RTW examination and care planning include yellow, blue and black flags. Yellow flags include feelings, beliefs, judgments and behaviors about symptoms, health conditions and self-efficacy in their management.[180] Work related barriers to recovery have been described as black and blue flags.[234,278] Black flags describe the nature of work and elements of the workplace such as job demands/characteristics and the insurance or compensation systems, while blue flags relate to the worker perceptions of work environment such as mental stress or lack of support.[234,278] This section of the CPG has been organized into two areas – a) Client Presentation and b) Socioeconomic and Work Environment Factors. Client Presentation includes factors that would be identified through the physical therapist examination, including history-taking. Information related to Socioeconomic and Work Environment Factors may be communicated prior to examination (from employer or other health and insurance stakeholders) or during examination through history-taking (with updates and clarifications throughout care). Factors that fit the flag designations are included throughout this section, but in general, yellow flags are most likely included in Client Presentation and factors that would be considered blue and black flags would be addressed Socioeconomic and Work Environment Factors.

Client Presentation

Risks for delayed RTW or work disability have been associated with the worker presentation including age, sex, current and prior medical history, pain complaints and presentation, reported functional status, beliefs and expectations, fear of movement, and non-organic signs.

Age

I – Two prospective cohort studies,[157,262] a secondary analysis of prognostic factors from a randomized controlled trial (RCT),[284] and a prospective analysis of registry outcomes[70] found no impact of age on RTW or work absence in individuals injured at work. In contrast, there were two prospective cohort studies that found a negative association between age and work status.[6,247] Data from Oyeflaten et al[247] analyzed the use of leave, pension, and vocational rehabilitation, controlling for age. While vocational services were associated with younger workers, sick leave, and pension were associated with older age. The probability of using vocational rehabilitation services decreased with age and was estimated as a hazard rate ratio (HRR) of 0.76 (95% confidence interval [CI]: 0.70, 0.83).[247]

II – Two systematic reviews, one with 3 prospective and 6 retrospective cohort studies,[291] and another with 29 studies (including 7 RCTs, 6 prospective cohort studies, and a variety of lower quality studies)[258] along with several other studies including a lower quality RCT,[210] prospective cohort,[208] and prospective observational study[267] and a retrospective cohort study[222] identified older age as a negative factor for working status/RTW. One review concluded older age was associated with poor RTW outcomes and decreased likelihood of finding work upon recovery,[258] while other studies found a correlation between increasing age and slower claim closure, but not overall RTW or recurrence.[5,52,142] Age was not found to be a significant predictor of RTW for individuals with shoulder and upper extremity problems,[16,191] or arthritis[44]. Duration of care and job loss were also found not to be associated with age for individuals with back pain.[146,172]

Sex

I – Abegglen et al[6] reported that men were at risk of more days of work disability and more complicated recovery 18 months following work injury than women ($P < .001$). In a 4 year study encompassing diverse diagnoses and vocations by Oyeflaten et al,[247] women were found to have a significantly greater risk of not returning to work (HRR = 0.73; 95% CI: 0.57, 0.94), receiving partial disability (HRR = 1.81; 95% CI: 1.00, 3.26), or receiving full disability (HRR = 2.08; 95% CI: 1.23, 3.49). Men more frequently had musculoskeletal diagnoses (58%) while women more often had a mental diagnosis (55%; $P < .001$).[247] Two RCTs found that sex did not impact RTW in workers with back pain.[284,290]

II – Female sex was associated with extended absence and poor RTW outcomes in a systematic review by Street and Lacey[291] and several other studies.[5,146,222] Street and Lacey[291] included 3 prospective and 6 retrospective cohorts, and identified the traditional role of women in a caregiver/home role as an influence on longer recovery times or not returning to work. In contrast, Aas et al[2] found that women in a prospective cohort study had higher RTW rates and shorter work absence following brain injuries. Keeney et al[179] found that women were less likely to experience back re-injury compared to men (odds ratio [OR] = 0.60; 95% CI: 0.47, 0.81).

II – In a systematic review, Rinaldo and Selander[258] included 3 studies that identified sex as a risk factor for work disability; one RCT found sex was not a risk factor related to RTW while a pair of prospective and retrospective cohort studies disagreed on which sex was more at risk for disability. Kvam et al[192] identified conflicting results in a prospective cohort, finding women were less likely to achieve "full return to work" (OR = 0.09; 95% CI: 0.02, 0.48), but no relationship was found between sex and part-time return to work or disability pension. Lydell et al[208] found women were less likely to be engaged in sustained full-time work after 5 years (OR = 0.310; 95% CI: 0.104, 0.922), but not at 10 years.

Evidence Summary

There is conflicting evidence on the role of age and sex as risk factors for delayed RTW and work participation following injury. Research indicated that other factors such as social[192,291] and economic considerations[291] may influence the relationship between sex and delayed RTW.

Worker's Expectations and Beliefs

I – Based on a large prospective cohort with 10 year follow-up, Palmlof et al[249] reported a higher risk of long-term sickness absence for workers who perceived lower physical and mental health in relation to work demands at baseline. Among those 20 – 34 years old, the incidence rate ratio (IRR) in the exposure category 'rather poor/poor' was 2.15 (95% CI: 1.14, 4.06), while it was 4.94 (95% CI: 3.02, 8.08) for those 35 – 49 years old and 6.68 (95% CI: 4.05, 1.04) for individuals in the 50 – 65 age range. Regarding mental health, the strongest associations were found in those reporting 'rather poor/poor' mental work capacity with an IRR of 2.00 (95% CI: 1.26, 3.16), 2.32 (95% CI: 1.50, 3.60), and 3.70 (95% CI: 2.23, 6.16) for the three age groups respectively. Schultz et al[274] reported an 80.5% accuracy rate for predicting RTW and a 74.4% accuracy for failure to RTW for the following predictive factors: pain guarding, disability-related perceptions, beliefs, and expectations of recovery. In a follow-up investigation, Schultz et al[273] reported the key psychosocial predictors for RTW were expectations of recovery and perception of health change and that their models were better at predicting who will return than who will not return to work. Xu et al[327] used the stages of change model to predict RTW outcomes for a group of unemployed workers with chronic pain and physical injury. This model focuses on the decision-making of the individual. The authors reported that the most significant factors for predicting workers' RTW are the readiness of workers for action and their confidence in returning to work.

II – Carlsson et al[59] investigated associations between motivation for RTW and RTW. Participants were on long-term sick leave due to pain or mild to moderate mental health conditions. Participants categorized as being motivated to RTW had more than two-fold odds of reporting "increased employability" or "increased work": OR = 2.44 (95% CI: 1.25, 4.78). Gross and Battie[123] reported that recovery expectations predict future recovery in workers filing injury claims for back pain (adjusted Hazard Ratio: 0.9), but does not seem to predict recovery in claimants with other musculoskeletal conditions. Rinaldo and Selander[258] performed a literature review and reported psychological factors are very important in determining the outcomes of vocational rehabilitation. Salzwedel et al[267] reported that the patient's expectations regarding his/her ability to work plays a crucial role in predicting RTW 6 months after an acute cardiac event and cardiac rehabilitation (OR = 0.19; 95% CI: 0.06, 0.59). Patients with the comorbidity of depression were also less likely to RTW (OR = 0.52; 95% CI: 0.36, 0.76).

Fear of Movement

I – Fritz and George[103] found that work-related concerns, measured using the Fear Avoidance Beliefs Questionnaire (FABQ) work subscale had the greatest predictive validity of prolonged work restrictions for patients with acute, work-related low back pain (LBP). They reported that a score of 29 or less would reduce the risk for prolonged work restrictions from 29% to 3% in a patient receiving therapy for acute work-related LBP (negative likelihood ratio [-LR] = 0.08). Staal et al[282] found that workers with moderate FABQ and Tampa Scale of Kinesiophobia (TSK) scores had a better chance of returning to work than workers with higher (worse) scores (HR = 1.9 to 2.2 for fear-avoidance beliefs about work, and 1.9 to 2.3 for fear of movement/re-injury). Storheim et al[290] reported that the best predictors of RTW were fear-avoidance beliefs for work (95% CI: 0.38, 0.64), disability, and cardiovascular fitness. Wideman et al[324] reported that fear of

movement was the only factor from the Fear Avoidance Model to significantly predict RTW status at 1-year follow-up (*B* (regression coefficient) = 0.061, $P < .05$).

II-Holden et al investigated the predictive validity of fear avoidance beliefs as assessed by the Work Subscale (FABQ-W) of the Fear Avoidance Beliefs Questionnaire in a sample of 117 patients with a work-related musculoskeletal disorder. They identified two FABQ-W cut off points that identified participants as high or low risk of non- return to work, following an interdisciplinary rehabilitation program. ROC curves for the FABQ-W cut-offs showed maximum sensitivity was 100% for a score of ≤ 27.5, with a score of > 39.5 identified as having optimum specificity (81.9%). All participants with an initial FABQ-W score of 27.5 or less achieved a successful outcome.

Nonorganic Signs/Symptom Magnification

I – Fritz et al[105] reported that Waddell non-organic signs were not effective screening tests for the early identification of patients at increased risk for delay in returning to work after an episode of acute LBP).

II – Chapman-Day et al[65] determined that the presence of symptom magnification syndrome (SMS) did not impact the readiness to work rate, but did impact stay at work at 6 months after discharge from a work rehabilitation program. Among workers who did not display SMS, 76% continued to work full time at 6 months in contrast to 39% for those with SMS, ($P = .006$).

Evidence Synthesis and Rationale

Strong evidence indicates that a patient's beliefs, perceptions and motivation regarding injury and RTW impact the course of recovery and time to RTW following a work-related injury. The specific barriers identified in these studies were fear of movement/fear avoidance beliefs, decreased motivation to RTW, pain severity, perceived ability/disability, recovery expectations, job satisfaction, self-efficacy, locus of control at work and satisfaction with one's health care provider. A number of tools were used to identify these risk factors, including the FABQ, TSK, Roland Morris Disability Questionnaire, and Oswestry Disability Index (ODI). Early identification of patients at risk for delayed RTW can inform treatment by allowing physical therapists to integrate appropriate approaches and/or to refer patients for necessary evaluation and treatment by other providers. The potential benefits of early identification and management of recovery barriers far outweigh the costs associated with work injury cases, which include the medical and productivity costs to the worker, employer, insurer and society (see Economic Burden section). There is additional time required for the physical therapist to administer and score relevant questionnaires and/or interview the worker, but the time is modest and benefit of early identification of barriers to recovery far outweigh the cost of ineffective treatment and ongoing work absence.

Recommendation

A

Physical therapists should screen for the presence of psychosocial factors, including fear avoidance beliefs, severe pain, perceived ability/disability, low recovery expectations, poor job

satisfaction, and low self-efficacy, at the time of initial evaluation and throughout the episode of care, using validated tools and patient interview.

History of Restricted Work Ability and Prior Sick Leave

I – Oyeflaten et al[249] found individuals with previous long-term sick leave of more than 12 months for musculoskeletal or mental health conditions had three times higher risk of delayed RTW than those without prior sick leave (HRR = 3.13, 95% CI: 1.51, 6.46), while

Injury Type and Severity

I – Hou et al[158] found no difference in duration of work absence following traumatic work-related injury based on the type of injury (low energy cutting or crushing injuries versus high energy motor vehicle, fall or strike accidents), or duration of hospitalization (less than or more than 14 days). Schultz et al[276] found study participants with sub-acute back pain were seven times more likely to RTW than individuals with chronic problems.

II – A systematic review by Street and Lacey[293] with 3 prospective and 6 retrospective cohort studies reported that greater injury severity and a diagnosis of carpal tunnel syndrome, back or neck injury were predictive of poor RTW outcomes such as longer recovery periods.

II – Aas et al[3] found that individuals with acquired brain injury without comorbidities (HR = 0.519; 95% CI: 0.336, 0.802) and those with mild cognitive impairments (HR = 0.404; 95% CI: 0.214, 0.763) returned to work earlier compared to those who had comorbidities or moderate cognitive impairments.

II – Hebert and Ashworth[143] reported that amputation level, number of surgical procedures, and length of hospital stay were significantly related to days of total disability following lower extremity amputation. Each additional surgical procedure accounted for 52 additional days of disability, each day of acute care resulted in 10 additional days of disability, and there were more days away from work for transtibial (mean = 676.4, standard deviation [SD] = 100.4) or transfemoral amputation (mean = 684.6, SD = 122.1) compared to toe amputation (mean = 126.8, SD = 26.3). Significantly more days of work absence were also noted following transtibial amputation compared to a partial foot amputation (mean = 345.1, SD = 76.3).[143]

Pain and Symptom Patterns

I – Patient symptoms, pain patterns, and pain experience were associated with RTW outcomes in a number of prospective cohort studies[276,292,322,323] and an RCT.[150] The presence of radiating pain was found to increase the risk of delayed RTW in a number of studies.[276,322,323] Van der Weide et al[322] found the presence of right leg sciatica was one of the best negative predictors of RTW (HR = 0.45; 95% CI: 0.30, 0.70) and this was similar to an OR = 0.216 in the study by Schultz et al.[276] Pain intensity was associated with longer time to RTW in regression modeling (HR = 0.89; 95% CI: 0.83, 0.96) done by Heymans et al.[150]

II – Gauthier et al[111] reported that lower pain catastrophizing and lower pain severity were significant predictors of RTW. A systematic review of studies of various evidence levels, several prospective cohort studies found pain symptoms/ patterns were associated with RTW outcomes.[24,103,147,209,260] Specific factors associated with poor work outcomes were radiating/non-centralizing[24,103,148] or higher intensity pain/difficulty managing pain[24,147,260] and longer duration of problem prior to evaluation.[24,103,147,148] Cougot et al[75] found that a visual analog pain rating of less than 4/10 was predictive for RTW in those with chronic back pain. Mngoma et al[225] developed pain profiles of patients with subacute LBP, determined differences in depression and anxiety symptoms over time between the profiles, and analyzed the association between the profiles and RTW at the end of a treatment program. Patients in the severe pain cluster had higher depressive and anxiety symptom scores than patients in the moderate pain cluster. When each cluster is considered separately, only 31% in the severe pain cluster had returned to work at program completion, compared to 90% in the moderate pain cluster.

Self-Reported Function

I – Margison and French[212] found that the Örebro Musculoskeletal Pain Questionnaire (OMPQ) correctly classified claimants' ability to RTW, and concluded that it may be used for early identification of individuals likely to fail a physical therapy program and who might benefit from biopsychosocial interventions. Claimants with an OMPQ score of 147 or less were classified as "fit to return to work" and claimants with a score >147 were classified as "not fit to return to work", and received additional treatment including cognitive behavioral intervention. The model correctly classified 78% of derivation claims.[212]

II – Self-reported function or disability as identified by measures such as the Oswestry Disability Index ODI[103,148] and Roland Morris Disability Questionnaire (RMQ)[24] were found to predict workers at risk of work disability. Fransen et al[103] found three times higher risk delayed RTW for individuals with Oswestry scores indicating worse than minimal disability. Baldwin et al[24] found a 10-point increase above baseline values, indicating higher levels of functional disability, in RMQ score was associated with a 25% increase in probability of not returning to work within 1 year. Lydell et al[209] reported that perceived functional capacity and pain intensity are important predictors for RTW in the long-term, but that quality of life, measured by one global question on a visual analog scale (VAS) was not.

II – Milidonis and Greene[223] studied questions from the NHIS Disability Supplement related to work status in individuals with arthritis, and found that self-reported "difficulty lifting 10 pounds" was associated with not working (OR = 1.64; 95% CI: 1.15, 2.34). Other items were correlated with work disability status including overall number of functionally limited activities and difficulty with activities such as walking, stairs, or lifting up to 25 pounds (r = 0.30 – 0.34).

Multiple Concurrent Risks

I – Abegglen et al[7] completed a hierarchical regression analysis of individuals following mild to moderate work injury, where older age, sex (men), and higher scores on the job design, somatic condition/pain and anxiety elements of the Work and Health Questionnaire were identified as risk factors in the final model that demonstrated a medium effect size on days of work disability

(f^2 = 0.17). Heymans et al[150] performed a secondary analysis of data from a prior RCT[149] and identified several prognostic factors which were significantly associated with lasting-RTW. Multivariate analysis identified that pain intensity, pain radiation, workers predicted timing of RTW, job satisfaction, expectations about the success of treatment by the occupational physician, and social support contributed to lasting return to work. Kinesiophobia was related to later RTW during long-term follow-up. Multivariate analysis explained 18% of variance in the RTW model, indicating that despite a significant association with these prognostic factors, RTW was not predictable. Roesler et al[264] and Haahr and Anderson[133] reported that higher injury severity, higher pain, lower self-efficacy, and more functional limitations are risks for work disability. Van der Weide et al[322] reported that radiating pain, high functional disability, poor interpersonal relationships, and high work demands were related to delayed RTW (P = .0001), while high avoidance coping style predicted functional disability at 3 months for workers with LBP (P = .004). At 12 months, psychosocial factors including lack of energy and social isolation more accurately predicted functional disability (P < .0001). Vendrig et al[307] reported that self-perceived disability (P < .001) and self-report of decreased pain (P < .01) were closely related to a successful RTW. Hunt et al[162] reported that physical examination findings alone in out-of-work workers with subacute LBP had limited prognostic value in predicting RTW at 3 months (60-69% correct classification), and concluded that non-medical (eg, psychosocial, work, and economic) factors may be more powerful predictors of the course of recovery than medical assessments.

II – Armijo-Olivo et al[17] examined prognostic factors for RTW following upper extremity injuries. Multivariate modeling revealed that prior claims (1-5 prior claims with reference of prior claims, OR = 1.69; P = .0007), and > 21 physical therapy (reference 10 or less visits, OR 4.2, P < .001), and total Disabilities of the Arms, Shoulder, and Hand (DASH) score (OR = 1.01, P = .01) were predictive of work status at 90 days.

II – Abásolo et al[6] found osteoarthritis not including the spine (HR = 1.75; 95% CI: 1.14, 2.6), inflammatory disease (HR = 1.66; 95% CI: 1.009, 2.72), sciatica (HR = 1.30; 95% CI: 1.08, 1.56), and duration of previous episodes (HR = 1.003; 95% CI: 1.001, 1.005) were all risk factors for recurrent/subsequent additional work absence. De Buck et al[45] found that individuals with chronic arthritic or rheumatic problems who had a period of complete sick leave were four times more likely to experience job loss at 2 years (OR = 4.74; 95% CI: 1.86, 12.07).

II – Ernstsen and Lillefjell[92] investigated the impact of physical functioning on RTW in patients with co-morbid musculoskeletal pain and depression. They reported that self-reported physical functioning measures (muscle strength, mobility, endurance capacity, and balance) were inversely related to RTW following a 57-week rehabilitation program. The odds of a participant with higher self-reported physical functioning measures of being on an active work re-entry strategy were 23%-39% lower compared with those with poorer physical function. This suggests that the depression impacts RTW, and should be further investigated and considered in treatment planning.

II –Kuijpers et al[192] developed a clinical prediction rule for work related shoulder pain during a 6-month period to help identify workers who may be at risk for sick leave. Risk factors included cause (overuse injury/strain), sick leave in the prior 2 months (3 categories; none, 0-1 week, >1

week), pain intensity (3 categories; 0-3, 4-6, 7-10), and psychological comorbidities (anxiety, distress, depression).

III – Stromberg et al[294] found that increased duration of post traumatic amnesia was associated with work disability in individuals following closed brain injury (duration of 3-4 weeks, models vary slightly at 1, 2, and 5 years). Pre-injury employment and high school/equivalent education was associated with better long-term employment outcomes. Turi et al[304] reported that following an aneurysmal subarachnoid hemorrhage, patients had decreased RTW 1 year after stroke if they were older, depressed, and/or anxious (P = .052).

Evidence Synthesis and Rationale

Several risk factors for delayed RTW can be detected during the examination process. Strong evidence has consistently identified radicular signs and symptoms,[147,150,276,322] pain severity/symptomology/behaviors,[17,133,192,260,264,276] and the extent of functional disability determined via self-report instruments[17,24,103,133,223,276] as being associated with delayed RTW and non-RTW. Prior work absence[6,45] or episodes of leave,[17,249] were also noted in the literature risk for work disability. Co-morbid depression and musculoskeletal pain were shown to impact RTW.[92] While the conditions related to work injury are numerous, results were consistent across different areas. The potential benefits of early identification of risk factors have been discussed above and the key costs/harms of identified related to time and resources for documentation. Data on many of the risks noted in this section are already being collected as part of routine physical therapist examination, therefore, the GDG believes that there will be a low cost of implementation. However, research is needed to provide more specific risk profiles to inform clinical prognosis. Clinical research looking at risk-targeted interventions may also strengthen practice.

Recommendation

A

Physical therapists should document the risk factors that may be associated with delayed RTW or work disability during the examination process including type of injury, previous injury episodes, extended work absence prior to referral, high levels of self-reported functional disability, severity of pain, pain behaviors, and comorbidities.

Socioeconomic and Work Environment Factors

Educational Level

I – Hou et al[158] found more years of higher education was associated with early RTW in individuals with traumatic orthopedic injuries, while Storheim et al[292] found no impact of level of education on RTW following back pain.

II – Two systematic reviews identified that lower education was associated with longer sick leave for a broadly defined workforce and specifically for individuals with arthritis.[223,293] Several other studies found that education was not associated with ability to RTW in individuals

categorized with musculoskeletal pain.[17,193] One study found higher education was associated with working full time at 5 years post injury, but not at 10 year follow up.[209]

Evidence Summary

There are conflicting findings about the relationship between level of education and delayed RTW. Whether less than high school education is a barrier for returning to work, and/or higher education is a facilitator remains in question. Researchers noted that education may need to be considered in the context of the type of work and socioeconomic factors such as the competitiveness of related labor markets to fully understand the impact of education on return to work.[209,223,293]

Work Demands, Culture, and Policy

I – Oyeflaten et al[249] found manual workers had lower probability of being at work and higher probability of full disability payment when compared to administrative or professional workers (RTW HRR = 1.69; 95% CI: 1.29, 2.22; sick leave HRR = 0.73; 95% CI: 0.57, 0.94).

I – Kapoor et al[176] showed that individuals with acute back pain and higher levels of physical work had lower/negative expectations about returning to work (P <.001). Storheim et al[292] found physically demanding jobs, irregular shifts, and strict routines as potential predictors of not returning to work full time (P <.05). Heymans et al,[150] using a univariate analysis, found that daily bending and high trunk rotation demands negatively impacted RTW status for employees with back pain (P <.10), but not when performing a multivariate regression analysis.

I – Kuijpers et al[192] found overuse (OR = 1.9; 95% CI: 1.1, 3.5) as one of four risk factors in a prediction model related to sick leave for individuals with shoulder pain. Higher physical workload and lower decision authority were also associated with longer sick leave at the univariate level but not at the multivariate level. Haahr and Andersen[133] found that individuals with manual jobs (OR = 3.0; 95% CI: 1.0, 8.7] and high work-related physical strain (OR = 8.5; 95% CI 1.0, 74.7) had poor global improvement at 1 year following onset of lateral epicondyle tendinopathy, although Roesler et al[264] found job classification was not predictive of RTW for individuals with broadly defined traumatic hand injuries.

I – Van der Weide et al[322] found prognostic factors related to delayed RTW included high work quantity and problematic relationships with work colleagues (both HR = 0.82; 95% CI: 0.73, 1.00). Poorer RTW outcomes were also found with limited employee influence on work planning (HRR = 1.40; 95% CI: 1.03, 1.90),[286] and lesser willingness of work colleague to listen (HRR = 1.33; CI: 1.03, 1.72).[286] Schultz et al[275] found skill discretion and co-worker support were significant (P < .10) but only weakly associated with RTW and cost models, respectively, following back pain. Abegglen et al[7] reported the job design element of the Work and Health Questionnaire as one of several factors predicting days of work disability (f^2 = 0.47).

I – Schultz et al[276] found that work accommodation was a predictive variable for workplace impact on occupational disability for workers experiencing back pain. Availability of accommodation was associated with better prognosis for RTW (73.7%) than Non-RTW (40%).

The integrative predictive model developed by the authors, which included medical, pain, psychosocial, and workplace factors, had an overall prediction rate of 77.6%, correctly classifying 80.5% of RTW and 74.4% of Non-RTW). The study also found that union members were 2-3 times more likely to RTW than nonmembers.

II – Physical demands or work classification were identified as risk factors in several studies. Abásolo et al[6] found manual work was a risk for delayed RTW in individuals with musculoskeletal conditions compared to those in administrative/professional type positions (HR = 0.86; 95% CI: 0.79, 0.94), as well as for injury recurrence (HR = 1.19; 95% CI: 1.003, 1.42). Frequent kneeling was also a factor for recurrent problems (HR = 1.39; 95% CI: 1.15, 1.69).[6] A systematic review by Street and Lacey[293] found jobs with high levels of manual work were associated with extended absence. Lydell et al[209] found no predictive effect for bending (*P* =.513), heavy physical labor (*P* =.472), or heavy lifting (*P* =.314) after 5 or 10-years but found light labor as a positive predictor for RTW at 5-year follow-up compared to heavy physical labor (95% CI: 1.3, 17.7).

II – Fransen et al[103] found job requirements including lifting 75% of the day compared with lifting up to 25% of the day (OR = 1.9; 95% CI: 1.3, 2.8) and lack of light duties (OR = 1.8; 95% CI: 1.3, 2.7) as significant risk factors negatively impacting RTW following back pain. A systematic review by Rinaldo and Selander[260] identified unsuitable equipment and bad postures as risks for non-RTW in individuals with back, neck, or shoulder problems. Keeney et al[180] identified several work-related baseline predictors of re-injury in bivariate associations (including heavy lifting, whole body vibration, physical demands, fast pace, and excessive amounts of work [$P < .05$]) one year after back injury, however only constant whole body vibration was significant in multivariate modeling (*P* =.04).

II – Heymans et al[147] found moderate to poor job satisfaction was associated with higher risk of not returning to work at 6 months following sick leave for back pain as part of a clinical prediction rule, but the variance explained by the model was limited. Rinaldo and Selander[260] found lack of coworker/supervisor support and experiencing exclusion in decision making about work ability also hindered RTW.

II – Strong evidence of the impact of work accommodation to reduce delayed RTW and costs was found in a systematic review with mixed level studies (less than 50% of the studies were RCTs).[102] This included the role of early assessment, contact with the workplace or RTW coordinators and ergonomics. Longer durations away from work were found in a systematic review with studies of various evidence levels when light duties were not available as an accommodation, and increased rates of RTW were noted when workplace based/coordinated RTW services were available for individuals with neck, back, or shoulder pain.[260] Busse et al,[53] in a high level retrospective cohort study, found claims resolved almost twice as fast when RTW programs were available for those with back pain (HR = 1.78; 99% CI 1.45, 2.18). Availability of modified work significantly lowered duration of wage replacement in univariate analysis (OR = 0.65; 95% CI: 0.51, 0.82), but not in multivariate analysis including the DASH in individuals with work-related upper extremity injuries.[17] Muenchberger et al[231] conducted a multistage study, identifying work risk predictors that were clinically useful in facilitating RTW. Items that

facilitated RTW included a proactive response by employer, workplace accommodations, elimination of risk factors from workplace, and modified work.

Job satisfaction, locus of control at work, or perceived employer satisfaction

I – Clausen et al[71] reported that employees who perceive their work to have low meaning, based on the Copenhagen Psychosocial Questionnaire (COPSOQ), had a lower probability for returning to work than colleagues with a high meaning (HR = 0.69; 95% CI: 0.49, 0.97). Similarly, Brouwer et al[41] reported that perceived work attitude (HR = 1.33; 95% CI: 1.01, 1.75), self-efficacy (HR = 1.49; 95% CI: 1.12, 1.99), and perceived social support (HR = 1.39; 95% CI: 1.12, 1.99), are relevant predictors of time to RTW. Stapelfeldt et al[286] identified that only "job satisfaction" significantly predicted RTW (HRR = 3.26; 95% CI: 1.03, 10.3, n = 30). Abegglen et al[7] found self report measures of job design (including elements of job control, learning and perceptions of impact) predictive of days of work disability ($f^2 = 0.47$).

II – Svedmark et al[298] reported high perceived stress (15-month estimate 3.11; 95% CI: 0.93, 5.28) and low 'control of decision' (15-month estimate −3.09; 95% CI: −5.84, −0.33) were associated with more neck pain, increased neck disability, and decreased work productivity in women after a rehabilitation intervention.

Evidence Synthesis and Rationale

For individuals with general musculoskeletal or upper extremity problems, physical demands/type of work was the most consistent work-related risk factor for delayed RTW.[6,103,133,143,150,180,249,293] Work and colleague relationships were also consistently identified in the literature.[260,276,286,322] The influence of factors related to non-physical work demands such as psychological demands, meaningfulness of work, and influence on work planning were also found across subgroups.[71,132,260,264,275,276,286] Across multiple studies, work policy factors related to employer response following injury, specifically availability of RTW programs, modified duties, or ergonomic changes were noted to serve as a facilitator or barrier to RTW outcomes.[17,53,102,103,231] While some information on job demands may be identified during history and examination, worker reporting and knowledge of RTW programs may be limited, negatively impacting the physical therapist ability to plan for timely and appropriate RTW. Timely and appropriate RTW can be significantly influenced by clinician's knowledge of risks/barriers and facilitators which can impact care planning, as well as influencing determination if health services need to supplement or replace graduated RTW. Routine communication of information on job demands and availability of RTW programs could aid in minimizing RTW delays, although practically there are limited systems to accomplish this and case by case queries are routine. The time and effort of therapist communication between supervisor or stakeholders can be seen as inefficient and costly, yet there are few systems that routinely facilitate communication of RTW programs, policies and job information. Employer policy and job description information may be difficult to access or lack detail relevant to rehabilitation. Process improvement related to accessing accurate and relevant job content and return to work policy could improve efficiency in the rehabilitation process.

Recommendation

B

Physical therapists should document work demands, work culture, job satisfaction, and workplace policies regarding the availability of transitional or modified work to define potential RTW barriers and facilitators at the time of worker evaluation and reevaluation.

DIAGNOSIS/CLASSIFICATION

Work-related injury or illness is diagnosed or classified in a number of ways. Medical and regulatory diagnosis information most often follow the International Classification of Diseases (ICD), yet it is impractical to comprehensively list the extensive ICD codes relevant to injured workers and the use of codes that focus on body functions and structures has limited relevance in a guideline focusing on the activity and participation limitations.

Current diagnosis and classification related to worker function is grounded in principles presented in the Americans with Disabilities Act (ADA)[9] and the ICF. The ADA fundamentally focuses on the work ability of the patient/worker – assessing an individual's ability to perform the fundamental duties (or demands) of their job. Functionally, this means a functional gap analysis is conducted to identify work limitation diagnosis/diagnoses, as well as a review of modifications (or accommodations) that would help the worker bridge performance gaps and successfully perform work tasks. Any residual gaps in work ability form the basis of functional goal setting. The benefit of this approach is that it is tailored to the individual, however it also complicates attempts to standardize measures or classification of function as there is not a single medical standard for activity/participation-based diagnosis/classification.

Kaech-Moll et al[174] used a Delphi approach to identify a set of clinically appropriate ICF categories relevant to physical therapist practice internationally, which were broad enough to capture the variability of vocational demands while still being narrow enough for practical use (Table 4.) Many of the "mobility" domain items identified by Kaech-Moll et al[174] are consistent with generally accepted taxonomies/terminologies describing job demands in the workplace, including the Occupational Requirements Survey (ORS)[247] and Dictionary of Occupational Titles,[85] which functionally connect clinical, practical, and regulatory considerations of job matching and work rehabilitation outcomes. The ICF categories of interpersonal interactions and environmental/support and relationship also address potential risk factors for delayed RTW.

TABLE 4. ICF Activity and Participation Domains related to work and included in examination

Code	Title of Domain	Description
d4	Mobility	changing body position or location or by transferring from one place to another, by carrying, moving or manipulating objects, by walking, running or climbing, and by using various forms of transportation
d410	Changing basic body position	getting into and out of a body position and moving from one location to another, such as getting up out of a chair to lie

		down on a bed, and getting into and out of positions of sitting, standing, kneeling, or squatting.
d415	Maintaining a body position	staying in the same body position for carrying out a task (includes lying, squatting, kneeling, sitting, and standing)
d420	Transferring oneself	moving from one surface to another, such as sliding along a bench or moving from a bed to a chair, without changing body position
d430	Lifting and carrying objects	raising up an object or taking something from one place to another (includes lifting, carrying in the hands or arms, or on shoulders, hip, back, or head; putting down)
d440	Fine hand use	performing the coordinated actions of handling objects, picking up, manipulating, and releasing them using one's hand, fingers, and thumb (includes picking up, grasping, manipulating, and releasing)
d445	Hand and arm use	performing the coordinated actions required to move objects or to manipulate them by using hands and arms (includes pulling or pushing objects; reaching; turning or twisting the hands or arms; throwing; catching)
d450	Walking	moving along a surface on foot, step by step, so that one foot is always on the ground (includes walking short or long distances; walking on different surfaces; walking around obstacles, walking forwards, backwards, or sideways)
d455	Moving around	moving the whole body from one place to another by means other than walking, such as climbing over a rock or running down a street, skipping, scampering, jumping, somersaulting, or running around obstacles
d460	Moving around in different locations	walking and moving around in various places and situations, such as walking between rooms in a house, within a building, or down the street of a town
d470	Using transportation	using transportation to move around as a passenger (includes using human powered transportation; using private motorized or public transportation; using humans for transportation)
d475	Driving	being in control of and moving a vehicle or the animal that draws it (includes driving human powered transportation, motorized vehicles, animal-powered vehicles)

d5	Self –Care	caring for oneself, washing and drying oneself, caring for one's body and body parts, dressing, eating and drinking, and looking after one's health.
d7	Interpersonal interactions and relationships	carrying out the actions and tasks required for basic and complex interactions with people (strangers, friends, relatives, family members, and lovers) in a contextually and socially appropriate manner
d825	Vocational training	engaging in all activities of a vocational program and learning the curriculum material for preparation for employment in a trade, job, or profession
e3	Support and relationship	people or animals that provide practical physical or emotional support, nurturing, protection, assistance, and relationships to other persons, in their home, place of work, or in other aspects of their daily activities. The environmental factor being described is not the person or animal, but the amount of physical and emotional support the person or animal provides.

Source: adapted from ICF Browser, https://apps.who.int/classifications/icfbrowser/: last accessed 4-19-20 (recreation and leisure removed due to focus on worker role in this CPG)

Evidence Summary and Rationale

The isolated use of body functions and structures-based diagnosis leaves gaps in understanding work related limitations and prognosis and is not consistent with regulatory guidance that considers the worker's ability to perform tasks with or without accommodation (eg, modification of job processes or equipment). The risk of not accurately understanding work activity limitations can have negative impacts on communication, clinical decision making, RTW recommendations, and the patient's work participation and earnings. Research and policy updates in the area of functional diagnosis have been nominal, compared to the ICD. While the costs of updating regulatory and insurance systems to accommodate a new set of diagnosis codes may be high, therapists can include relevant ICF diagnostic classification in prognosis and goal related documentation with minimal cost. The limited ICF activity and participation domains related to work or vocational demands generated in an international Delphi study are consistent with regulatory guidance and serve as a manageable schema for classifying work related activity and participation. Relevant domains include mobility (position changes, material handling, hand and arm use, walking/moving, and transportation), self-care, and vocational training. While the GDG found support in the Delphi study for key elements of work activity and participation-based diagnosis, it acknowledges the need for physical therapists to address of body functions and structures as appropriate to manage underlying physical health conditions.

Recommendation
F

Physical therapists should document work-related diagnoses and goals during examination based on activity limitations and participation restrictions using relevant ICF domains including lift/carry, posture/positional changes, walking/moving around, hand/arm use, self-care/transfers, ability to use transportation, and interpersonal relationship skills.

CLINICAL COURSE

For this CPG we interpret Clinical Course in the context of work loss or restriction. The literature in the area of RTW is vast and varies by condition. A full review of the evidence on RTW is not feasible. However, national estimates of work injury and RTW are available from the U.S. BLS and Occupational Safety and Health Administration (OSHA) for work-related injuries and we provide a summary below that may be informative for clinical decision-making.

Duration of Care

Data from the BLS in 2018 documents more than 2.8 million non-fatal workplace injuries and illnesses, with more than 900 000 occupational injuries and illnesses requiring time away from work. Data across all injuries and illness showed a gross median of 8-9 days of time loss (days away from work [DAFW]). A categorical breakdown of the data shows 42% of individuals RTW in 1-5 days, 12% at 6-10 days, 11% at 11-20 days, 6% at 21-30 days, and 30% of cases extending beyond 30 days. (*pending 2018 and 2019BLS Injury and Illness references throughout this section)*

For musculoskeletal problems including sprains/strains, pain, or tendinopathies, data showed a median of 8-14 days of work absence. Problems related to the upper extremity, wrist, and knee all tended to exceed the gross median time loss (medians of 21, 17, and 21 days respectively) while problems such as fractures, carpal tunnel syndrome, amputations, and repetitive motion problems were associated with 30 or more days median time loss.[305]

Median time loss data can differ by worker age and occupation. Median time loss of 5-8 days is noted for workers under 45; rising to 11-14 days for individuals aged 45 and above.[306] Occupational classification can also impact work recovery with some of the highest median days of time loss occurring in transportation/warehousing (71 days), construction (55 days), manufacturing (48 days), retail (42 days), and healthcare/social assistance (30 days) jobs.

In addition to data on lost work days (DAFW), data are also collected for days of job transfer or restriction (DJTR). Survey data show that cases of job transfer and restricted duty have essentially doubled over the last 20 years demonstrating that modified or altered work strategies are consistently used for workers with musculoskeletal conditions.[2] Table 5 shows 2016 data for DAFW and DJTR in select industries to help illustrate that significant numbers of workers are participating in modified duty at the workplace during injury recovery.

TABLE 5: 2018 Data on the number of nonfatal occupational injuries and illnesses involving days away from work, restricted work activity or job transfer (adapted from bls.gov)

Industry	Total DAFW	Total DJTR	Total MSK DAFW	Total MSK DJTR
Beverage and tobacco product manufacturing	2690	4280	1100	2250
General merchandise stores	25 340	36 010	8640	15 760
Couriers and messengers	13 070	12 400	5890	6480
Waste management and remediation	6710	3950	1610	1740
Hospitals	52 190	38 860	23 510	21 670
Accommodation	19 200	17 420	6090	6550

Abbreviations: DAFW, days away from work; DJTR, days of job transfer or restriction; MSK: musculoskeletal

Median days of restricted duty or job transfer for musculoskeletal disorders ranged from 13 to 24 days.[2] Survey data for restricted duty or job transfer days for workers commonly evaluated by physical therapists included back-related conditions ranging from 12 to 20 days, shoulder related conditions 15 to 30 days, wrist related conditions 9 to 44 days, and knee-related conditions between 14 and 23 days.[2]

Evidence Synthesis and Rationale

Data from the BLS indicates that approximately 70% of individuals injured at work will RTW 1 week to 1-month post injury, and 30% of workers will return later than 1 month post injury.[306] The course of care and clinical progression of workers may be impacted by health conditions (body structures/body functions), age (greater/less than 45 years old) and role specific elements such as industry/type of work (participation). While there are some concerns about injury underreporting and there is research on specific injury, diagnosis, or occupation injury subgroups,[77,99,203,204] the size and scope of BLS data means it is often considered the most comprehensive single source of data on work injuries when compared to the costs and difficulty of accumulating similar volumes of data. Over the past two decades there has been a paradigm shift in work culture and healthcare to reduce work absence and disability through increased use of modified/restricted work duties following injury. Data from the BLS can be used to help forecast and benchmark common RTW windows regarding worker compensation cases [examples of common proprietary benchmark guidelines include the Occupational Disability Guidelines (ODG),[244] and American College of Occupational Environmental Medicine, and the Occupational Medicine Practice Guidelines].[8]

Recommendation F

Physical therapists may document and use benchmark data related to injury type, body part, job category, and age to form a prognosis and a RTW plan.

Care Delivery Patterns

II – Two studies examined care that included physical therapy or chiropractic as the primary provider of services and both reported benefits related to days of work absence (and related wage replacement costs).[34,291] Blanchette et al[34] studied characteristics associated with the timing of the first healthcare consultation for injured workers. While most workers received first consultation within 7 days, longer time to care was significantly associated with a longer episode of care in individuals experiencing their first compensable injury (HR = 0.98; 95% CI: 0.97, 0.99) and each day of delay in initial consultation resulted in a 2% drop in the HR related to ending compensation.[34] First healthcare consultation occurred significantly sooner for males, for those previously compensated, and when early RTW programs were available.

II – Stephens and Gross[291] evaluated the impact of a soft tissue injury continuum of care with a variety of services offered in different stages for patients filing uncomplicated soft tissue work injury claims. The study found primary care from physical therapists, chiropractors, or medical providers was indicated in the first 6 to 8 weeks following a claim (for cases expected to recover in that timeframe). In the second stage, claimants off work following 6 to 8 weeks were identified using computer-generated case management prompts and referred for multidisciplinary assessment to identify RTW barriers and determination of the most appropriate subsequent care which may include continued care by the primary provider or multidisciplinary rehabilitation. The continuum of care model demonstrated significant positive improvement in RTW outcomes for the intervention group (HR = 1.54; 95% CI: 1.50, 1.58), compared to a concurrent reference group comprised of injured workers with fractures and traumatic non-soft tissue injuries (which were not anticipated to show changes based on the altered clinical course). Appropriate timing of multidisciplinary assessment resulted in a positive reduction in work absence duration (HR = 8.67; 95% CI: 7.02, 10.70) compared to non-adherent care.[291] Carlsson et al[60] found multidisciplinary care was not of benefit early in the course of care for individuals with musculoskeletal care/psychiatric problems. The number of days on sick-leave was significantly higher (P =.038) in the intervention group with early multidisciplinary care.[60]

III – Bernacki et al[27] followed data from workers' compensation claims from the state of Louisiana, noting 43% of injured workers who experienced lost time received services billed in the 97xxx Current Procedural Terminology code series (Physical Medicine and Rehabilitation), which totaled 4% of the total amounts paid on the claims. Nine percent of claims involved care from a pain management physician.

Evidence Synthesis and Rationale

Physical therapists may provide services as a primary provider or following referral.[34,291] Stephens and Gross[291] reported that staged care initiated with a physical therapist, chiropractor, or physician, followed by a comprehensive multidisciplinary evaluation at 6-8 weeks for those who had not returned to work, resulted in significant improvement in RTW outcomes compared to care that deviated from the recommended multidisciplinary evaluation timeline or other key continuum elements. Blanchette et al[34] reported the number of days until initiating first consultation can impact duration of compensation (with worse results associated with delayed start of care beyond 7 days), which should be considered when the physical therapist is the first

point of care. While US physical therapist and chiropractic license provisions may provide accessible/cost-effective service provision, state regulations and/or insurer policies may limit the ability of physical therapists to act as a primary care providers following work injury, which creates a clinical research gap (related to US physical therapist practice). Stephens and Gross[291] noted that primary care was not recommended for conditions that would spontaneously resolve (which minimizes potential harms of medicalization and inefficient care). Additional research into timing and costs of care/interventions based on risk stratification and clearly designated intervention groups may provide additional information to refine one or more optimized care continuum/s for clinicians in the future.

There was no evidence of benefit initiating multidisciplinary assessment/care before 8 weeks.[60,291] Cost and duration of care may be unnecessarily increased when multidisciplinary care is initiated too early, especially when individuals may not demonstrate risks associated with delayed RTW. Although Stephens and Gross'[291] continuum of care considered services provided by multiple providers, one of the strongest effects came from the timing of the multidisciplinary assessment at approximately 8 weeks post injury, allowing for a cross-discipline standard of care. While research in this area did not discuss specific pathways post multidisciplinary care, there is research on this topic discussed later in the review.

Recommendation

C
Physical therapists may serve as the first healthcare provider or provide evaluation and treatment based on referral for workers up to 6-8 weeks post injury (initial contact is recommended within 7 days when the physical therapist is the first point of contact).

B
For patients who have been out of work for 6-8 weeks, PTs should communicate with the insurer and physician and engage in a multidisciplinary assessment to address potential barriers to work and collaboratively determine the most appropriate plan of care.

Therapeutic Alliance

Work disability is recognized as a multifactoral problem which is influenced by factors extending beyond worker characteristics,[205] including interactions with healthcare providers. One aspect of physical therapy management is the therapeutic alliance, also referred to as the working alliance, between the clinician and patient. Therapeutic alliance has been described as the social connection between therapist and patient.[100,107,137,217,292] It has three main components: 1) therapist-patient agreement on goals, 2) therapist-patient agreement on interventions, and 3) the affective bond between the therapist and patient.[100] Articles addressed in this area considered the relationship between the worker and the health system and its impact upon duration of work absence and barriers or facilitators to the course of care and RTW outcomes.

II – A systematic review of qualitative articles by Kilgour et al[186] looked at 13 medium and high quality articles that considered the impact of workers experiences after work injury on their recovery (not specific to RTW) and the interactions between injured workers, health care

providers, and worker's compensation insurers (using an 18 item quality assessment framework and meta-ethnographic method of synthesis). Although research was considered in varied countries, worker experiences were found to be similar across studies. Findings showed health provider-worker interactions can be both healing and harming and the authors considered this from the perspective of how interactions can influence the care received. Five theme areas were identified that may influence care including whether conditions are considered legitimate, workers' compensation system intrusion in the healthcare provider-injured worker relationship, non-therapeutic encounters (lack of influence on decision making and ability to obtain information, interactions with non treating examiners, and diagnosis/treatment difficulties.[186] While supportive worker-focused interactions were found to be important to injured workers, negative or difficult interactions created more adversarial relations.[186] Key concepts identified for promoting positive provider-worker interactions included demonstrating respect and understanding, assuming legitimacy, educating workers on process considerations, good communication (listening to the client), providing a supportive environment to allow worker to ask questions and voice concerns, and avoiding bias, stigma, stereotyping, or hostility.[186] Butler and Johnson[55] examined worker satisfaction using two components – bedside manner (took my pain seriously, listened to me, explained the injury and treatment) and effectiveness of care (provider delivery of active vs. passive elements of care). The study found workers were more concerned with the effectiveness of care, than bedside manner component of satisfaction, and one standard deviation of positive change in worker satisfaction with health providers reduced claim duration by about 25%.

II – Muenchberger et al[232] conducted a multistage study which identified nine key clinical factors and three clusters impacting recovery trajectory. In addition to progressive/supportive employer policies regarding RTW, clinically useful elements found to facilitate RTW included clear RTW goals, communication between the medical team and injured worker, and timeliness/intensity of rehabilitation.

II – Azoulay et al[22] performed a pilot study to investigate the effect of medical provider agreement and the patient's perceptions regarding care management for back pain. The majority (97.1%) of patients agreed with their physical therapist management of their condition and believed their care was consistent with the physician referred care. Patients disagreeing (28.6%) with their physician on medical management did not return to work later, however they were less satisfied with their medical care (P =.05) and catastrophized more about their pain (P =.03).

IV – Kirsh and McKee[188] studied the experiences of injured workers, identifying a range of financial, emotional, and physical hardship that were attributed to limited input into medical care planning and insufficient information concerning their rights or RTW processes. More than half of workers felt understood or respected by health professionals and coworkers, but not necessarily by employers, insurance boards, or society.[188] Recommendations for health providers to consider included working from a perspective of claim legitimacy, including the worker in treatment planning, and improving worker access to information about their rights.

Gaps in Knowledge

Research related to measuring working or therapeutic alliance, identifying meaningful thresholds of patient/provider agreement on alliance, the impact of worker engagement/readiness for change, and provider bias could further improve the ability to make specific recommendations in this area. Additional clinical research on leveraging facilitators and overcoming barriers to achieving alliance will strengthen practical application of this content.

Evidence Synthesis and Rationale

There is moderate evidence[50,100,115] that a worker's rehabilitation experience with health providers (and potentially the healthcare system) can influence the RTW trajectory of the worker,[55,186] although research is limited on the exact nature and impact of the underlying factors. The studies noted in this section show potential for considerable impact of the relationship component of care, noting potential negative impact on RTW delays and health services the worker may receive.[186] While the majority of studies noted an impact of the worker-provider relationship, one study found provider-patient alliance did not impact RTW outcomes but did impact satisfaction.[22] Another indicated perceptions of care effectiveness may be more important than relational components in achieving positive RTW outcomes.[55] This study helps illustrate the need to understand the impact and directionality of factors impacting the worker-provider relationship (and related outcomes). Within the context of this review, studies identified a number of areas for consideration by clinicians working with injured workers and potential areas for self-reflection. Maintaining a positive working relationship can help minimize work disability.[188,232] Understanding worker's stressors, engaging in respectful communication, and seeking worker input regarding care decisions can help foster change strategies to reduce hardships and challenges that negatively impact RTW.[188,232] Appropriate (clinical and process related) information, advice, and encouragement may also positively impact RTW.[37] Supportive worker interactions include respecting the worker and assuming legitimacy, ongoing communication, providing education, minimizing system intrusion on provider-worker relationship, and avoiding bias, stigma, stereotyping, or hostility.[186] While the responsibility for implementing best practices lies with the clinical provider, resource costs of schedule time, payment policy, and systems factors may present real or perceived barriers to implementation.

Recommendation
B
Physical therapists should foster a therapeutic alliance by including the worker in RTW planning and engaging in worker-focused supportive behaviors throughout the episode of care, documenting and addressing worker goals, preferences, and concerns.

Temporary Workers as a Vulnerable Population

II – Vermeulen et al[311,314] conducted a series of studies focused on temporary workers who developed musculoskeletal disorders. In addition to clinical care, regulatory requirements in the study setting required insurance physicians to engage in specific discussion and planning for RTW. Specific discussion of RTW was reported in 47% of cases, planning was noted in 19% of cases, and there was limited vocational rehabilitation referral for temporary workers.[314] Using a RTW coordinator and a structured/stepwise participatory RTW program (development described in Vermeulen et al[311] resulted in a non-significant delay in RTW during the first 90 days,

followed by a significant advantage in RTW rate after 90 days compared to usual care (HR = 2.24; 95% CI: 1.28, 3.94).[312]

Evidence Summary

Temporary workers may not have specific job duties to return to following injury. Lack of defined RTW job duties or clear goals can delay return to employment for temporary workers.[314] There is evidence that an interactive RTW process that identified work benefits, problem solved barriers to RTW, and achieve consensus on a RTW plan through collaboration with a RTW coordinator was associated with engagement and minimized RTW delays.[311,312]

EXAMINATION

EXAMINATION – BODY FUNCTIONS AND STRUCTURES

Few articles were identified in the literature search regarding body function and structures examination measures specifically associated with RTW. The focus of this CPG considers work activities and participation, readers are reminded this document is meant to be used as a companion document to complement condition specific CPGs/best practices.

Assessment of Body Functions & Structures

I – Hunt et al[163] evaluated whether physical examination variables could predict RTW status in sick-listed workers with subacute LBP. Only lumbar extension mobility was statistically significant (*P* =.039) at 3 months and allowed correct prediction of RTW in 62.9% of cases. There was a trend for significance for a functional test composite score created from the McKenzie push up, prone active extension, active sit-up, bilateral straight-leg raise, and timed walk (*P* =.055). This functional composite score had an overall correct classification rate of 61.6%, and the authors concluded that medical variables alone were not strongly predictive of RTW status at 3-month follow-up.

I – Werneke and Hart[325] investigated anatomical pain patterns to assess the validity of the modified Quebec Task Force Classification (QTFC) system and the Pain Pattern Classification (PPC) system to classify patients, and to predict pain and disability at discharge, and work status at 1 year. They reported that the PPC system predicted pain intensity and disability at the time of discharge from rehabilitation. Although this study lacked precision, patients classified as having non-centralized symptoms were almost nine times more likely not to RTW (OR = 8.8; 95% CI: 1.9, 40.1).

Evidence Synthesis and Rationale

The limited number of studies limits the generalizability of findings and recommendations in this area. Detection of red flag contraindications and client safety often involves body function and structure examination, necessitating systems review and targeted examination of a worker as part of a baseline evaluation to avoid significant harm. Several studies in the risk section also refer to

elements of body functions and structures examination which also support the use of exam measures in this area. While assessment of body functions and structures is often considered a standard of practice during examination, there was not significant evidence to support the use of isolated body structure and function measures to specifically predict RTW outcomes when used in isolation.

Recommendation
D
Physical therapists may examine body functions and structures during evaluation and relevant re-evaluation to identify safety considerations or impairments that underly functional limitation, but impairment measures should not be used independent of activities and participation measures for development of a RTW prognosis and care plan.

EXAMINATION – SELF-REPORT MEASURES

Work Ability Index

I – Roelen et al[263] examined the predictive ability of the Work Ability Index (WAI) to identify male construction workers at risk of premature work exit. Scores on the WAI were found to have a sensitivity of 0.63 and specificity of 0.83 for risk of disability pension at follow-up, however they did not correlate with risk of early retirement (area under curve [AUC] = 0.58; 95% CI: 0.53, 0.61) or unemployment (AUC = 0.51; 95% CI: 0.47, 0.55). WAI showed fair discrimination to identify workers at risk of disability pension with AUC = 0.74 (95% CI: 0.70, 0.77), with discriminative ability of the WAI decreasing with age.

III – Bethge et al[32] examined whether the WAI was associated with modifiable behavioral and occupational health risks, health service utilization, and intended rehabilitation and pension requests in people aged 40-54 years who received sickness benefits in 2012. They found that lower scores on the WAI were associated with a higher prevalence of occupational risk (RR = 1.74-2.4, P <.0001) for risks such as high job demands, high effort/reward ratio, or low procedural/relational justice, but was only slightly increased for behavioral health risks (RR = 1.26 – 1.54, P <.001) for behavioral factors such as high body mass index (BMI) or exercise less than 2 hours/week. People with low WAI scores had four times the health care utilization of those with high scores. Risk of intended rehabilitation and pension requests was four to six times higher in those with low WAI scores. The authors concluded that the WAI is a useful tool for identifying those workers on sick leave who would benefit from rehabilitation.

III – Notenbomer et al[240] explored the association between work ability as determined by the WAI and the frequency and duration of sickness absence. WAI scores were negatively associated with frequent (OR = 0.85; 95% CI: 0.82, 0.88), long-term (OR = 0.79; 95% CI: 0.75, 0.82), and combined sickness absence (OR = 0.74; 95% CI: 0.71, 0.77, P < .001), with WAI scores for these participants being significantly lower (mean WAI score 37.2 – 41.2) than those for the individuals in the reference group (mean WAI score of 43.2). Kinnunen and Nättie[187] investigated two items of the WAI as predictors of disability pension and long-term sickness absence over a 3-year follow-up. These items were “current work ability compared with lifetime best” (work ability score [WAS]) and “Do you believe that, from your health perspective, you

will be able to do your current job two years from now?" (future work ability [FWA]). Risk of disability pension was higher for response of poor current work ability (HR = 9.84; 95% CI: 6.68, 14.49) than for moderate (HR = 1.59 (95% CI: 1.32, 1.92). Similarly, disability pension risk was high for those who reported poor FWA (HR = 8.19, 95% CI: 4.71, 14.23). These same measures predicted an increase in number of days of long-term sickness absence. At three-year follow up, WAS (IRR = 3.08; 95% CI: 2.19, 4.32) was a better predictor of long-term sickness absence days than FWA (IRR = 1.51; 95% CI: 0.97, 2.36).

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

II – Armijo-Olivo et al[18] investigated addition of the DASH tool to a generic model predicting RTW in individuals with upper extremity musculoskeletal conditions (including fractures, dislocation, sprains, strains, contusions, nerve damage or joint disorders); AUC improved from 0.70 to 0.76 with use of the DASH. Various combinations of factors were explored to find the best predictive model. The final model included the generic model plus DASH and SF-36 (AUC = 0.77). The authors also looked specifically at the predictive validity of item 23 on the DASH, which has to do specifically with work. They found no statistically significant difference when adding the full DASH score (AUC = 0.77) or item 23 alone (AUC = 0.76) to the final model for analysis. The authors concluded that the DASH tool contributes significantly to predictability for RTW beyond generic factors, and item 23 has equal predictive ability to the total score of the DASH. Dale et al(1233) evaluated the responsiveness to change of a modified version of the Work portion of the DASH questionnaire (DASH-W). Changes in modified DASH-W scores at 1-year were moderately correlated with changes in work ability (r = 0.47), work productivity (r = 0.44), and symptom severity (r = 0.36).

III – Moshe et al[231] identified predictors of RTW in patients with upper limb conditions. Participants' score on the DASH questionnaire was the only significant independent predictor of RTW (OR = 0.915; 95% CI: 0.84, 0.99), with average DASH score in the non-RTW group (55.7) being significantly higher than in the RTW group (26.6).

Other Self-Report Measures

I – Abegglen et al[7] examined the validity of the Work and Health Questionnaire (WHQ) in workers with minor to moderate severity injuries. They also examined the prognostic ability of the WHQ to identify workers at risk of a complicated rehabilitation. Good model fit was found with the following five factors: job design, work support, job strain, somatic condition/pain, and anxiety/worries. Internal validity of the WHQ in workers with an insurance claim for mild to moderate severity injury was supported. Furthermore, the WHQ was found to have good psychometric properties useful in identifying workers with multiple psychosocial risk factors. Increased number of days of disability were found to be related to higher age (P < .001), male sex (P < .001), and higher scores on the following WHQ subscales: Job Design (P < .05), Somatic Condition/Pain (P < .001), and Anxiety/Worries (P < .001).

I – Bergström et al[26] and Gabel et al[108] examined the predictive ability of the original Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPQ) (generally related to spinal conditions) and the broader Örebro Musculoskeletal Screening Questionnaire (ÖMSQ) which applied to a

broader group of musculoskeletal conditions. Cronbach alpha for the internal consistency of the total ÖMPQ score was 0.87,[26] whereas that of the ÖMSQ was 0.83.[108] The ÖMSQ was found to have high test-retest reliability (r = 0.978, P < .001).[108] The AUC for the ÖMPSQ ranged from 0.67 (least accurate, for predicting sickness presenteeism) to 0.93 (most accurate, for predicting disability pension).[26] For prediction of long-term sick leave, accuracy decreased with time (AUC = 0.81 from 0-6 months, AUC = 0.69 from 13-24 months). Gabel et al[108] showed predictive validity of the ÖMSQ through positive likelihood ratios (+LRs) for absenteeism, long-term (28 days or more) absenteeism, functional status, problem severity, high cost, no absenteeism, and low cost. Sensitivity of the ÖMPSQ was 0.89 with a cutoff score of 90, but specificity was 0.46.[26] Findings suggest that routine assessment of psychosocial risk factors in employees with LBP could be useful in predicting future work disability, and that the ÖMSQ was shown to retain the predictive capacity of the original ÖMPSQ.

I – Gatchel et al[111] examined the association between Pain Disability Questionnaire (PDQ) scores taken before and after an interdisciplinary functional restoration program and health-related outcomes at one-year follow-up in people with chronic disabling musculoskeletal disorders. Higher pre-rehabilitation PDQ scores were associated with decreased work retention. Higher post-rehabilitation PDQ scores were associated with decreased rates of RTW, decreased work retention, and an increase in the number of individuals seeking care from another provider. Furthermore, PDQ scores were found to be associated with psychosocial factors such as perceived pain intensity and depression.

I – Roy et al[267] examined the discriminative validity of the Chronic Pain Grades questionnaire and its ability to predict disability and work status in workers with chronic upper extremity injuries. Baseline scores on the Chronic Pain Grades did not predict outcomes related to upper extremity disability, work productivity loss, or work instability. Initial scores on the Chronic Pain Grades could predict work status at 6 months, but when considering only those participants who were not working at baseline the Chronic Pain Grades questionnaire was not predictive of RTW.

I – Shaw et al[280] investigated the validity of the Back Disability Risk Questionnaire (BDRQ) for predicting the development of chronic back disability. Classification accuracy of the BDRQ was 75.0% (sensitivity 44.8%, specificity 88.8%). The presence of persistent pain, functional limitation, or impaired work status was predicted by the following seven factors in the BDRQ: injury type, work absence preceding medical evaluation, job tenure, prior back surgery, worries about re-injury, expectation for early RTW, and stress. Thus, the BDRQ may be useful in providing prognostic factors for disability in workers with back pain.

I– Trippolini et al[303] investigated the reliability and validity of the 20-item Modified Spinal Function Sort (M-SFS) using a test-retest design. The M-SFS measures a worker's perceived self-efficacy to perform work-related tasks. The authors reported item distribution showed no ceiling or floor effects. The M-SFS total score for all participants was 54.4 (SD 16.4) and 56.1 (SD 16.4) for test and retest. Internal consistency was Chronbach's alpha 0.94 and 0.95 for test and retest, respectively. The test-retest reliability measured with the ICC was 0.90 (95% CI: 0.84, 0.94).

II – Backman et al[23] designed and pilot tested the Ergonomic Assessment Tool for Arthritis (EATA) in a population of workers with inflammatory arthritis. The EATA consists of both self-report and clinician-assessment components. Assessment forms were individualized based on job demands. At 12 months, 85% of ergonomic recommendations based on the EATA were implemented for 73% of participants. The authors concluded that the EATA helps provide and implement solutions to reduce ergonomic risk factors by collaborating between occupational therapists and their clients in a single consultation. The EATA was able to assess workers in a range of occupations with varying job demands.

II – Ross et al[266] examined the ability of the Worker-Based Outcomes Assessment System (WBOAS) to improve treatment effectiveness and decrease cost of care delivered by physical and occupational therapists. The WBOAS includes the following self-report measures in part or in entirety: SF-36, Treatment Outcomes in Pain Survey (TOPS), and Work Limitations Questionnaire (WLQ). Physical and occupational therapy care that included the WBOAS was found to improve physical functioning, injury avoidance, and cost-adjusted income based on these dimensions ($P \leq .05$). Mental health, pain-symptoms, and RTW or stay-at-work success, as well as cost-adjusted outcome on these dimensions, were not improved ($P > .05$).

II – Van Schaajik et al[272] evaluated the reproducibility of the Work Ability (WA) and Work Functioning (WF) instruments. Work Ability is the extent to which people are capable of doing their job satisfactorily with respect to the job demands and their health. Work Functioning is described as the relationship between health-related capacities and the ability to fulfill obligations to meet expectations in the workplace. The participants completed the WA questions and composite WF questionnaire twice, one week apart. General, physical and mental/emotional WA had moderate ICC values of 0.52, 0.69 and 0.56, respectively. ICC values of WF were found to have good reliability at 0.85. Generally, the SEM of the WA ranged from 0.71 to 0.75 across multiple dimensions. The smallest detectible change in the WA elements ranged from 1.98 to 2.09. The SEM of the WF score was 4.78, and the smallest detectible change was 13.25.

II – Wastberg et al[321] performed a psychometric analysis of the Worker Role Self-Assessment (WRS) instrument. Test/retest reliability using Altman categories ranged from "fair" to "very good", with most items showing "good" or "moderate" agreement. Internal consistency was measured in two samples, with a Cronbach alpha at the 1-2 week interval between sampling of 0.75 at first measurement and 0.83 at second measurement, while values for first visit and completion of work training portion of the intervention were 0.65 and 0.78 respectively. One item showed good predictive validity of rehabilitation outcomes ($P = .009$, "I do not think work will be part of my life in the future"). The utility of the WRS was found to be good, but a ceiling effect was found which caused limitations to assess change. Because of this, the authors recommend revision of the WRS with further testing to follow.

III – Many other studies found varying degrees of support for additional measures, including the Readiness for Return to Work (RRTW) scale,[39,255] Roland Morris Disability Questionnaire,[83] Worker Role Interview (WRI).[307]

IV– Haraldsson et al[140] reported support for the Structured Multidisciplinary work Evaluation Tool (SMET).

TABLE 6. Self-report measures examined in the literature and their recommended uses

Outcome Measure	Author	Level	Population	Validated for
Back Disability Risk Questionnaire (BDRQ)	Shaw et al[280]	I	Adults with nonspecific low back or thoracic pain of occupational origin, with onset or exacerbation in the past 14 days	Sensitivity 44.8%, specificity 88.8%. May be useful in providing prognostic factors for disability in workers with back pain.
Chronic Pain Grades	Roy et al[267]	I	Individuals with work-related injuries attending upper-extremity specialty clinics	Baseline Chronic Pain Grades scores could predict work status at 6 months, but could not predict outcomes related to upper extremity disability, work productivity loss, or work instability
Disabilities of the Arm, Shoulder and Hand (DASH)	Armijo-Olivo et al[18]	II	Worker's compensation claimants with upper extremity injuries	DASH in addition to generic model aids in predicting return to work. Item 23 alone has equal predictive ability to total DASH score.
DASH	Moshe et al[231]	III	Patients with upper limb disorders referred for an occupational fitness evaluation	DASH score was a significant predictor of return to work.
Disabilities of the Arm, Shoulder and Hand-Work (DASH-W)	Dale et al[79]	II	Healthy workers possibly at risk for carpal tunnel syndrome	Changes in DASH-W scores at 1-year recall were moderately correlated with changes in work ability, work productivity, and symptom severity.
Ergonomic Assessment	Backman et al[23]	II	Workers with inflammatory arthritis	Helps provide and implement solutions to

Tool for Arthritis (EATA)				reduce ergonomic risk factors
Modified Spinal Function Sort (M-SFS)	Trippolini et al[303]	I	Patients with chronic (>3 months), nonspecific musculoskeletal disorders	Recommended to assess perceived self-efficacy for work-related tasks
Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ)	Bergström et al[26]	I	Employees with back pain	Good internal consistency. Sensitivity 0.89 with cutoff score of 90, specificity 0.46. Most accurate for predicting disability pension, least accurate for predicting sickness presenteeism. Accuracy in predicting long-term sick leave decreased with time.
Örebro Musculoskeletal Screening Questionnaire (ÖMSQ)	Gabel et al[108]	I	Patients with acute musculoskeletal injuries	Good internal consistency and high test-retest reliability. Predictive validity for absenteeism, long-term absenteeism, functional status, problem severity, high cost, no absenteeism, and low cost.
Pain Disability Questionnaire (PDQ)	Gatchel et al[111]	I	Patients with chronic, disabling musculoskeletal disorders	Higher scores associated with decreased work retention, decreased rate of return to work, increased number of patients seeking care from another provider, and psychosocial factors
Roland Morris Disability Questionnaire (RMQ)	Denis et al[83]	III	Female nurses with low back pain	Worse disability on RMQ correlated with increased work limitation. RMQ scores showed strong discrimination between nurses in the regular group and those in the off/modified work group.

Readiness for Return to Work (RRTW)	Braathen et al[39]	III	Patients in a 5-day inpatient rehabilitation program, with musculoskeletal disorders, mental health problems, or fatigue syndromes	Satisfactory content validity and internal consistency
RRTW	Park et al[255]	III	Patients with open worker's compensation claims for musculoskeletal disorders	Satisfactory construct validity and concurrent validity
Structured Multidisciplinary work Evaluation Tool (SMET)	Haraldsson et al[140]	IV	N/A	Evaluates physically, environmentally, and psychosocially experienced demands. Very good content validity, good pragmatic and communicative validity
Work Ability Index (WAI)	Roelen et al[263]	I	Male construction workers	WAI scores associated with risk of disability pension, no correlation with risk of early retirement or unemployment
WAI	Bethge et al[32]	III	People aged 40-54 years who received sickness benefits in 2012	WAI is sensitive for identifying workers who would benefit from rehabilitation. Lower scores were associated with higher prevalence of occupational and behavioral health risks, as well as increased health care utilization.
WAI	Notenbomer et al[240]	III	Employees in the Netherlands who participated in an occupational health survey	Poor-moderate scores associated with disability pension and increased number of days of long-term sickness absence

Worker-Based Outcomes Assessment System (WBOAS)	Ross et al[266]	II	Patients with musculoskeletal injuries referred to physical/occupational therapy	Physical/occupational therapy care including WBOAS improved physical functioning and injury avoidance. It did not improve mental health, pain/symptoms, return to work or stay-at-work success
Work and Health Questionnaire (WHQ)	Abegglen et al[7]	I	Workers with minor to moderate injuries	Internal validity supported, good psychometric properties useful for identifying workers with multiple psychosocial risk factors.
Worker Role Interview (WRI)	Velozo et al[307]	III	Workers with low back pain recruited from industrial rehabilitation, workers of all injury types recruited from work-hardening programs	Not supported as a valid measure for predicting return to work outcomes
Worker Role Self-Assessment (WRS)	Wastberg et al[321]	II	Unemployed patients with chronic pain syndromes, stress-related disorders, and/or medical/social problems	Satisfactory test/retest reliability and internal consistency. Ceiling effect affected sensitivity to change. Authors recommend revision and further testing.
Work ability & work functioning instruments	Van Schaajik et al[272]	II	People working at least 12 hours/week at the same job for the past 4 weeks	Work ability showed instrument showed moderate reliability; work functioning instrument showed good reliability.

Evidence Synthesis

Many self-report measures have been published (Table 6). The WAI was found to be predictive of disability pension, long-term sickness absence, and workers who would benefit from a rehabilitation program, but not of unemployment or early retirement. Scores on the DASH were found to be predictive of RTW outcomes in workers with upper extremity conditions. The

DASH-W, or item 23 alone, may be considered in place of the full DASH questionnaire. The WBOAS, WRS, and Chronic Pain Grades were found to have conflicting evidence in RTW outcomes. The benefits of using these self-report measures (establishing a RTW prognosis, determine suitability for rehabilitation and inform the plan of care) outweighs the time to administer and score the tool.

Recommendation
B
Physical therapists should use validated generalizable or condition specific self-report measures, such as the WAI and DASH-W, that specifically address RTW in the initial evaluation to estimate RTW related outcomes and guide the course of treatment.

EXAMINATION – ACTIVTY LIMITATIONS – PHYSICAL PERFORMANCE MEASURES

Physical performance measures in work rehabilitation are performance-based tests used to evaluate the worker's ability to perform physical tasks related to work. Most of the investigations assessed worker ability with commercially available Functional Capacity Evaluation (FCE), a series of performance-based tests that include material handling, mobility, and sustained positional tolerance.

Use of physical performance tests to identify work ability

I – Gross and Battié[123] investigated the Isernhagen Work Systems' (ISW) FCE and reported that this FCE was a weak predictor of work ability in 336 patients with upper extremity work-related injuries. They reported that higher weights lifted from waist height to overhead (HR = 1.5 – 1.7) and floor to waist (HR = 1.2 – 1.3) were modestly associated with faster RTW. Similarly, Kuijer et al[192] explored to what extent the standardized IWS FCE matched observed work demands in workers with chronic LBP. They reported that seven of the 11 FCE activities analyzed could be directly matched with work demands. The standardized IWS FCE was not able to match with all observed work demands in the 18 occupations studied.

II – Matheson et al[218] evaluated the ability of the IWS FCE tests of lifting ability and grip force to determine RTW in a population of out of work individuals. The IWS FCE lifting ability (floor to waist, waist to crown, horizontal) and two measures of grip force (whole-hand isometric grip force) were used in the study. For each IWS FCE performance variable, those who returned to work performed better than those who did not RTW (all: $P < .05$). Of the performance variables, only floor-to-waist lift ($P = .028$) was related to RTW, with greater lift ability related to improved likelihood of RTW. Grip tests were not related to RTW.

II – A study by Chapman-Day et al[66] investigated the impact of symptom magnification syndrome on rehabilitation and RTW. The presence of symptom magnification was determined from information gathered on 13 measures during intake and FCE which was used to establish a work conditioning/work hardening program. The RTW status was determined by the therapist by comparing the patient's current functional ability to the employer's job description or self-reported job demands described at intake. If the therapist deemed the patient to be able to perform all functions, the patient was categorized as RTW full duty. If the patient could meet

some but not all demands, RTW modified duty was recommended. Some patients were determined to need further medical care and were discharged from the program to return to active care with physician. Following discharge from the program, Chi square analysis found no relationship between symptom magnification scores and status at discharge. The RTW full duty rate for those with symptom magnification was 72%, and for those without was 80%, a non-significant difference, suggesting that symptom magnification does not affect RTW.

III – Denis et al[83] reported that the RMQ and Sørenson back extensor endurance tests correctly classified 87% of the nurses' work status. The authors noted that RMQ was the single best measure to discriminate between the off/modified work group and the regular work group of nurses with 92% sensitivity and 83% specificity (based on a cutoff score of 2.5 RMQ and 67 sec for Sørenson). The authors concluded that both the RMQ and Sørenson test can be used as a diagnostic and prognostic tool in this Canadian nursing population.

II – Gross et al[131] used the WorkWell FCE (formerly the Isernhagen Work Systems FCE) at the beginning and end of the rehabilitation program to evaluate the rate of clinically important functional change in workers with musculoskeletal disorders. The clinically important rate of change, 5 kg/week, was based on workers who RTW at their pre-accident status.

III – Gross et al[130] reported that better performance on the IWS FCE was related to faster time to Total Temporary Disability (TTD) suspension and claim closure. Claimants were approximately 9% less likely to experience TTD suspension at any time in the follow-up year for each FCE task item rated as "failed." Higher amounts of weight on floor to waist lift were crudely associated with case closure. Increased number of failed tasks related to longer time to claim closure.

Short-form FCE (an abbreviated physical performance test) to predict work ability

I – Branton et al[40] evaluated the ability of a short-form FCE to predict future timely and sustained RTW and reported that overall FCE performance was not significantly associated with future recurrence (OR = 1.31; 95% CI: 0.48, 3.60).

II – Gross et al[129] found no statistically or clinically relevant differences between the short-form FCE, that takes 43% less time to complete, and standard FCE in regards to median claim duration, days to claim closure, and recurrence.

III – Gross et al[128] developed a short form FCE based on 3 items from the IWS-FCE, and then validated the data from a cohort of participants who had undergone the IWS-FCE; a second validation was composed of participants who had undergone a modified one-day FCE. After Cox regression analysis, only three items remained independently predictive. These three items were maintained within the short-form FCE and include floor-to-waist lifting, crouching, and standing. They reported that data analysis of the three item FCE meets the predictive ability of the IWS-FCE (P =.05).

Ability of FCEs to predict sustained work ability

I – Kuijer et al,[192] also using the standardized IWS-FCE in a small sample of 18 participants to determine if the FCE results could be matched to the participants' job demands. They found that the general (non job-specific) FCE result did not predict the participant's ability to perform specific job demands and did not predict sick leave.

II – Chapman-Day et al[66] identified the presence of symptom magnification during intake and FCE. They reported that at 6-month follow-up the relationship between symptom magnification and work status was statistically significant ($P = .006$), but not immediately following an industrial rehab program. This suggests that although symptom magnification does not predict RTW (study details discussed above), it may impact sustained work ability several months later.

II – Gross and Battie[127] found that 46 of 226 patients (20%) experienced a recurrent back-related event within the year following FCE, with 16% of those with a higher number of failed tasks having recurrent events in contrast to 25% of those with fewer (< 8) failed tasks having a recurrent events after RTW. Gross et al(942) also reported that the FCE did not predict sustained work ability in 336 patients with upper extremity work-related injuries, with no difference found based on the type of upper extremity injury.

II – Gross and Battie[124] reported that the IWS FCE performance indicators were not significantly correlated with self-reported outcomes of work status (future recurrence) ($r = 0.02 – 0.07$), pain intensity ($r = 0.02 – 0.09$), and disability ($r = 0.08 – 0.26$).

Reliability and/or validity of FCE models

Job-specific FCE

II – Cheng and Cheng[68] examined the predictive validity of a job-specific FCE for RTW of patients with distal radius fractures. The FCE protocol used a psychophysical testing approach and was customized to be job-specific using the standardized FCE method, the Baltimore Therapeutic Equipment Work Simulator. Among the patients, 63.9% were classified with a pass rating, and 36.1% had a fail rating. The recommendation to return to previous job (94.83%) was correct more often than the recommendations do not work at the moment (60.47%), change job (52.63%), and return to previous job with modifications (9.38%). A longer period from injury to FCE and compensable injury reduced the predictive ability of job-specific FCE. The authors concluded that job-specific FCE could have better predictive validity in patients with a specific injury versus a nonspecific injury, particularly in determining whether a worker can return to his or her previous job.

The Ergo-Kit FCE

I – Gouttebarge et al[116] reported poor criterion-related validity for future work disability for the two isometric Ergo-Kit FCE lifting tests ($-0.17 < r < 0.07$) and moderate for the three dynamic lifting tests ($P < .01$), especially the carrying lifting strength test. Predictive validity on sustainable RTW was poor.

II – Caron et al[62] evaluated the relevance of the Ergo-Kit FCE findings for healthcare professionals making RTW determinations, and also explored the relationship between the patient's self-report and test findings. Discriminative validity and convergent validity

evaluated with Pearson correlation coefficients showed a poor convergent validity between the scores on the Von Korff questionnaire and the Ergo-Kit FCE lifting tests ($-0.29 \leq r \leq 0.05$).

The Physical Work Performance Evaluation

II – Lechner et al[198] examined the predictive validity of the Physical Work Performance Evaluation by determining whether the test results accurately predicted the worker's RTW status at discharge and at 3 and 6 months post-discharge from a work rehabilitation program (n = 30). They reported moderate agreement ($k = 0.69 – 0.74$) between the recommendations for RTW based on the FCE and actual RTW actions, suggesting that the FCE is a valid predictor of RTW ability.

II – Tuckwell et al[304] evaluated the test-retest reliability for nine tasks in the "dynamic strength," "position tolerance," and "mobility" sections of the Physical Work Performance Evaluation. The authors reported substantial test-retest reliability ($k = 0.75 – 0.77$) for four Dynamic Strength tasks of the Physical Work Performance Evaluation. Percentage agreement for the three "position tolerance" tasks ranged from 66.7% – 83% and the k coefficients also varied widely (0.38 – 0.70), with sitting the weakest, and better scores for standing and kneeling. Mobility tasks had variable agreement, ($k = 0.19 – 0.60$), with better agreement for squatting and walking than stair climbing.

The Blankenship FCE

III – Brubaker et al[44] determined the sensitivity and specificity of the validity criteria of four components of the Blankenship FCE, and reported a sensitivity of 80% and a specificity of 84.2% in determining submaximal effort. The 70% cutoff score developed by The Blankenship Group was shown to provide the greatest diagnostic accuracy for determining effort. Five indicators of validity were shown to have 70% sensitivity or greater and 12 indicators had 100% specificity.

Progressive Isoinertial Lifting Evaluation (PILE)

II – Haldorsen et al[136] used physical testing to place a patient into a prognostic category for RTW. The evaluation included a self-report questionnaire, spinal mobility, number of tender points, The Sock Test, and the PILE lifting test. They reported that the instrument differentiated between patients with different prognosis for RTW, independent of the type of treatment, especially for patients classified to have poor prognosis. For those with poor prognosis, 44% returned to work after 14 months compared to 61% among patients with good prognosis and 57% among patients with medium prognosis.

II – The PILE was used to investigate the sensitivity and specificity of maximal effort testing in FCE by Lemstra et al.[199] A population of out of work workers with back pain was used (n = 90). One group was asked to perform maximally and the other group was to perform at 60% of their perceived maximum, and to lead the evaluator to believe they were performing maximally. The PILE lifting protocol, handgrip tests, and a clinical examination performed by a physical therapist were done. The proportion of participants the tester thought was giving 100% effort who were actually randomized into the 100% effort group was 30 out of 46, or 65.2% (sensitivity). The proportion of participants the tester thought was giving 60% effort who were actually randomized into the 60% effort group was 37 out of 44, or 84.1% (specificity). If the

evaluator thought the participant was giving 100% effort, the probability that the participant was in the 100% effort group was 30 out of 37, or 81.1% (positive predictive value). If the evaluator thought the participant was giving 60% effort, the probability that the participant was in the 60% effort group was 37 out of 53, or 69.8% (negative predictive value).

Semi-Structured Interviews to determine work ability

II – Gross et al[121] compared the improvement in functional levels at baseline and at discharge between WorkWell FCE results and the patient's report during a semi-structured functional interview based upon the WorkWell FCE. They found that claimants undergoing FCE had 15% higher average functional work levels recommended at time of assessment ($P < .002$) but differences at other follow-up times were smaller (0 – 8%) in favor of functional interviewing and not statistically significant. Gross et al[122] compared the functional outcome and difference in compensation between a semi-structured interview and the WorkWell FCE. The interview took place during a half-day session (1.5 – 3 hours). Functional levels were similar across groups (mean, 2.4 out of 4 for FCE, 2.3 out of 4 for interview; $P = .58$) representing a mean difference of 3%. In regards to compensation outcomes, there were no statistically significant differences between groups.

The Joule FCE

IV – The interrater reliability for the Joule FCE was investigated by Mitchell et al[225] for lifting and carrying (bilateral and unilateral) and forceful tasks (lifting, carrying-bilateral and unilateral). Interrater reliability for determining the last safe weight lifted for each forceful task subtest of this FCE protocol was high as evaluated by intraclass correlation coefficient > 0.90 and with narrow CIs, ranging from 0.738–0.987 for unilateral non-dominant carry to 0.939–0.997 for waist to floor carry. Reasons for terminating tests and identifying maximum safe capacity were also identified as having high interrater reliability, as determined by percentages (%) of agreement, ranging from 97.2% to 100% for agreement for reasons for terminating tests and from 97.2% to 98.6% for identifying maximum safe capacity, but was only between 8.3% and 50% for full agreement for identification of last weight safely lifted in forceful tasks.

II – Although the study by Scheman et al[273] did not assess a specific FCE model, the authors reported that the evaluator's instructions impact results. There was no significant difference in the percentage of change in performance between groups when they were given the same instructions. Patients who were told test results would determine job classification showed less improvement in their performance on the physical capacity evaluation following 3 weeks of treatment than patients advised to perform to the best of their ability. Patients told to do their best improved significantly more than the other group on all 3 measures (floor-to-waist lift, waist-to-chest lift, and weight carried).

Evidence Synthesis and Rationale

Most of the studies included in this systematic review investigated specific commercially available FCE models to evaluate work ability. Investigations used varied methodology, leading to challenging analysis. Full FCE protocols generally include 11-15 performance tasks and last 3-6 hours over one day. There is moderate evidence that lifting tests (primarily floor to waist) predict time to recovery and current work ability.[123,130,136,218] Material handling tasks have

demonstrated better reliability than mobility and positional tolerance tests.[304] There is strong evidence that FCE does not predict sustained RTW, which is not surprising since there are multiple psychosocial, workplace, and environmental factors that impact sustained work. Standardized FCEs may not match a worker's specific job requirements,[192] an important consideration because job-specific testing is reported to have better predictive validity.[68] Users of FCE should be aware of the reliability and validity outcomes that support or refute the FCE model or specific performance measures used, and should be aware that not all studies demonstrated validity or consistency across all subtests of a model. Physical therapists need to consider the worker's stage of healing and symptom reports and physiological responses during performance testing to ensure safety. Additional research on test method reliability, validity, usefulness, and safety are available outside the specific scope of this systematic review. A barrier to implementing FCE is the time and costs associated with the full test battery. A short-form FCE and semi-structured interviews were developed to mitigate these barriers.

The short-form FCE and semi-structured interviews had similar outcomes as a full FCE,[40,129] which improves the utility and cost effectiveness of these performance measures. Gross et al[129] also reported good worker satisfaction with the shortened test battery. The short-form FCE has protocols for the trunk and upper and lower extremities, with 5 primary tasks per protocol (combinations of material handling, mobility, and positional tolerance). Therapists can add additional measures if needed. Both the short-form FCE and semi-structured interviews take 1.5 - 3 hours to perform. Full battery FCE, short-form FCE, and semi-structured interviews are most often performed at the end of a treatment episode when a fitness to work determination is needed.

Clinicians engaged in treating injured workers are able to evaluate the worker's ability to perform his/her essential job functions during the course of care by using selected physical performance tests. The use of selected item performance tests (with therapist discretion to add relevant tests) is supported by moderate evidence.[83,123,129,130,136,218] In addition to cost savings, testing in this manner can be more easily integrated into a treatment session than longer, more comprehensive testing. By using physical performance tests throughout the treatment episode, the clinician can monitor the worker's response to testing from one treatment session to the next, and adjust the activity/exercise program as necessary. Testing throughout the episode of care provides stakeholders with specific information regarding the worker's ability and tolerance for RTW.

Gaps in Knowledge

Future research should aim to elucidate the most efficient testing methodology, especially for evaluation of movement and positional tolerance, sustained work tolerance, and clinician training protocols.

Recommendation

B

Physical Therapists should use physical performance testing including a full FCE test battery, a short-form FCE, job specific functional testing, or semi-structured interview to inform treatment, predict time to recovery and current work ability but should not use the testing to predict sustained RTW.

F
Physical Therapists should measure the worker's ability to engage in work activities throughout the episode of care using standardized, valid, and reliable physical performance tests to inform the plan of care.

EXAMINATION – PSYCHOSOCIAL FACTORS

The following studies validated tools that evaluate both work and psychosocial factors to identify people at risk of delayed recovery or delayed RTW:

I – Abegglen et al[7] reported that the WHQ has good psychometric qualities (internal validity) with high clinical utility to identify injured workers with multiple psychosocial risk factors for a complicated recovery. They identified 5 subscales, and each subscale was predictive of at least one of the evaluated outcomes 18 months post-injury. The 5 coefficients demonstrated a significant relationship with days of working disability: sex, age, job design ($P < 0.05$), somatic condition/pain ($P < 0.001$), and anxiety/worries ($P < 0.0001$).

I – Margison and French[213] reported that the OMPQ could correctly predict clinical discharge status ("fit" versus "not fit" for RTW) for 85% of claimants after a standardized 6-week physical therapy-based work conditioning program. The derived OMPQ cutoff score of 147 was tested in two language groups both separately and combined. The combined validation group showed 85% of 211 cases were correctly classified. Sensitivity was 37.5%, specificity was 89.2%, positive predictive value was 28.6%, and negative predictive value was 94.6%.

II – Haldorsen et al[136] developed and validated a brief standardized screening instrument to differentiate between patients with good, medium, or poor prognosis for RTW. The screening instrument consisted of a patient completed questionnaire (15 questions, related to psychological and motivational factors, based upon earlier research) and physical therapy evaluation that included flexibility, tender points, SOCK test, and a PILE test. Their instrument differentiated between patients with a different prognosis for RTW, independent of the type of treatment. This was especially the case for patients classified to have poor prognosis (44% returned to work after 14 months compared to 61% among patients with good prognosis and 57% among patients with medium prognosis).

II – Iles et al[166] reported the predictive validity of the Plan of Action for a Case tool that allows case managers to identify workers at risk of delayed RTW. The 41-item Plan of Action for a Case tool gathered information from the worker, health practitioner, and employer, and improved the ability to identify workers at risk of ongoing work disability and identified modifiable factors for a case-manager led intervention ($P < .001$).

The following studies validated tools that evaluate fear-avoidant beliefs to predict people at risk for delayed recovery or delayed RTW:

I – Fritz and George[105] reported that the work subscale of the FABQ was the strongest predictor of work status of the variables tested on 78 workers with LBP. The -LR was 0.08 for scores less

than 30, and the +LR (meaning the presence of fear avoidance beliefs) was 3.33 for scores greater than 34.

I – Wideman and Sullivan[326] developed a Cumulative Prognostic Factor Index to better evaluate prognosis and to facilitate decisions regarding clinical management. They reported that the risk associated with problematic recovery increases with Cumulative Prognostic Factor Index scores above 0 and that levels of risk are most severe with elevated scores on all 3 psychosocial factors (fear of movement, depression, and pain catastrophizing).

The risk of delayed recovery for workers with subacute LBP was investigated with the following tools:

I – Schultz et al[274] determined the predictive validity of a Psychosocial Risk for Occupational Disability Scale using a paper and pencil version. Stepwise backward elimination resulted in a model with these predictors: Expectations of Recovery, SF-36 Vitality, SF-36 Mental Health, and Waddell Symptoms. The correct classification of RTW/Non-RTW was 79%, with sensitivity (Non-RTW) of 61% and specificity (RTW) of 89%.

I – Shaw et al[280] assessed the validity of the BDRQ to predict development of chronic back disability. The BDRQ is a 16-item patient questionnaire that provides a self-assessment of factors related to prognosis for work-related back pain. The study included 519 working adults seeking outpatient care for acute, work-related back pain. Classification accuracy of the BDRQ was 75.0% (44.8% sensitivity, 88.8% specificity). Classification accuracy at 3 months was 76.3%.

I – Fritz et al[106] reported that nonorganic tests, using the definitions given by Waddell et al, did not demonstrate predictive validity for RTW for people with subacute LBP.

II – Carleton et al[59] reported an association between Waddell's Symptoms Screen and measures of psychological distress, pain, and treatment outcomes. Patients who endorsed more than two of Waddell's symptoms reported higher levels of psychological distress, perceived disability, pain intensity, and pain duration. Patients in the negative symptoms group were significantly more likely to RTW (50%) in comparison to people in the positive symptoms group.

II – Franche et al[102] reported acceptable internal validity and concurrent validity of the Readiness for Return-To-Work Scale (RRTW) scale. The RRTW was used to assess the stage of readiness for RTW in a cohort of workers who had been absent from work due to a work–related back or upper extremity musculoskeletal disorder. For workers (n = 333) not working, 60% of the variance was explained by four factors—a) Precontemplation, b) Contemplation, c) Prepared for Action-Self–evaluative, and d) Prepared for Action-Behavioral. For those working, 58% of the variance was explained by two factors—(1) Uncertain Maintenance and (2) Proactive Maintenance.

III – Park et al[255] examined the construct and concurrent validity of the RRTW in a population of claimants enrolled in an occupational rehabilitation program. They reported that construct and

concurrent validity of the RRTW was supported based on their analysis. Mental health was found to significantly compromise RTW with the non-job attached/not working group.

TABLE 7. Exam Questionnaires Validated for the Indicated Psychosocial Construct

Psychosocial Factor	Validated Questionnaires
Psychosocial & Work Factors	• Work and Health Questionnaire (WHQ)[7] • Örebro Musculoskeletal Pain Questionnaire (OMPQ)[213] • Plan of Action for a Case (PACE)[166]
Fear-Avoidant Beliefs	• Fear Avoidance Beliefs Questionnaire (FABQ)[105,156] • Cumulative Prognostic Factor Index (CPFI)[327]
Psychosocial Factors & Low Back Pain	• Psychosocial Risk for Occupational Disability Scale[274] • Back Disability Risk Questionnaire (BDRQ)[280] • Waddell's Symptoms Screen (WSS)[59]
Stage of Change	• Readiness for Return-To-Work Scale[102,255]

Evidence Synthesis and Rationale

Tools and screening examinations have been investigated for their reliability and validity in identifying the presence of psychosocial factors, alone or in combination, that contribute to delayed recovery or delayed RTW. These tools are listed in Table 7. Pain severity, pain catastrophizing, fear-of-pain, readiness for change, and psychosocial factors at the workplace may impact recovery, and their presence can be identified through questionnaires and some exam processes. While Waddell's Non-organic Signs and Symptoms may suggest the presence of psychosocial factors that might interfere with recovery, diagnostic accuracy has not been demonstrated. As seen in the Ernstsen and Lillefjell[93] investigation, self-reported physical function was inversely related to RTW in patients with comorbid depression, indicating that RTW is impacted by more than physical factors.

Recommendation

A

Physical therapists must use reliable and valid tools, as part of the evaluation and throughout treatment to identify the presence of fear avoidance, psychosocial risk, or readiness for change that impact RTW outcomes to guide patient management.

EXAMINATION – JOB DEMANDS

Understanding job demands is a key component of activity and participation prognosis, care planning, and RTW decision making. Job demands form the goal or standard in assessing vocational abilities. Several studies identified measures that aim to characterize work demands as a discrete activity or as part of a job matching activity.

I – Baker and Jacobs[24] evaluated the accuracy of using remote methods (tele-ergonomics) to identify demands/risks and potential mismatches between workers and their computer workstations. Sixteen diagnostic questions of the Computer Workstation Checklist were used with photographs to supplement the questions. Remote ergonomic evaluation was compared to results of an onsite computer workstation visit with 92% of mismatches identified, sensitivity of 0.97 and specificity of 0.88.

II – Backman et al[23] looked at development of the Ergonomic Assessment Tool for Arthritis which included a self-report instrument component and semi-structured ergonomic assessment interview (with supplemental photographs). The interview components include a work task summary, questions about work organization/work process, and physical demand questions related to sitting, standing/walking, upper extremity use, and materials handling. In addition to a content validation process, the tool was evaluated in pilot testing demonstrating feasibility as a comprehensive ergonomic assessment, and usefulness/flexibility to assess both office work and physically demanding jobs. At 1 year, 85% of recommendations were implemented by 74% of the participants.

III – Velozo et al[307] researched the Worker Role Interview that examines worker's physical status and functional performance, motivation, lifestyle, capacity, and environmental elements. The 3 studies included in the article found the semi-structured interview had good measurement properties/reliability and was independent of diagnosis; however, none of the variables predicted RTW, with OR of 0.33 to 1.0 (small study size may have had an impact). The authors concluded the semi-structured interview may help identify potential worker-work disconnects between perceptions/ability or to help identify barriers to RTW.

IV – Escorpizo et al[94] reviewed ICF core sets for arthritis and musculoskeletal problems to identify measures that related to productivity and employment, linking questionnaires to domains relevant to ICF core sets for arthritis and musculoskeletal problems. All of the questionnaires considered ICF relevant information related to activities and participation (including employment). The aim of the study was not to propose which questionnaires were preferred, however the Work Activity Limitation Scale (WALS), WRF, and Work Limitations Questionnaire – 25 items (WLQ-25) had the highest coverage of work demands commonly discussed in this CPG including carrying, moving, and handling objects (d430–d445), interpersonal relationships (d710–d760), and elements of general tasks and demands (d210–d240). The overall kappa coefficients for percentage of linkage agreement with ICF categories were 0.75 for the WALS (bootstrap CI: 0.61, 0.94), 0.66 for WRF (CI: 0.47, 0.94), and 0.73 for WLQ-25 (CI: 0.66, 0.84).[94]

Clinical Application of Job Demand Information

II – Bernacki et al[28] noted that for RTW planning to be effective, a task or job analysis should be performed. Lambeek et al[196] completed a process evaluation of an integrated care program which focused on achieving patient, supervisor, and therapist consensus on the best ways to promote graded activity and RTW. Physical workload (36.4%) and work design (25.5%) were the most frequently identified work barriers. Common RTW solutions focused on work design (25.3%), training (22.2%), and equipment changes (20.7%).

V – Michel et al[223] analyzed patterns of data collection for work rehabilitation programs, finding job related information was most often collected at program entry (89%) or at the end of the program (66%). The most common methods of data collection were individual interview (91%) and self-administered questionnaire (71%). Obstacles to RTW (84%) and feasibility of work modification (90%) were commonly discussed as part of care, but collection information on fitness for work data occurred less than in 50% of cases. Job information was used to adapt programs in less than 20% of centers, although it was almost always used in requests for RTW medical examination and approximately 2/3 of requests for determining disability status.

The use of job demand information found in the methods section of a number of intervention studies illustrates the need for a practical examination method that helps identify the abilities or gaps in work ability at the time of evaluation/reevaluation. Common examination methods identified in intervention studies in this CPG that were used to establish and progress a plan of care include job analysis and related questionnaires,[28,46,68,101,207,274,289] ergonomic assessment,[73,75,176,251,260] and functional/performance based examination.[38,66,68,93,191,192,264,302]

Gaps in Knowledge

There is a research gap in understanding what specific job information is relevant and necessary for developing an effective plan of care, and how accurate provided job information may be for work rehabilitation/stay at work planning.

Evidence Synthesis and Rationale

This CPG did not identify any specific examination measures of job demands, although several studies[23,24,94,307] identified measures that considered situational or generalized descriptors of worker status/job demands that may help the clinician identify potential RTW (stay at work) barriers. Prospective studies discussing ergonomic assessment[23,24] and interview[307] had some limited sample sizes and strength but did not provide specific/criteria for assessment. Baker and Jacobs[24] showed good sensitivity and specificity in clinical determination of mismatches between workers and work, but the study was small. Although information provided by the employer or case manager is often considered as a best practice standard, no relevant studies were identified in this search and there is no regulatory or policy guidance in most states on providing healthcare providers with this information. The benefit of employer-provided information compared to worker-reported information may be the employer stakeholder understanding of essential functions/demands. The costs of performing a formal job analysis on every job may be cost prohibitive, although some type of measurement is needed for clinicians to objectively document/determine worker status and progress. Articles identified in this literature search illustrated that job information is consistently sought and used by clinicians in the

development of a clinical plan of care,[28,38,46,66,68,73,75,93,101,176,191,192,207,251,260,264,274,289,302] with low quality evidence that most information is likely generated from interview, self-administered questionnaire, or ergonomic analysis.[28,46,68,73,75,101,176,207,223,251,260,274,289] Not understanding the job/possible modifications may limit therapist development of effective intervention options and negatively increase the costs and duration of care.[196]

Recommendation
C
Physical Therapists should document essential job demand information obtained from workplace stakeholders or by interview in the absence of workplace specific data and reviewed by the worker for accuracy to develop a work prognosis, plan of care, and to inform RTW decision making.

ADMINISTRATIVE AND ECONOMIC OUTCOME MEASURES

Administrative measures, such as case closure or days away from work, and economic measures, such as employer related costs and medical costs, are cited as primary or secondary outcomes in the literature. Case closure is an administrative measure which marks the regulatory end of a work-related injury or illness. This indicates that the worker has achieved maximum medical improvement with the primary rehabilitation goal of returning to work. Return to work is further defined as sustained work over a period of time, return to restricted or modified work, or productivity. Economic measures include both direct and indirect costs to the employer and for services rendered from the time of injury to case closure. This information is tracked for individual workers, or at a program level.

II – Wasiak et al[320] suggest an expanded phase-based conceptualization of RTW outcomes with descriptions including off work, work reintegration, work maintenance, and work advancement. After reviewing current literature, these are also categorized as 'tasks and actions,' 'contextual,' or 'process driven' outcomes.

III – Cheng et al,[70] rather than defining outcome by "achieving" or "not achieving" physical therapy goals such as the absence of impairment or pathology, recommend that measure of outcome should consider the perspective of the employer, patient, and physical therapist. For the employer, a successful treatment results in the return of an injured worker to his/her job responsibilities. In this study, rehabilitation provider goals and employer goals were moderately correlated, 81% of patients achieved rehabilitation provider goals and 77% achieved desired employer outcomes.

IV – Vogel et al[317] suggest that in contrast to using RTW as a singular outcome, alternative metrics should be used to evaluate the success or effectiveness of rehabilitation programs as well as for administrative benefits. Proposed measures include attempts to RTW (no attempt, failed attempt, successful attempt), current working status (working/not working), duration of RTW (greater or less than 3 months duration), and number of working hours (less than pre-injury or equal to/greater than pre-injury).

Gaps in knowledge

There is a lack of consistency and comprehensiveness of RTW measurements.[317,320] Further research is needed to measure and determine factors that affect RTW and control for specific work status such as unemployed, off work, restricted duty or job change.

Evidence Summary

Administrative and outcome measures are not typically the focus of research; however, they are relied upon to objectively measure change with intervention. The level of work returned to by the worker, case closure, case costs, and disability duration are examples of administrative and economic measures that are monitored over the course of care. There is moderate evidence that administrative and economic measures need to be relevant to the employee and the employer as well as to justify interventions taken by the physical therapist.[70]

INTERVENTIONS

INTERVENTIONS –COMMUNICATION AND COORDINATION OF SERVICES

Communication refers to sharing appropriate information among stakeholders such as the employer, employee, medical providers, therapists, and payers. This communication allows the coordination of services that may include identification of graded RTW, RTW barriers, facilitation of workplace adaptation, and the development of a plan of care with common, work related goals.

I – A secondary analyses of prognostic factors of a randomized trial with a population of 351 workers sick listed for 3-16 weeks due to LBP, compared usual care (medical consultation and physical therapy) with coordination of services with a case manager integrating care between the rehab physician, physical therapist, occupational therapist, social workers, specialists of social medicine, and the employer.[287] Coordination of services was more effective than brief intervention (usual care) when measuring RTW only in the subgroup of patients with low job satisfaction (HRR = 1.41; 95% CI: 0.77, 2.57), no influence on work planning (HRR = 1.23, 95% CI: 0.67, 2.25)and feeling at risk of losing their jobs due to their sick leave (HRR = 1.95, 95% CI: 0.78, 4.88).

I – Coordination of services between medical providers, rehabilitation team, and the workplace was shown to be cost beneficial in a 6-year follow-up study in a population with occupational back pain.[208] In the original study workers with LBP and work absence of more than 4 weeks were assigned to one of four interventions: usual care, clinical rehabilitation, occupational intervention, combined clinical and occupational intervention (referred to as the Sherbrooke model). Consequence of disease costs at one-year follow-up were higher in usual care group ($7133) than in the experimental arms (respectively, $6458, $6529, $6515) and much higher in the subsequent 5.4 years ($16 384 compared to $3586, $6291, and $545).

I – Comparison between usual care alone and the addition of case coordination in populations with neck or back pain found no differences in RTW rates or employment status at one-, two-, and five-year follow-up.[233,257] The intervention groups met with a case worker to discuss work history, family life, obstacles to RTW, and facilitation of communication with the employer.

I – No difference was found in the rate of RTW between groups involved in advice and education from a team, and the same program with the addition of a case manager for coordination of communication among stakeholders.[169,228] A cost effectiveness and cost benefit analysis found that the brief intervention resulted in fewer sick leave weeks and was less expensive than the addition of case management.[170]

I – A systematic literature review showed no significant difference in work status outcomes comparing usual care with the addition of case management for workers on sick leave or disability for at least 4 weeks.[318]

I – A comparison of usual stroke care to the addition of workability assessment and workplace visits by the therapist and worker in a population of 80 previously employed stroke survivors aged 26 to 60 was performed.[241] At 6 months follow-up, 60% in the intervention group returned to work versus 20% in the usual care group.

I – A systematic review of studies that included workplace intervention defined as promotion of changes in work design and organization, working conditions, or work environment through communication between workers and supervisors, included 14 randomized controlled trials involving 1897 workers.[316] Moderate-quality evidence supports workplace interventions to reduce time to first RTW. The effectiveness of workplace interventions differs based upon cause of work disability.

II – Communication, initiated by the physical therapist, directly with a workplace representative and the patient, to identify workplace adjustments and to agree on a RTW plan was compared to standard physical therapy treatment.[268] There was a significant increase in quality-adjusted life-years (QALY) after 12 months in the intervention group compared to the reference group (0.033, $P = .01$). 86% of the intervention group was working for at least 4 weeks in a row at 12-month follow-up without report of sick leave compared to 74% of the reference group ($P = 0.01$).

II – In this study, the employee, the case manager, the occupational therapist/ergonomist, and the employer met at the employee's workplace to design a RTW plan within one week of sick-listing.[19] Compared to traditional case management, this early, work focused intervention, resulted in a total mean number of sick days of 110 in the intervention group compared to 131.1 in the reference group ($P < .05$) during 0-6 months; and 144.8 versus 197.9 sick days, respectively, ($P < .01$) during 0-12 months.

II – Comparison of a coordinated and tailored work rehabilitation approach with conventional case management, showed a net benefit of the tailored approach of approximately $10 666 per person.[49] The coordinated and tailored approach included the occupational physician, occupational physical therapist, chiropractor, psychologist, and a social worker who maintained contact with the workplace.

II – A systematic review included 10 studies showing strong evidence that duration of work disability is reduced by work accommodation offers and contact between healthcare provider and workplace; and moderate evidence that disability duration is reduced by interventions which include early contact with worker by workplace, ergonomic work site visits, and presence of a RTW coordinator.[103] There is weak evidence that these interventions have impact on quality of life outcomes.

II – Lambeek et al[196] performed a study of a workplace intervention consisting of communication between therapist, patient, and workers supervisor that focused on work adjustments to facilitate RTW. Application of the program was appropriate when there were problems with communication with the employer and when patients showed chronic pain behavior. Application of the program was not recommended if the patient had any juridical conflict with the employer, lacked motivation, had uncomplicated LBP, or was physically very fit.

II – An intervention involving physicians, specialists, and physical therapists was compared to the same program with the addition of case management with a RTW focus.[212] The caseworkers contacted participants' employers by phone to inform them of the program and inquire about possible temporary modifications at work. The patients created a RTW schedule together with the caseworker and the multidisciplinary team. The work-focused intervention had the same effect on pain and disability as control interventions.

II – A pilot study compared RTW outcomes of conventional case management and an integrated occupational, clinical, and case management approach for 72 workers with non-specific back pain lasting 4-10 weeks and with medium and high risk for disability.[275] By 6 months after onset of back pain, workers at high risk of work disability who received the integrated intervention were more likely to RTW than high risk workers who received conventional case management. The intervention group had 87 workdays lost compared to 120 days in the control group (*P* =.016).

II – Usual care was compared to a participatory RTW program in a population of workers sick-listed due to musculoskeletal disorders between 2 and 8 weeks.[312] The RTW plan consisted of communication between insurance representatives, the labor expert of the Social Security Agency (SSA-Netherlands), the sick-listed worker, and the RTW coordinator. The median duration until sustainable first RTW was 161 days in the participatory RTW program group, compared to 299 days in the usual care group (log rank test; $P = .12$). The median total number of days at work during follow-up was 128 days (interquartile range [IQR] 0 – 247 days) in the participatory RTW program group and 46 days (IQR, 0 – 246 days) in the usual care group. An economic evaluation found that for each 1-day gain in time to RTW, there was a cost of approximately 80 Euros ($106 USD) using the participatory RTW program.[313]

III – To be most effective, a RTW program includes a task or job analysis and identification of alternative work assignments with participation of medical providers, safety professionals, injured employees, and supervisors and an individual trained in ergonomics to facilitate the job placement process.[28] In this study of the Johns Hopkins' Facilitated Early Return to Work

Program in Baltimore, Maryland, the number of lost workday cases decreased from 20 per 1000 to 10 per 1000 employees in the same periods.

Evidence Synthesis and Rationale

There is conflicting evidence regarding the impact of communication and coordination between all stakeholders on RTW. In the studies that controlled for risk of delayed recovery,[196,275,287,316] communication and coordination of services between all providers improves RTW outcomes and leads to cost savings. A case management meeting, without identification of high risk for delayed RTW, is not beneficial in promoting RTW. A work-place visit with stroke survivors leads to improved rate of RTW in this population.

Recommendation
B
Physical therapists should communicate and coordinate services with the employer, the employee, case managers, and other medical providers when a prognosis of high risk for delayed RTW is identified.

INTERVENTIONS – GRADED, MODIFIED, TRANSITIONAL WORK AS PART OF PLAN OF CARE

I – Van Vilsteren et al[316] performed a Cochrane review and found moderate quality evidence that workplace interventions result in a reduction of work absence in workers with musculoskeletal disorders and reduced time to first RTW (HR = 1.55; 95% CI: 1.20, 2.01). High quality evidence was found regarding the role of workplace adaptations, changes in work design/organization, equipment, or work environment changes on cumulative work absence with a mean difference of 33.33 fewer days (95% CI: -49.54, -17.12). There was no evidence that workplace interventions impacted time to RTW in workers with mental health problems or cancer.[316] Ntsiea et al[241] found that workplace intervention for individuals employed prior to experiencing a stroke resulted in a 60% RTW rate which was 3 times higher than a usual care group at 6 months follow-up. Intervention was tailored according to functional ability and workplace challenges for individuals between ages of 18 to 60 and with less than 8 weeks since onset of stroke.[241] Those who received workplace intervention had better functional mobility, activities of daily living scores, and higher quality of life scores as compared to those in the usual care group.[241]

I – Roels et al[264] performed a systematic review to identify interventions enhancing employment in individuals following spinal cord injury. There was significant variability of rehabilitation settings, duration of time since injury, and types of interventions. Only one high quality RCT looked at supported employment – the results confirmed that a vocational intervention improved employment rate for people with spinal cord injury at one- and two-year follow-up.[264] Even considering a number of cases of extended work absence, the results after 1 year found the employment rate was 26% for competitive work (defined as a paying job earning at least minimum wage), compared to 10.5% in the treatment as usual interventional site control group and 2.3% in the treatment as usual observational control group.[264]

II – Van Dujin and Burdorf[91] found that individuals who engaged in modified work as part of their rehabilitation during their first episode of sick leave were less likely to have a recurrence of

musculoskeletal sick leave compared to those returning directly to full duty (univariate association OR = 0.37; 95% CI: 0.18, 0.75, multivariate model OR = 0.35; 95% CI: 0.16, 0.78). Bethge[30] explored the long-term effects of graded RTW following a rehabilitation program for patients at the end of an orthopedic, cardiac, oncologic, or psychosomatic rehabilitation program. The probability of disability pension was decreased by about 40% in the gradual RTW group [5.4% versus 8.6%; HR = 0.62; 95% CI: 0.49, 0.80], and accumulated time loss was reduced by 52 days (95% CI: 40, 64).

II – One RCT found limited support ($P = 0.10$) for reducing work hours to part time (and workload in some cases), with earlier sustained RTW (of 4 weeks) in the intervention group.[315] One cohort study in the review by Williams et al[328] found adaptation of work hours and job tasks was effective on RTW after 200 days of sick leave with a HR = 1.78 (95% CI: 1.13, 1.76).

II – A systematic review with one RCT and one consecutive cohort study by Khan et al[185] found inconclusive evidence to support vocational rehabilitation as an intervention to improve job retention or RTW for individuals with multiple sclerosis, noting methodological limitations of studies and a need for clinicians to be aware of timing of interventions and the importance of identifying/managing barriers to work. Van Dujin et al[92] found duration of sick leave was influenced by chronicity and disability and not modified work. The work by Van Dujin et al[92] identified conditions that may impact modified work feasibility – workers were less like to return to modified jobs that required frequent lifting (OR = 0.16; 95% CI: 0.07, 0.40) or if they had low support from coworkers (OR = 0.29; 95% CI: 0.12, 0.69), but were more likely to return to modified duty for jobs with prolonged standing (OR = 5.21; 95% CI: 2.13, 12.75).

Gaps in Knowledge

Although research in this area shows consistent benefits of graded or modified work, there is a gap in research in relation the interplay of diagnostic groupings, job demands, and timing of intervention delivery.

Evidence Synthesis and Rationale

Research in this area spanned a number of conditions, however there was moderate to strong evidence in favor of graded/modified work strategies reducing the duration of leave compared to usual care,[315,316,328] along with improved worker coping over subsequent episodes of care.[92,241,264] Individuals with musculoskeletal problems, those experiencing their first episode of work absence, those who have been out of work for 12-16 weeks, or those attempting to go back to work following cardiac conditions, stroke, or spinal cord injury may benefit most from this category of interventions.[241,264] There is mixed or no evidence of the benefits of modified work for individuals with multiple sclerosis, traumatic upper extremity injuries, and oncologic or mental health problems.[158,185,316] Van Dujin et al's[92] results questioned if jobs with frequent/prolonged demands may be less amenable to modified or graduated work, and if delivery timing contributes to limited success in individuals with chronic progressive conditions. Additional information on the use of graded/modified work as part of a multi-component intervention is discussed later. Barriers to implementation of graded or transitional RTW may include jobs with frequent material handling and work/workplace adaptability in implementing

the intervention.[92] The practical application of graded/modified work is consistent with physical/social benefits of work engagement and minimizing future disability. The conflicting evidence regarding recurrence is the only construct that might be considered related to harm, although the literature only identified recurrence of sick leave (which may be impacted by multiple factors), not reinjury. This is an important point because provider fear of worker reinjury could negatively impact clinician exploration of this intervention and reduce clinical effectiveness of care. As noted earlier in this review, a number of employers are integrating modified RTW in their policies and processes based on research and expect health providers to partner with them in collaborative RTW planning. Because graded RTW is often combined with other strategies, cost information is presented later in this review.

Recommendation
B
Therapists should provide recommendations to patients and the health care team for graded, modified, or transitional work to promote work reintegration unless barriers or contraindications are documented.

INTERVENTION – ERGONOMICS/PARTICIPATORY ERGONOMICS

Ergonomics is a broad term in occupational health, with a range of definitions and applications that addresses the efficiency and safety of work. This section considers studies focusing on ergonomics interventions impacting stay at work/RTW (secondary/tertiary prevention). The term participatory ergonomics used in this section considers the common definition applied at the individual worker/clinician level: actively involving worker(s) in developing and implementing workplace changes that aim to reduce risks and improve productivity.[176,230] Ergonomics interventions will also be discussed as a component of multimodal interventions later in this section.

I – Anema et al[16] found ergonomic interventions had a beneficial effect on RTW in a RCT involving individuals out of work 2-6 weeks due to back pain. The authors found that workplace modifications/adaptation of job tasks reduced the time needed to RTW by 27 days (P =.002) compared to usual care, with a HR of 1.7 (95% CI: 1.2, 2.3) for RTW.[16]

II – Franche et al[103] completed a systematic review (4 high quality RCTs, 3 high quality prospective cohorts, 3 high quality non RCT/pre-post design studies) to synthesize evidence on effectiveness of workplace-based RTW interventions and strategies that assist workers with musculoskeletal and other pain related conditions to RTW after a period of work absence. There was strong evidence that work disability duration is significantly reduced with work accommodation offers; and moderate evidence that it is reduced by interventions which include early contact with worker by workplace and ergonomic work site visits. There was limited or insufficient evidence of sustainability of effects. Steenstra et al[289] found work assessment and modification based on participatory ergonomics resulted in RTW 30 days earlier than usual care (95% CI: 3.1, 51.3), and Arnetz et al[19] who found workplace ergonomics assessment and interventions reduced sickness absence compared to reference group with case management which had an OR of 1.9 at 6 months (95% CI: 1.0, 3.6) and an OR of 2.5 at 12 months (95% CI: 1.2, 5.1). Franche et al[103] found moderate evidence that costs were decreased with early

workplace/worker/health provider contact, ergonomic site visit and work accommodation, although there was limited evidence of sustainability over 1 year. A cost-benefit ratio of 6.8 was reported (in addition to shortened disability duration) by Arnetz et al[19], with direct savings of 1195 USD per case in the intervention group (conserviative calculation since indirect cost savings tend to be greater than direct costs). Steenstra et al[289] reported that the workplace intervention group had slightly higher direct costs than the reference group.

II – Verhagen et al[309] performed a Cochrane review on a range of conservative interventions for work related complaints of the upper extremities, reporting the results of two studies relevant to the impact of ergonomic interventions which showed decreased sick leave (RR = 0.48; 95% CI: 0.32, 0.76), however ergonomic interventions were not more beneficial compared to other interventions. Martimo et al[216] reported increased on-the-job productivity at 8 and 12 weeks, when ergonomic improvements were made for injured workers with upper extremity disorders. While productivity losses decreased for both groups at 8 weeks, there were no significant differences between groups. At 12 weeks both the proportion and magnitude of productivity loss was lower/more improved in the intervention group ($P < .001$).[216]

Evidence Synthesis and Rationale

The majority of studies demonstrated improved RTW with ergonomics interventions, with a moderate to strong effect when compared to usual care. Most programs involved a structured ergonomics element, although others noted informal, case specific interventions for work/worker matching using modified work or other strategies to reduce stress/force/risk consistent with ergonomics strategies (which resulted in some vagueness in the recommendation). Higher level of worker/stakeholder involvement may improve RTW outcomes.[216] The effect of ergonomics compared to other interventions or supplementing exercise is not clear. The use of ergonomics as a sole intervention aimed at minimizing time away from work was addressed in a limited number of studies; the largest application may be related to promoting "stay at work" (preventing or minimize time out of work). Ergonomics interventions may not show a short-term impact for 8-12 weeks.[216] Ergonomics principles (matching the worker and work) is consistent with the ADA Act (fostering work participation with/without accommodations). (*pending EEOC reference)* While the ergonomics needs of clients and employer willingness to adapt work stations vary from case to case, additional research into intervention clusters, and level of worker-workplace stakeholder interaction may be helpful in determining best practices for different situations. No harm was associated with ergonomic interventions. There were some conflicting cost/cost-benefit outcomes included in this group of articles, although costs of providing ergonomics were largely positive and described ergonomics interventions as slightly more expensive than usual care/other intervention in those noting higher direct costs of the intervention. There was variability of direct/indirect costs studied in this section; later sections of this review will look at case/longer term costs related to ergonomics as part of a multicomponent intervention. While not all physical therapists may be comfortable performing practical workplace ergonomics assessments and developing recommendations, provider networks and professional development opportunities have resulted in many outpatient clinics offering these services.

Recommendation
B

Physical therapists should offer participatory ergonomics assessments and recommendations for worker/stakeholders when work demands exceed worker ability, aimed at helping workers stay at work with debilitating conditions, temporarily aiding workers in job performance during rehabilitation, or permanently accommodating workers following work injury/absence.

INTERVENTIONS – PSYCHOLOGICALLY-INFORMED PRACTICE

Psychologically informed physical therapy treatment addresses both physical and psychosocial factors by integrating behaviorally based techniques into conventional physical therapy. This intervention is focused on influencing a patient's pain perception, behaviors, attitudes and beliefs, and his/her response to a painful experience. Examples of this treatment include graded activity, graded exposure, motivational interviewing, coaching, and education regarding pain neuroscience, activity, and body mechanics. This approach can be incorporated into work rehabilitation programs.

Improved RTW following psychologically informed intervention

I – Gross et al[132] reported that workers with musculoskeletal disorders who received motivational interviewing added to a rehabilitation program were more likely to collect temporary disability benefits during the follow-up year (mean, 8.2 versus 0.2 days; $P < .001$), receive job search allowance (mean, 3.1 versus 1.0 days; $P = .01$) but were less likely to experience any recurrence (4.5% versus 9.1%; $P = .04$) and less likely to experience recurrence of partial temp disability benefits (2.9% versus 7.7%; $P > .02$) as compared with those who had the same intervention without motivational interviewing.

I – Hara et al[139] investigated the impact of the use of a cognitive behaviorally based follow-up phone call on RTW outcomes. Workers received at least monthly telephone follow-up after completion of an occupational rehabilitation program, compared to a group that received no phone follow-up. The telephone follow-up was delivered over 6 months. Acceptance and Commitment Therapy, a type of cognitive behavioral therapy (CBT), was used in the booster phone follow-up. One year after discharge the intervention group had 87% increased odds (OR = 1.87; 95% CI: 1.06, 3.31), of (re)entry to competitive work ≥1 day per week compared with the controls, with similar positive results for sensitivity analysis of participation half time (≥2.5 days per week). The cost of boosted follow-up was 390.5 Euros ($461) per participant.

I – Heathcote et al[143] performed a systematic review and meta-analysis of resilience training programs compared with rehabilitation providing standard care for out of work patients with physical injuries. The authors defined resilience as a positive adaptation or adjustment in the face of adversity that is related to self-efficacy. They reported that resilience rehabilitation programs significantly increased the likelihood of ever RTW (OR = 2.09; 95% CI: 0.99, 4.44), decreased the number of days taken to RTW (mean difference, –7.80; 95% CI: –13.16, –2.45), and increased total self-efficacy scores (mean difference, 5.19; 95% CI: 3.12, 7.26).

I – Kool et al[191] reported improved RTW outcomes for workers with non-acute LBP who received function-centered treatment emphasizing improved self-efficacy, versus pain-centered treatment. At the 3-month follow-up RTW was 47% in the function-centered group versus 27%

in the pain-centered group (P =.037). In a follow-up study, Kool et al[190] reported that function-centered treatment significantly increased the average number of workdays during the follow-up year. The benefit was 40 days (increase in average), and the effect size was 0.35.

I – Linton et al[202] compared 3 interventions to prevent chronic disability. A control group received minimal intervention (examination, reassurance, and activity advice). Intervention groups were: minimal intervention plus CBT; CBT plus physical therapy. At follow-up, the control group had the highest percentage of individuals on sick leave (9%–14%), the CBT group fell in the middle (6% – 8%), and the CBT+PT group had the lowest percent on sick leave (2% – 5%).

II – Godges et al[114] investigated whether education and counseling on pain management, physical activity, and exercise could significantly decrease the number of days off work for workers with LBP (compared with conventional care). Patients who scored 50 points or higher on the FABQ were randomly assigned to the education or control group. The median number of days to RTW was 19 and 35 days for the education and comparison groups respectively. All those in the education group had RTW in 90 days or less versus 83.3% in the comparison group (P = 0.27).

II – Olsson et al[247] reported that the Redesigning Daily Occupations Program improved the participant's work ability at 1-year follow-up (WAI single item, P = .003). This program focused on changing women's perceptions regarding perceived work ability.

II – Park et al[254] compared motivational interviewing added to functional restoration versus functional restoration alone, for injured workers with a work-related musculoskeletal disorder. Return to work at the time of discharge was 12.1% higher for the intervention group (21.6% versus 9.5%, P =.03).

II – Wisenthal et al[329] reported improvement in depressed patients' perceptions regarding RTW readiness following a Cognitive Work Hardening program performed by occupational therapists. The program included identification of work barriers, pacing techniques, targeted coping and behavioral skill development and customized work simulation based on individual need. The therapists used education, role playing, coaching and goal setting techniques during the intervention. Scores on the WAI, Multidimensional Assessment of Fatigue, and Beck Depression Inventory-II improved significantly from pre- to posttest (P < .05).

III – Nicholas et al[236] reported benefit of a multimodal intervention program that targeted workers identified as having high risk for delayed recovery based on psychosocial risk factors (using an Örebro short version cut point score >50) within 1-3 weeks following injury. The intervention included several stakeholders (including a RTW coordinator, psychologist, physiotherapist, insurance case manager) who focused on the worker's perceived barriers to RTW. The physiotherapists used an activity based approach to treatment. Lost days of work for this program were compared with results for workers receiving usual care (risk factors were addressed if there was a poor response to the initial care after 6-8 weeks). Workers were followed for 2 years. The mean lost work days for the control group was 66.5 (SD, 116.2) versus 20 days (SD, 30; median, 10.1 days) for the intervention group.

Conflicting results following psychologically informed intervention

I – Palmer et al[251] performed a systematic review to evaluate the effectiveness of RTW interventions. Among the interventions in the 42 included studies, 37 promoted behavioral change, with interventions often applied in combination with exercises. The psychological interventions included CBT or coping and relaxation, or were vocationally focused at overcoming psychosocial barriers to working, or attitudes toward and perceptions of work. The authors reported that most of the behavioral interventions were effective. There was no clear benefit of one behavioral intervention over another, although studies that involved setting graded tasks were slightly more positive (the median relative risk for RTW was 1.21 overall, and relative risk for avoiding musculoskeletal disorders-related job loss was 1.25; the median reduction in sickness absence was 1.11 overall).

I – Staal et al[286] developed a graded exercise program (physical exercise based on operant conditioning principles) for workers with LBP and compared the treatment to usual care. The median number of days of absence from work over 6 months of follow-up was 58 days in the graded activity group and 87 days in the usual care group. The intervention had no statistically significant effect on functional status and pain when compared with usual care. In a level II secondary analysis, Staal et al[285] reported that workers who perceive their disability to be moderate, and workers with moderate scores for fear-avoidance beliefs, have a better chance of a successful treatment result (i.e., RTW) than workers with higher scores.

II – Doda et al[87] evaluated the prevention of musculoskeletal pain and discomfort between ergonomic interventions tailored to the employee's readiness for change (based on the Stage of Change model) with standard ergonomic interventions. They reported lowered risk of musculoskeletal symptoms with the tailored interventions for workers with LBP, but not other musculoskeletal complaints.

II – Verhagen et al[309] performed a Cochrane review to assess the effects of non-surgical interventions for work-related complaints of the arm, neck, and shoulder and concluded that behavioral interventions had inconsistent effects on pain and disability, with some subgroups showing benefit and others showing no significant improvement when compared with no treatment, minor intervention controls, or other behavioral interventions.

Studies refuting the benefits of psychologically informed intervention

I – Anema et al[16] reported a negative effect during follow-up for the group that received graded activity with an operant-conditioning behavioral approach (HR = 0.4; 95% CI: 0.3, 0.6) compared with the group that received workplace intervention.

I – Meyer et al[222] reported no statistically significant improvement in RTW when a progressive exercise treatment by a rheumatologist was compared to an interdisciplinary work rehabilitation program ($P > 0.46$). The work rehabilitation program included an operant behavioral therapy approach to improve self-efficacy.

II – Heinrich et al[146] compared the effectiveness of physical training alone, physical training with a cognitive behavioral component and workplace specific exercises, versus usual care. Pain severity and functional status similarly improved in both intervention groups. At 12 months follow-up there was no difference in claim duration between physical training and usual care (HR = 0.7; 95% CI: 0.4, 1.1) or the more comprehensive treatment approach and usual care (HR = 0.9; 95% CI: 0.6, 1.4).

II – Marchand et al[212] compared work-focused and control interventions. They also evaluated the influence of fear avoidance beliefs on pain, disability, and RTW at 12 months. The physical therapist focused on reducing fear avoidance, and advised patients on activities and encouraged exercise. The changes in FABQ scores were not significantly different between the groups. It should be noted that the control interventions included education and cognitive behavioral interventions.

II – Two studies by Steenstra et al[288,289] evaluated the addition of graded activity as part of a multistage RTW program for workers with LBP. They reported that graded activity did not significantly improve pain or functional status. In addition, they concluded that the clinical intervention of graded activity was associated with higher costs.

Evidence Synthesis and Rationale

The majority of investigations reported benefit following psychologically informed treatment. Some of the interventions that resulted in RTW included: coaching on performance of activities that patients reported as problematic; individualized goal setting; motivational interviewing; workplace visits; practical sessions in ergonomics; instruction in relaxation and coping techniques; patient education regarding activity pacing and goal setting; and problem solving. A common element in these studies was that the intervention was directed to the identified barriers for RTW. For example, Godges et al[114] demonstrated benefit of education and counseling on pain management, physical activity and exercise on patients with an elevated FABQ score. Some studies combined several treatment elements (such as education, targeted coping and behavioral skill development and progressive work simulation) into the intervention.[143,236,247,329] Staal et al[285] reported positive outcomes when treatment was directed to patients with moderate (versus higher) scores for perceived disability. The study by Nicholas et al[236] demonstrated a long-term positive outcome when workers with high psychosocial risk factors were targeted in treatment. This suggests that there is a subgroup of people for whom psychologically informed treatment should be targeted. There are gaps in our current knowledge in regards to how best to package and deliver psychologically informed treatment in work rehabilitation in addition to identifying the subgroup of patients most likely to benefit from this intervention.

Recommendation

B

Physical therapists should incorporate psychologically informed practice such as individual goal setting, motivational interviewing, education regarding activity pacing, problem solving, relaxation, and coping techniques into the plan of care when psychosocial barriers are identified during the episode of care.

INTERVENTIONS – EDUCATION

The literature investigated the impact of sharing information with the worker or supervisors, using a verbal or written format, on the ability to work. Topics generally included information related to pain, return to activity, ergonomics advice, exercise, and symptom management.

I – Education about LBP, pain pathways, fear-avoidance beliefs and coping, training sessions in the workplace, and instruction in a home-based exercise program based on a booklet in a population with LBP lasting 3 months was no better than usual care.[65] 24% of the intervention group and 21% in the control group had one or more recurrence of LBP with sick leave. Mean duration of sick leaves due to LPB episodes was comparable between groups (25 days; SD 50 days in control group compared to 32 [SD 65] days in intervention group, P =.940)

I – Education of managers in ergonomics and the use of ergonomics action checklists was shown to increase the number of workplace improvements targeted at prevention and management of LBP in the first three months after training.[176] No significant difference in measures at 10 months was found.

II – Patients with subacute LBP return to work sooner if they are referred to a clinic offering information regarding somatic findings, explanation of radiographic findings, and the importance to engage in physical activity as normally as possible.[135] The physical therapist instructed patients in training and stretching, how to manage back pain, and how to resume normal activities in a 1 – 1 1/2 hour session. The education intervention group had fewer days of sickness compensation (mean of 125.7 days per person) compared to the control group (169.6 days). The effect occurred during the first year after intervention. There were no significant long-term effects found in a follow-up study.[227]

II – Provision of an ergonomic training brochure to provide basic information on workstation evaluation for computer workers was compared with a control group.[96] Intensity, duration, and frequency of work-related upper extremity musculoskeletal disorders decreased significantly in the intervention group compared with the control group. There was no improvement of workdays lost between groups (P = .05).

II – Mailing an educational pamphlet to recently back-injured workers did not reduce subsequent work loss, speed recovery, or reduce health care visits.[142] The pamphlet contained information to encourage self-care and quick return to activities. A follow-up phone call interview was made at 3- and 6-months post-injury. At 3 months 7.9% of those that received a pamphlet were not working, compared to 7.7% of those not receiving the pamphlet (P = 1.00). At 6 months, 6.5% of persons that received a pamphlet were not working compared to 5.9% of those not receiving the pamphlet (P = .84).

II –Distribution of written information and 2-3 group training sessions for supervisors in the use of a participatory approach for dealing with employees' work functioning problems due to health concerns resulted in no difference on days away from work and perceived social norms.[183]

Evidence Synthesis and Rationale

There is moderate evidence that engagement of the worker on an individual basis, with information about somatic and radiographic findings, the rationale for activity, and ergonomics training improves work status. There is strong evidence that education by way of a pamphlet, training of supervisors or group training of the worker is not beneficial. Educational strategies should match the desired outcomes. Passive education with pamphlets or group sessions may create change at the knowledge level, but not create desired behavioral change. Skills in ergonomic assessment, may require actual training in the performance of ergonomic assessment.

Recommendation

B

The physical therapist may actively engage the worker with information regarding their somatic findings, the benefits of activity, and strategies to return to activity to improve work ability and limit time away from work.

B

Physical therapists should not rely upon written material or group training to motivate and direct the worker in strategies to return to activity.

INTERVENTIONS – PROGRESSIVE/GRADED EXERCISE

I – Schaafsma et al[271] completed a Cochrane review of RCTs/cluster RCTs looking at the impact of light or intensive physical conditioning (including structured and graded exercise to increase physical, psychological, and emotional preparedness) for reducing time lost and promoting RTW in individuals with LBP. Physical conditioning focused on training to meet functional job demands and was comprised of graded strengthening, endurance, cardiopulmonary function, and motor control and flexibility activities (which may have included work-related exercises). Fewer than 5 sessions (5-10 hours total duration) was considered low intensity, while high intensity was defined as more than 5 sessions or full time delivery for more than 2 weeks.[271] (There was heterogeneity of high intensity programs, while it was not uncommon to find 3-12 weeks of delivery with approximately 10-30 hours per week, but there were a number of studies with intervention duration of approximately 2-5 hours per week.) Schaafsma et al[271] found low quality evidence of little or no impact of physical conditioning on sickness absence duration compared with care as usual for workers with acute (less than 6 weeks) injuries, regardless of the level of exercise. There was low quality evidence that light physical conditioning reduced sickness absence duration, and conflicting evidence supporting intense physical conditioning for workers with sub-acute (6-12 weeks) LBP. There was moderate quality evidence that intense physical conditioning reduced sickness absence duration for workers with sub-acute LBP at 2 years, and that intense physical conditioning reduced absence duration in workers with chronic LBP (defined as more than 12 weeks) at 12-24 months compared to usual care. Another study not included in the review by Schaafsma et al[271] found tailored physical activity was more effective than a reference group at 12 weeks, but there was not a significant difference compared to a chronic pain self-management program at 12 weeks or 11 months.[12]

I – Sundstrup et al[297] studied a workplace based high intensity progressive upper extremity strength training program compared to job specific ergonomic analysis/training. Strength training prevented deterioration of work ability for individuals with chronic problems who were exposed to forceful and repetitive job tasks, with improved work ability (medium effect size, Cohen *d* = 0.52).

II – Van den Hout et al[161] examined graded activity paired with problem solving, compared to a pairing with education and found that employees in the problem-solving group had significantly fewer days of sick leave in the second half-year after the intervention. Heinrich et al[146] studied graded exercise with and without a cognitive behavioral component compared to usual care, finding neither was effective on claim duration compared with usual care at 12 months.

Evidence Synthesis and Rationale

There are conflicting findings regarding the benefits of graded exercise/conditioning on work-related outcomes, with little support for the role of graded exercise in the acute stages of care (less than 6 weeks).[271] High levels of intervention variability make aggregating the results of different studies difficult and limit generation of specific recommendations about intervention content. Intense graded activity based on client presentation and overload principles, work demands, and worksite integration shows a small effect on RTW and duration outcomes,[12,271,297] with inconsistent findings on benefits at 6-, 12-, and 24-month follow-up.[13,146,161,271] While studies showed an impact of graded exercise compared to usual care, results often did not yield a superior result when compared to other interventions. Stratification of light and intense exercise levels within several studies may provide some insight to key parameters of service provision for therapists to consider in their use of progressive exercise. Light exercise as a single intervention does not appear to be effective in impacting RTW. Building clinical research capacity for exploring practical progressive exercise interventions may help yield more concrete results by expanding sample sizes in subgroups to improve data for an updated Cochrane review. Therapeutic exercise is one of the most billed services in physical therapy; while no harms were identified in studies, understanding which exercises are appropriate and cost effective could make a significant impact on efficacy and cost benefits of future service delivery. Research in this area tended to look at simple intervention comparisons of progressive exercise to usual care or another intervention; exercise for care beyond 12 weeks is often accompanied by additional interventions which are discussed as part of the multicomponent intervention section later in this review.

Recommendation

C

Physical therapists may prescribe intense graded exercise, including work oriented functional activities, strengthening, cardiopulmonary, endurance, and motor control exercises after 6 weeks post injury, as part of a rehabilitation plan focused on specific RTW goals.

B

Physical therapists should not use light exercise as an isolated intervention to address RTW goals, except when there is explicit reason documented such as psychosocial or psychological involvement, catastrophic injury, or condition specific post-surgical guidelines.

INTERVENTIONS - CARE INVOLVING MULTIPLE COMPONENTS

The design of programs, as described in the literature with RTW measures as the primary outcome, vary widely in content and type of provider. For clarity in this section, programs with multiple components have been divided into three broad categories. *Exercise plus behavioral* interventions are clinic based and may include education, general or non-specific exercise such as strengthening, stretching, conditioning and a psychosocial or behavioral component. W*ork-focused* interventions are clinic based and target achieving goals related to RTW such as the inclusion of graded work specific activities (i.e., lift, push, carry, squat, etc.) and developing a RTW plan, which may include contact with the workplace. The third category, *addition of job site* interventions, includes active involvement of the worker, the employer, and rehabilitation professionals in the workplace. Examples of job site interventions include onsite interventions such as job coaching, ergonomic assessment and modifications, or planning for transitional work with the employee and supervisor. Job site interventions may be combined with behavioral approach with musculoskeletal intervention or a work-focused intervention. The programs may include combinations of professionals such as medical providers, physical therapists, occupational therapists, social workers, psychologists, providers of behavior-based care, case managers, vocational consultants, and social workers.

For each intervention (exercise plus behavioral approach, work-focused, and job site), the studies are divided into the following groups based on the results related to improving RTW outcomes: those that support the intervention, studies that provide conflicting evidence (some, but not all outcome measures, support the intervention), studies that show no difference, and studies that refute the intervention (outcomes are worse with the intervention).

Exercise plus a Behavioral approach

Studies supporting exercise plus a behavioral approach:

II – Extensive multidisciplinary treatment was shown to have better RTW outcomes for a population classified as having a poor prognosis.[136] A statistically significant difference was found in favor of extensive multidisciplinary treatment over ordinary treatments (55% and 36% RTW respectively, $P < .05$). Extensive multidisciplinary treatment for patients with good prognosis did not result in higher RTW. This RCT compared groups assigned to ordinary care, a "light multidisciplinary program" of one hour of education and 3-12 visits for exercise, and an "extensive multidisciplinary program" which consisted of 4 weeks with 7-hour sessions, 5 days per week, including cognitive-behavioral modification, education, and exercise interventions. The extensive multidisciplinary program encouraged patients to focus on their functioning and not to focus on their pain. Good, medium and poor prognosis were determined by physical therapist scoring of the ability to relax and spinal mobility, number of tender points, the Sock Test, and lifting test (PILE).

II – Problem-solving therapy in addition to behavioral graded activity resulted in fewer days of sick leave (50%) during the second half-year after the intervention compared to patients not receiving additional problem-solving therapy. Graded activity with problem solving therapy resulted in 85% returning to full employment when compared to 63% of workers participating in behavioral graded activity and group lectures, in a population of workers on leave due to LBP for 6-20 weeks.[161]

III – Workers with neck, low back, or lower extremity disorders lasting greater than 3 months[141,220,258] to 3 years[109] participated in programs involving exercise, a psychological component, and education. The studies demonstrated 90% rate of RTW and 55-91% work retention rate when compared to work status at initiation of the program.

Studies showing conflicting evidence for exercise plus a behavioral approach

II – A brief exercise plus behavioral intervention involving one consultation with a physician and 2 physical therapist visits based on a non-injury model for LBP, was compared to a program using the Interdisciplinary Structured Interview and Visual Educational Tool (ISIVET) in a population of workers on mean sick leave of 147 days (SD = 60.1) due to musculoskeletal pain.[41] There were no significant differences in the level of RTW between the groups at 12 months or 24 months, however patients in the ISIVET group returned to work faster than patients in the brief intervention group.

II – Compared to behavior oriented physical therapy alone, women, with 1-6 months of non-specific neck or back pain, participating in combined physical therapy (exercise) and CBT provided by psychologist, returned to work faster compared to the control group (HR = 1.9; 95% CI 1.1, 3.5).[171] Outcomes for men were not significantly different than treatment as usual.

II – Cognitive-behavioral treatment with routine musculoskeletal care involving diagnostic tests and physical therapy, initiated between 4 and 8 weeks of temporary disability led to 20% reduction in days of temporary work disability compared to routine rheumatologic [musculoskeletal] care. Relapse episodes were shorter in the intervention groups.[200] However, no significant difference was noted in the rate of RTW between groups. Direct and indirect costs were significantly lower in the intervention group, saving $1796 per patient.

II – A stepped wedge study with gradual introduction of an intervention including a 12-week program of ergonomics, physical training, and work tasks with integrated cognitive behavioral approach by physical and occupational therapists showed a significant reduction for measures of fear avoidance beliefs, but no significant effects were found for sickness absence due to LBP or work ability after the intervention.[260]

II – No significant difference in health outcomes (QALY) or costs were found by the addition of cognitive behavioral program to 3 weeks of daily exercise, massage, electromodalities, and education in a population with LBP lasting 6 months or more.[278] Patients in the intervention group were absent from work an average of 5.4 days (95% CI: –1.4, 12.1) less than patients receiving usual treatment. Indirect costs were lower for those in the CBT group: 751 Euros (US$946) (95% CI: 145, 1641).

Studies that show no difference with exercise plus a behavioral approach:

II – There was no difference in time until sustainable RTW or sickness absence days when comparing an outpatient based behavioral approach, using Acceptance and commitment therapy (ACT) to an in-patient program of physical training, ACT and work-related problem solving.[5]

II – There was no difference in the rate of RTW in patients with LBP lasting 4-12 weeks when comparing usual care with coordinated multidisciplinary care.[56] Usual care was described as care offered by a single discipline including passive modalities, exercises, back class, or spinal manipulation. The intervention group participated in a program including aerobic conditioning, strength training, and flexibility exercises and CBT.

II –Workers with chronic widespread pain lasting more than three months participated in a multimodal program consisting of aerobic training, CBT, relaxation, body awareness or the same program with the addition of group training in body awareness and functional training of the body as whole (Norwegian Psychomotor Physiotherapy) over the next 1.5 years.[14] After one year, 65% of the intervention group and 35% of the control group were back at work. The group difference was not statistically significant (P = .09). After 1.5 years, the difference was less, as 57% of those in the intervention group and 47% of the controls were working.

Studies that refute exercise plus a behavioral approach

II – A comparison was made between usual care and early assessment by a psychotherapist, physical therapist and occupational therapist in a population of workers sick listed less than 28 days.[60] The total number of sick-leave days was significantly higher in the intervention group.

Addition of Work-focused interventions

Studies supporting addition of work-focused interventions:

I – Improved rates of RTW were found using function-centered treatment (FCT), work simulation, strength and endurance training, when compared to pain centered treatment (PCT), back school, passive and active mobilization, stretching and low-intensity strength training, in a population of workers with at least 6 weeks of sick leave in the previous 6 months due to LBP. Results include RTW at 3-month follow-up of 47% in the FCT group compared to 27% in the PCT group (P =.037).[191] In a follow-up study comparing the two groups, the FCT group showed an increase in the average number of workdays during the follow-up year.[190] Additionally, more patients returned to work from the FCT group (59.8%), compared with 41.4% of the PCT group (OR = 2.11; 95% CI: 1.150, 3.853).

I – A systematic literature review included moderate to high quality studies including 6 studies (594 participants) that concluded work focused rehabilitation were more effective at returning people to work (OR 95% CI 3.18 (1.41-7.15), P<0.01 than those with no work-related training OR 0.55(0.24-1.23)NS (P =0.76).[143] Based on 21 studies included, it was also concluded that effective interventions consider psychosocial factors in addition to medical and occupational factors in the RTW assessment.

II – Conventional care was compared to a program based on a cognitive behavioral approach with a work-related emphasis in education and work task simulation with a population having greater than 12 weeks of sick leave in the prior year or expectation of long-term restrictions or health-related unemployment.[31] The intervention group was 2.4 times more likely to have a positive work status than the control group at 3 months. At 12 months the chance of a positive work status was still higher but was not statistically significant.

II – Conventional case management was compared to coordinated tailored work-focused rehabilitation in a population of workers absent from work 4-12 weeks due to musculoskeletal pain.[49] The tailored approach included a social worker for workplace coordination on the team made up of a physician, psychologist, physical therapist, and chiropractor. Work status outcomes showed that 42% had returned to work at 3-month follow-up (tailored: 45%, case management: 37%). At 6 months follow-up 69% had returned to work in the tailored approach group compared to 48% in the case management group. At 12 months, 71% of all participants had returned to work, 78% in tailored approach group and 62% in case management group.

II – Conversations discussing RTW and making a RTW plan, were significantly associated with RTW in a logistic multiple regression analysis compared to those that did not discuss RTW or make a RTW plan with occupational health professionals.[314] Occupational health professional intervention of "discussing and making a RTW action plan" was reported by only 19% of sick-listed workers. Seventy-four percent of workers reported no RTW plan was made by the insurance company's occupational health physician

II – A behavioral approach, Acceptance and Commitment Therapy, alone was compared to a program combining Acceptance and Commitment Therapy with physical exercise, work-related problem solving, and a development of a written RTW plan.[113] Participants in the more comprehensive program had a median of 85 (IQR, 33 – 149) sickness absence days at 12-month follow-up compared to the Acceptance and Commitment Therapy alone group with 117 days (IQR, 59 – 189; $P = .034$).

II – In a systematic literature review, multidisciplinary biopsychosocial rehabilitation was defined as an intervention that included a physical component in combination with either a psychological, social, or occupational component.[215] Nine studies were included. The occupational component in eight studies included a worksite visit or a work rehabilitation plan or both. Low to very low-quality evidence shows that persons experiencing LBP lasting 6-12 weeks receiving this approach demonstrated better outcomes than if they received the control interventions.

II – Strength in work simulation lifting and RTW status improved with an interdisciplinary program including work simulation, cardiovascular activity, overall strengthening, and coordination with employers.[319]

Studies showing conflicting evidence for work-focused interventions:

I – A functional restoration program including graded exercise, conditioning, work simulation, and education was compared to active individual therapy (three exercise sessions each week for 5 weeks and instruction in a home exercise program) in a population of individuals with non-specific back pain of 3 or more months.[262] There was no significant difference between groups for RTW (86.8% versus 85.7%). The functional restoration program group improved in subjective and objective measures of ability to RTW (95.5% compared to 78.1% in the individual therapy group, $P < .01$).

I – A systematic review determined that there is low to moderate certainty evidence that a combination of psychological counseling, work directed counseling, and physical conditioning in a population with coronary heart disease increases RTW up to six months and reduces the time away from work.[145] These programs may have little or no effect on rate of RTW after 6 months in this population .

Studies showing no significant differences with work-focused interventions:

I – The addition of a meeting between the employer, the worker, and therapist during participation in a multi-modal program based on Acceptance and Commitment Therapy did not change work participation in a population sick listed 2-12 months compared to the multi-modal program alone.[283]

I – Ordinary care was compared to coordinated and tailored programs offered by a multidisciplinary group including RTW coordinators, a psychologist, a physical therapist, an ergonomist, social worker, dietitian, psychiatrist, and a physician.[259] A positive effect with respect to increasing the recovery rate from long-term sickness absence was driven by location and contextual factors rather than specific intervention.

II – A Cochrane Review found low quality evidence due to high risk of bias in 7 of 9 studies, that neither supported nor refuted the benefits of any specific work-related intervention for relief of neck pain and moderate quality evidence that a multiple-component intervention reduced sickness absence in the intermediate-term, which was not sustained over time.[4] Work related interventions included education regarding mental health, ergonomics, anatomy, musculoskeletal disorders, and the importance of physical activity.

II – The establishment of a RTW team, introduction of standardized work ability assessment procedures, and a comprehensive RTW training course for all team members did not facilitate RTW more than ordinary sickness management in a population sick listed up to 8 weeks.[229]

II – Usual care compared to an outpatient training program including graded activity training, education to eliminate inappropriate pain behavior, cognitive techniques to set goals and improve coping strategies, and preparation to RTW, showed no significant difference between the two groups ($P = .840$).[221] The percentage of RTW over time was significant for both groups ($P < .001$). The multidisciplinary treatment was significantly more expensive than usual care. However, a higher reduction in productivity costs led to insignificant total costs difference after 12 months.

Studies that refute work-focused interventions:

I – After 5 years of follow-up, no differences were found in work status when comparing groups participating in standard examination and treatment to a group that included meeting with a case manager, review of a RTW plan by a multidisciplinary medical team, and arranging a meeting with a workplace representative.[257] Participants in the standard examination and treatment had spent 1.1 weeks less on permanent support, 4.2 weeks less on temporary support, 5.5 weeks less on sickness absence, and 10.8 weeks more in work compared to participants in the multidisciplinary intervention.

Job site intervention

Studies that support the addition of job site intervention:

I – A systematic review of effectiveness and cost-effectiveness of interventions involving consultation and consensus between the employee, the workplace, and occupational health professionals, and subsequent work modifications, appear to be more effective at returning to work people on sick leave with back pain for more than 2 weeks than interventions that do not involve such elements.[64]

I – Multidisciplinary biopsychosocial rehabilitation with comprehensive occupational or workplace intervention shows moderate evidence of a positive effect regarding RTW, sick leaves, and subjective disability based upon two relevant trials included in a systematic review of RCTs and non-randomized controlled clinical trials, of multidisciplinary rehabilitation for subacute LBP, among working age adults.[179]

I – Based on 16 studies investigating RTW interventions in populations with chronic pain, there was no conclusive evidence to support any specific RTW intervention for workers with chronic pain, however, programs including workplace interventions such as job coaching, coordination with employer for transitional work, job re-design and adaptations, were more effective than clinic-based rehabilitation in promoting RTW in a population with chronic pain.[322]

II – A workplace-based rehabilitation program including job coaching was compared to clinic-based rehabilitation programs, in a population with work-related rotator cuff disorders greater than 90 days from claim filing or date of injury.[69] Return to work in the workplace-based program was 71.4% compared to 37% in clinic-based rehabilitation.($P < .01$)

II – In a systematic review,[78] multi-domain interventions had a strong level of evidence showing a positive effect, with 4 high and 10 medium quality studies, on the primary outcome of lost time for musculoskeletal and pain-related conditions. Multi-domain interventions include at least 2 of 3 interventions: musculoskeletal and pain related (health-focused), service coordination, and work modification interventions. Cognitive behavioral therapy alone offered no effect on lost time for mental health conditions.

II – Integrated care including service coordination, a workplace intervention, and a graded activity program based on cognitive behavioral principles was found to be more cost effective

than usual care in a population of patients sick listed greater than 12 weeks due to LBP.[195–197] During the 12 months of follow-up, the median number of days of sick leave in the integrated care group was 82 (IQR, 51-164 days) compared with 175 (91-365) in the usual care group (P = .003).

II – Linking clinical and rehabilitation interventions with an occupational intervention including a participatory ergonomic intervention engaging the worker, employee representatives, and a union representative has a cost benefit[208] and saved more workday benefits than other models in a population of workers with absence of more than four weeks due to back pain.[207]

II – The rate of RTW is improved with the addition of motivational interviewing to a program based on graded activity, therapeutic exercise, and workplace accommodations in a population with disability duration of 140.3 days (SD = 183.8) due to musculoskeletal disorders.[254] Successful RTW at program discharge was 12.1% higher for unemployed claimants in the intervention group versus 9.5% in the control group (P = .03) and 3.0% higher for job attached claimants compared to the control group (P = .10). Successful RTW percentage increased to 47.4% when the motivational interviewing adherent intervention included RTW as the target behavior.

II – A systematic review concluded that clinical interventions combined with work-place based interventions are effective in RTW.[328] The workplace-based interventions consisted of early RTW, modified work, work related clinical interventions, ergonomics, lumbar supports, exercises, a workplace visit, and supervisor involvement for RTW. Studies included were of medium to very high quality.

Studies showing conflicting results with the addition of job site interventions:

I – A systematic review showed conflicting evidence addressing exercise, behavioral change, and workplace adaptation, finding that outcomes were more dependent on chronicity and complexity of injury.[251] Workplace level approaches included ergonomic changes to the physical environment, job modifications (eg, lighter duties, reduced hours), and interventions directed at managers (education and advice).

Studies showing no difference with the addition of job site interventions:

II – A program for prevention and early intervention of LBP in physically demanding jobs showed no significant difference in sickness absence, costs, or healthcare utilization related to LBP.[164] The program included group sessions tailored to the actual worksite and immediate treatment of sub-acute LBP through onsite services.

Evidence Synthesis and Rationale

There is moderate evidence that a behavioral approach with musculoskeletal interventions improves outcomes when a high risk for prolonged disability is identified. There is moderate support of a behavioral approach with musculoskeletal interventions including intensive muscle training,[81] graded activity with problem solving therapy.[161] There is low level evidence to support exercise, a psychological component and education.[109,141,220,258] Assessment by

psychologist, physical therapist, occupational therapist within 28 days of injury, increased sick leave.[60]

Moderate evidence supports the inclusion of work-focused goals and interventions in the plan of care to improve work status.[31,49,143,190] The evidence supports a coordinated approach which addresses physical, behavioral, and workplace barriers impacting work status. The level of risk for delayed RTW guides the provider in appropriate treatment planning. Assessment of risk is described in detail in the examination section. Individuals determined to be low risk show improved outcomes with a combination of a behavioral approach with routine musculoskeletal care and work-focused interventions which include combinations of functional capacity training, graded work activity, RTW planning, case management, and education.

There is moderate evidence that a combination of work-focused care along with job site intervention improves work status in a population at higher risk for prolonged work disability.[64,69,179,195–197,207,208,322,328] Studies defined job site interventions as any combination of graded RTW, job coaching, biomechanics training, or ergonomic education. Programs including job site interventions were more effective than clinic-based rehabilitation to decrease perceived pain and disability, improve functional capabilities, and prevent further work disability in populations with high risk of delayed RTW.

Gaps in Knowledge

There is a need to focus on the cost-effectiveness of interventions with multiple components, including those initiated by the employer, to improve RTW outcomes.[251] Further research related to interventions with multiple components should include topics related to participant waiting times before the start of interventions, matching participants' risk profiles to intervention type and intensity, and incorporating collaborative strategies between the various stakeholders in the RTW process.[322]

Recommendations

A

Physical therapists should not use exercise plus a behavioral approach as the only course of treatment to improve work status of individuals with work participation restrictions.

A

Physical therapists should treat workers with estimated low risk of delayed RTW with a combination of exercise plus behavioral approach and clinic-based work-focused interventions to improve work status.

A

Physical therapists should treat workers with an estimated high risk of delayed RTW with the combination of clinic-based work-focused interventions and job site interventions in the plan of care to improve work status.

B

Physical therapists should include a behavioral approach in the treatment plan for individuals with estimated high risk for delayed RTW to improve work status.

CONCLUSION

LIMITATIONS AND FUTURE DIRECTIONS

Work rehabilitation is a process which requires consideration of many factors, using various approaches to examination, intervention, and measuring outcome. The literature is inconsistent in defining the terminology and in the content of examination and interventions used in work rehabilitation. Therefore, direct comparison between interventions is difficult. Work related outcomes were also diverse but were consistent with the inclusion of some measure of ability to work. Because of the paucity of articles specifically studying the validity and reliability of outcome measurement tools, the guidelines do not include recommended outcome measures. However, an overview of specific outcome measures that are being used is provided. A majority of the studies are graded at lower levels of evidence. There is a need for consistent, high-level evidence in future investigations.

This CPG is focused on work rehabilitation by physical therapists. Psychosocial factors were often cited as secondary outcomes, not a primary treatment focus. Physical therapists involved in the rehabilitation process of a worker with injuries are encouraged to consult clinical guidelines available to guide psychologically informed care. The APTA maintains a list of related guidelines helpful to use in conjunction with this work rehabilitation guideline.

This CPG has focused on the rehabilitation of the worker with injuries. This excluded discussion of interventions aimed at prevention of injury, optimizing or maintaining the health of workers, or productivity indicators such as presenteeism. There is a need for investigation into early physical therapy management directed at limiting disability and enhancing individual and group participation in work.

FIGURES

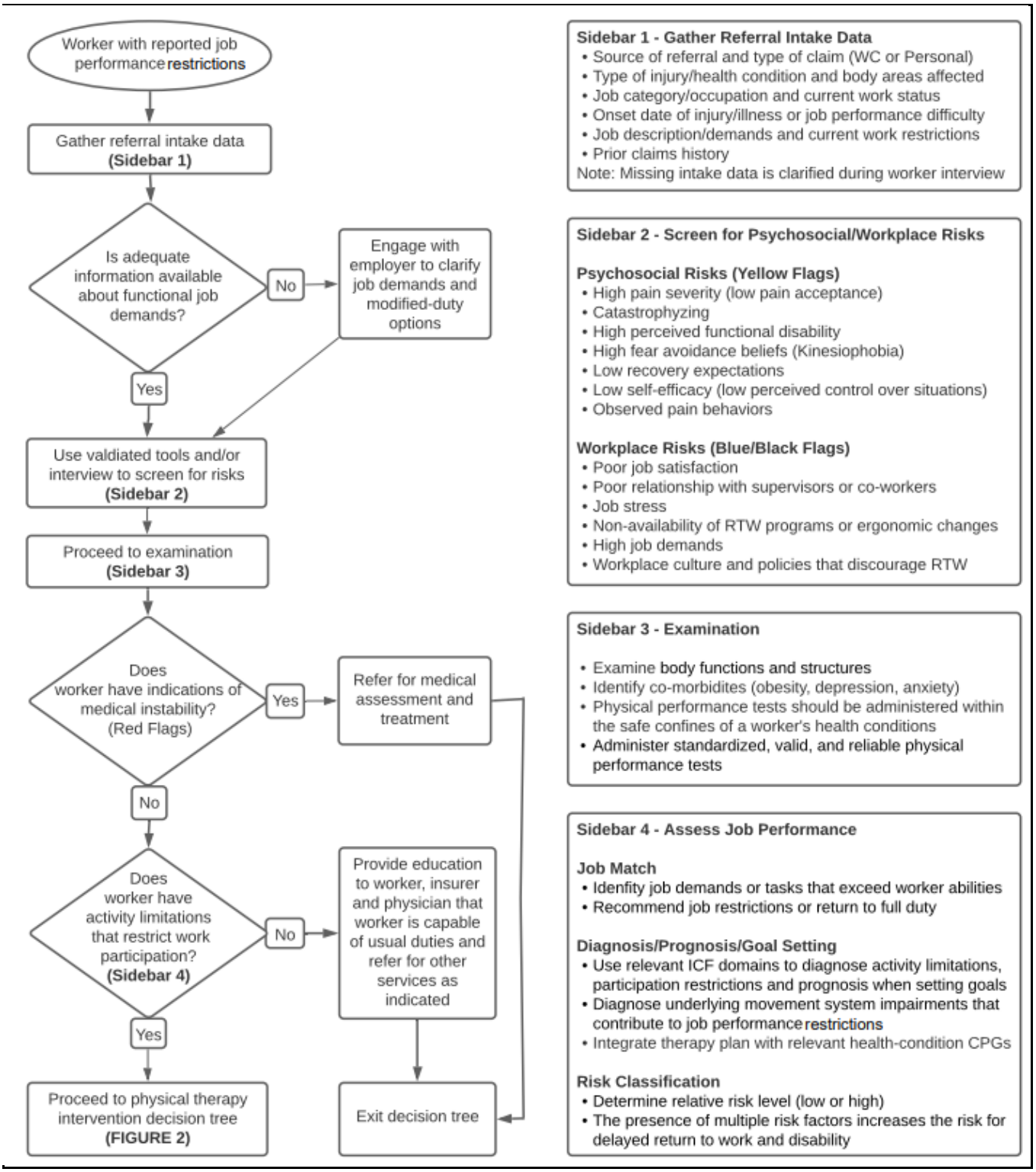

Figure 1. Physical therapist evaluation of workers with limited work ability.

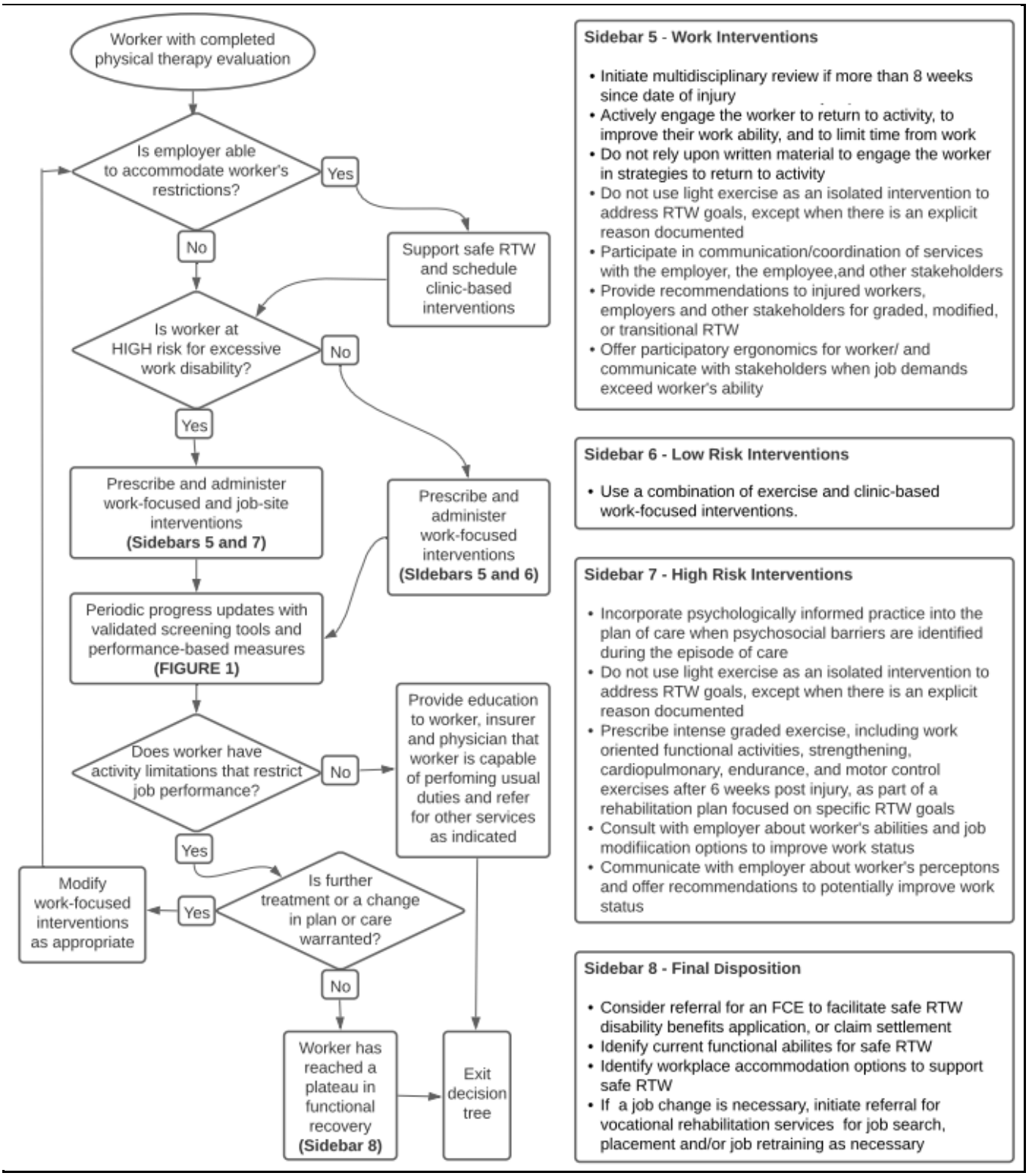

Figure 2. Developing and implementing physical therapy interventions for workers with limited work ability.

1

Area/Item	Rec #	Finding (+, -, n/a)	Comments
History/Physical[¥] - the following information is documented:			
▪ Date of injury (extended work absence prior to referral)	2		
▪ Type of injury/problem, and relevant body area (ICD-10)	2,5		
▪ Comorbidities	2		
▪ Previous work injury episode	2		
▪ Pain level (severe pain)	1,2		
▪ Pain behaviors	2		
▪ Self Report Measure/s (specific for RTW)	10		
o Psychosocial screening/factors	1,13		
▪ Recovery expectations (low)	1		
▪ Fear avoidance (high)	1,13		
▪ Self-efficacy (low)	1		
▪ Readiness for change (low readiness)	13		
o Perceived functional ability/disability (high levels of disability)	1,2		
▪ Job information	3,14		
o RTW policies -is transitional/modified work available? (lack of transitional/modified work availability)	3		
o Job demands/category - from workplace and/or interview (high levels or frequency of material handling)	3,5,14		
o Work culture (workplace relationships, meaning of work, influence on work)	3		
o Job satisfaction (low)	1,3		
▪ Worker goals, preferences, concerns are documented	8		
Exam[*] - data is documented (may include relevant examination modifications, test contraindications or stakeholder deferral)			
▪ Physical Performance Measures (FCE, SFCE, std interview)	11,12		
▪ Participatory ergonomics assessments (when work demands exceed worker ability)	17		
Evaluation and Prognosis - results and synthesis of the data are presented related to the following areas, and relevant planning decisions/updates are also documented.			
▪ RTW diagnosis – relevant areas may include self-care transfers, ability to use transportation, lift/carry, posture/position, walking/moving around, hand/arm use (based on job relevant information)	4		
▪ RTW Facilitators	3		
▪ RTW Barriers	3		

▪ Delayed RTW risk/s is/are identified or incorporated into prognosis** (number, level, type indicator?)	1,2,3		
▪ RTW Prognosis (integrates information on RTW diagnosis, risk areas and barriers/facilitators)	5		
▪ Communication about high risk with employee, employer, case managers, medical providers (call, note, etc.) when relevant	15		
▪ Recommendations for graded, modified, or transitional work unless barriers or contraindications are documented	16		
Interventions – appropriate interventions from the following list are reflected in the plan of care and treatment, (consider in conjunction with condition specific best practices)			
▪ Education – regarding somatic findings, benefits of activity, and strategies to return to activity (including work) †	19		
▪ Low risk of delayed RTW - combination of exercise plus behavioral approach and clinic-based work-focused interventions †† , β	24		
▪ High risk of delayed RTW - combination of clinic-based work-focused interventions and job site interventions †† ,β	25		
▪ Psychologically informed practice is documented when psychosocial barriers are identified***	18		
▪ High risk for delayed RTW - behavioral approach	26		
▪ Participatory ergonomics recommendations are discussed/ documented for when work demands exceed worker ability	17		
Re-evaluation – data is presented and relevant planning decisions/updates are also documented			
▪ RTW risk, diagnosis, prognosis are updated at reevaluation	1-5, 15, 16		
▪ Interventions are updated as client presentation evolves			
Care path beyond 6-8 weeks post injury - was the following information documented?			
▪ Communication about multidisciplinary eval with insurer and physician to facilitate planning and addressing RTW barriers	7		
▪ Intense graded exercise interventions (work oriented functional activities, strengthening, cardiopulmonary, endurance, and motor control exercises)	21		
Final disposition – were one or both of the following used for RTW decision making? ‡			
▪ Self-report measures specific to RTW were used to guide RTW decision making	10		
▪ Performance based testing/measures were used to inform RTW recommendations	11		

1 *Notes*

¥ *Associated risk information in parentheses*

* *Timing and content of ergonomics assessment and RTW examination may vary based on the type of problem and client presentation. Testing may not necessarily occur at the first visit, although basic understanding of functional performance for transfers, walking, lifting, carrying, etc. will also help the therapist advise on modifications and optimizing ADL/IADL/work task performance, as well as program updates during care. Testing protocols may be modified during acute phase or when a client is unable to perform a task.*

** *Risk level may be identified by the overall number of tasks and/or a high-risk measure score on one or more self-report instruments.*

*** *Interventions such as individual goal setting, motivational interviewing, education regarding activity pacing, problem solving, relaxation, and coping techniques (18)*

† *Do not rely upon written material or group training to motivate and direct the worker in strategies to return to activity. (20)*

†† *Do not use light exercise as an isolated intervention to address RTW goals, except when there is explicit reason documented (psychosocial, acute/catastrophic injury/post-surg)(22)*

β *Generally, not use exercise plus a behavioral approach as the only course of treatment (23)*

‡ *RTW recommendations were not made solely based on impairment data (9)*

Figure 3. Optimizing work participation – Personal development and reflection checklist.

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APPENDIX A - Search Strategies for All Databases

PsycINFO

((MAINSUBJECT.EXACT.EXPLODE("Work Related Illnesses") OR MAINSUBJECT.EXACT.EXPLODE("Occupational Health") OR (MAINSUBJECT.EXACT("Occupations") OR MAINSUBJECT.EXACT.EXPLODE("Occupations")) OR MAINSUBJECT.EXACT.EXPLODE("Industrial Accidents")) OR (ti(worker* OR employee* OR professional* OR manpower) OR ab(worker* OR employee* OR professional* OR manpower))) AND ((MAINSUBJECT.EXACT.EXPLODE("Employment Status") OR MAINSUBJECT.EXACT.EXPLODE("Employability") OR MAINSUBJECT.EXACT.EXPLODE("Reemployment") OR MAINSUBJECT.EXACT.EXPLODE("Retirement") OR MAINSUBJECT.EXACT.EXPLODE("Supported Employment") OR MAINSUBJECT.EXACT.EXPLODE("Unemployment") OR MAINSUBJECT.EXACT.EXPLODE("Work Adjustment Training") OR MAINSUBJECT.EXACT.EXPLODE("Personnel Termination") OR MAINSUBJECT.EXACT.EXPLODE("Occupational Adjustment") OR MAINSUBJECT.EXACT.EXPLODE("Career Change")) OR (MAINSUBJECT.EXACT.EXPLODE("Job Performance") OR MAINSUBJECT.EXACT.EXPLODE("Job Satisfaction") OR MAINSUBJECT.EXACT.EXPLODE("Employee Retention")) OR (MAINSUBJECT.EXACT.EXPLODE("Employee Engagement") OR ti("back to work" OR "return to work" OR RTW OR reemply* OR "stay at work" OR "remain at work" OR "sustain work*") OR ab("back to work" OR "return to work" OR RTW OR reemply* OR "stay at work" OR "remain at work" OR "sustain work*") OR ti(presenteeism OR "work* productiv*" OR "work place*") OR ab(presenteeism OR "work* productiv*" OR "work place*"))) AND (((MAINSUBJECT.EXACT.EXPLODE("Vocational Rehabilitation") OR MAINSUBJECT.EXACT.EXPLODE("Disability Evaluation") OR MAINSUBJECT.EXACT.EXPLODE("Human Factors Engineering") OR MAINSUBJECT.EXACT.EXPLODE("Ability Level")) OR (ti("recovery of function" OR

"functional recovery" OR "back school" OR "graded activit*" OR "work harden*") OR ab("recovery of function" OR "functional recovery" OR "back school" OR "graded activit*" OR "work harden*") OR ti("vocation* rehab*" OR "work rehab*" OR "job* rehab*" OR "employ* rehab*") OR ab("vocation* rehab*" OR "work rehab*" OR "job* rehab*" OR "employ* rehab*"))) OR (MAINSUBJECT.EXACT.EXPLODE("Physical Therapy") OR MAINSUBJECT.EXACT.EXPLODE("Massage") OR MAINSUBJECT.EXACT.EXPLODE("Physical Treatment Methods") OR ti("physical therap*" OR physiotherap* OR PT) OR ab("physical therap*" OR physiotherap* OR PT) AND pd(19990101-20190206))) AND la.exact("ENG")

Ovid MEDLINE

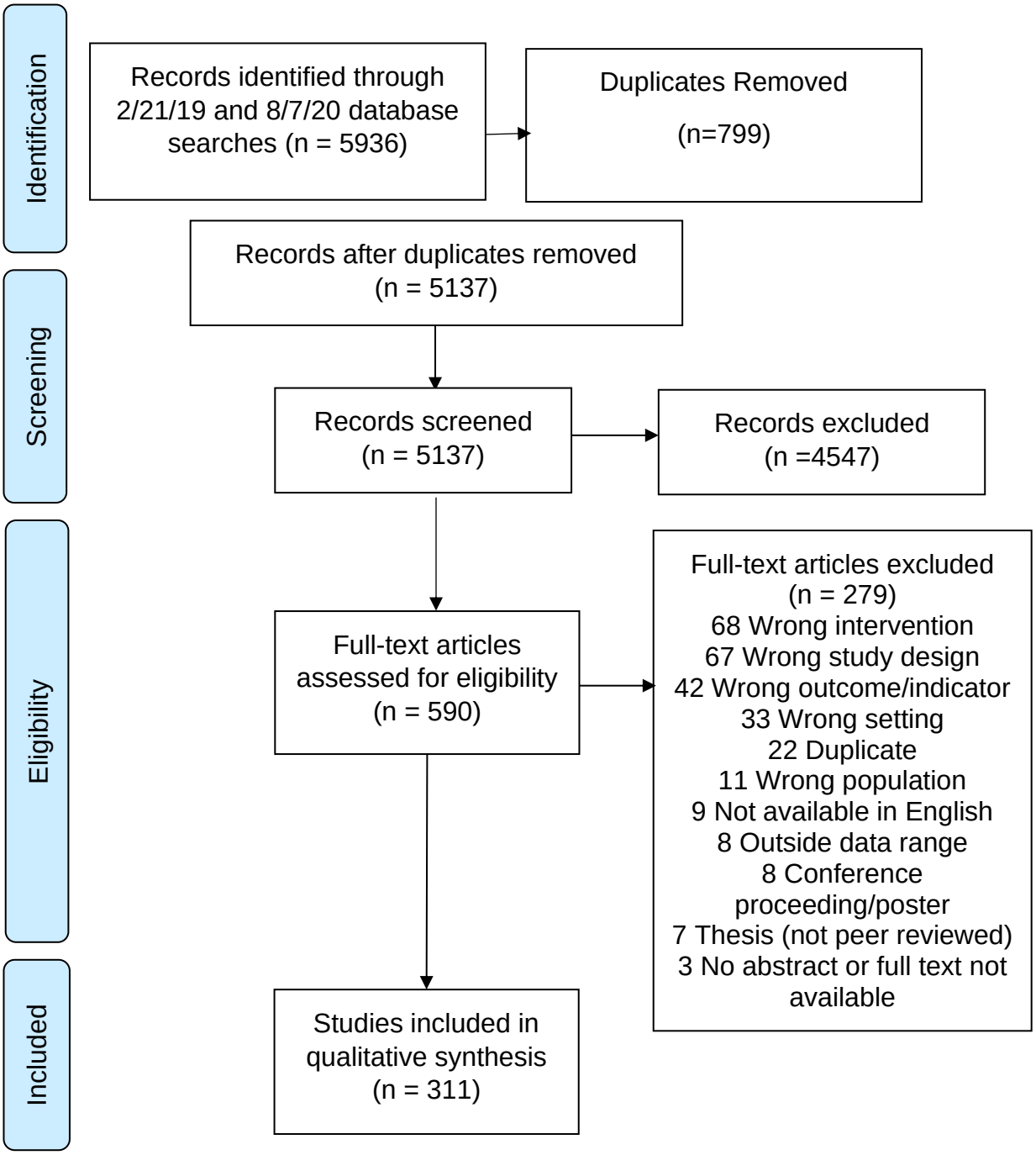
1 exp occupational groups/ (555072)
2 exp Occupational Diseases/ (126395)
3 exp Accidents, Occupational/ (17064)
4 exp Occupational Injuries/ (2339)
5 exp OCCUPATIONS/ (33020)
6 exp Health Occupations/ (1612521)
7 exp Health Manpower/ (12226)
8 ma.fs. (64345)
9 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 (2157811)
10 worker$.ti,ab. (164585)
11 employee$.ti,ab. (41434)
12 professional$.ti,ab. (255987)
13 manpower.ti,ab. (6867)
14 10 or 11 or 12 or 13 (443372)
15 9 or 14 (2420699)
16 exp Rehabilitation, Vocational/ (9993)
17 exp Disability Evaluation/ (49115)
18 exp Ergonomics/ (53874)
19 exp "Recovery of Function"/ (46104)
20 16 or 17 or 18 or 19 (153765)
21 "back school".tw. (241)
22 "graded activit$".tw. (210)
23 "work harden$".tw. (261)
24 ("vocation$ rehab$" or "work$ rehab$" or "job$ rehab$" or "employ$ rehab$").tw. (2538)
25 21 or 22 or 23 or 24 (3222)
26 20 or 25 (155097)
27 exp EMPLOYMENT/ (80077)
28 exp Sick Leave/ (5375)
29 exp Absenteeism/ (8620)

30 exp Work Performance/ (515)
31 exp Job Satisfaction/ (23275)
32 exp "Cost of Illness"/ (24443)
33 exp Work Schedule Tolerance/ (6476)
34 exp Work Engagement/ (129)
35 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 (136794)
36 ("back to work" or "return to work" or RTW or reemploy$).tw. (8941)
37 "stay at work".tw. (62)
38 "remain at work".tw. (36)
39 "sustain work*".tw. (38)
40 presenteeism.tw. (931)
41 "work$ productiv$".tw. (2054)
42 "work place$".tw. (2578)
43 36 or 37 or 38 or 39 or 40 or 41 or 42 (14200)
44 35 or 43 (145986)
45 exp Physical Therapy Modalities/ (140472)
46 exp Physical Therapists/ (1385)
47 (physiotherap$ or "physical therap$").tw. (41555)
48 PT.ti,ab. (46876)
49 45 or 46 or 47 or 48 (210133)
50 15 and 26 and 44 (5492)
51 49 and 50 (219)

Cochrane Database of Systematic Reviews

("Physical Therapy Modalities" OR "Physical Therapists" OR "physiotherapy*" OR "physical therap*" OR "PT") AND ("Rehabilitation, Vocational" OR "vocation* rehab*" OR "work* rehab*" OR "back school" OR "job* rehab*" OR "employ* rehab*") AND ("Return to Work" OR "back to work*" OR "return to work*" or "reemploy*")

APPENDIX B - PRISMA Flowchart of Articles



APPENDIX C – Inclusion and Exclusion Criteria

Inclusion Criteria:	Exclusion Criteria:
• Articles published in peer-reviewed journal using the following type of study designs: systematic reviews, meta-analyses, experimental and quasi-experimental, cohort, case series, and cross-sectional studies. • Articles which considered work rehabilitation in clinical or workplace settings that included elements consistent with physical therapist examination/intervention and management (as well as articles related to patient/stakeholder perspectives that impact delivery of care by physical therapists). • Must have intentional work related or RTW component or goals (assessment, measures, intervention risk factors, prognosis, role of therapist). • The study population included workers, 16-65 years of age, regardless of sex. • Studies that focused on conditions that limit activity and participation in work (across all areas of physical therapist practice). • Primary outcomes that are work-related such as RTW, days on sick leave, post injury employment status, stay-at-work, work-engagement, and costs related to	• Meeting abstracts, press releases, theses, non-systematic review articles, case reports, and articles not in English. • Studies published outside of the date range of January 1999-August 2020. • Non-human studies. • Topics outside the scope of physical therapist practice (ie, severe psychological conditions as primary diagnosis, neurocognitive/neuropsychological management, or surgical management of work-related conditions). • Studies outside the context of work or employment. • Studies that did not have an intentional RTW outcome/focus (studies where work is considered just incidentally, work entry for individuals with developmental disabilities, etc.).

RTW or longevity of work. (Prevention interventions were included when outcomes included measures of work retention, avoiding time loss, or restricted duty). • Qualitative studies were retained for full text review, tagging, and extraction, but only included in the evidence synthesis if they added new information or provided expanded understanding of quantitative studies.	• Reviews that were not systematic reviews (scoping or narrative reviews).

APPENDIX D – Levels of Evidence Table*****

Level	Intervention/ Prevention	Risk/Clinical Course/Prognosis /Differential Diagnosis	Diagnosis/ Diagnostic Accuracy	Prevalence of Condition/ Disorder	Exam/ Outcome
I	Systematic review of high-quality RCTs High-quality RCT†	Systematic review of prospective cohort studies High-quality prospective cohort study‡	Systematic review of high-quality diagnostic studies High-quality diagnostic study§ with validation	Systematic review, high-quality cross-sectional studies High-quality cross-sectional study‖	Systematic review of prospective cohort studies High-quality prospective cohort study
II	Systematic review of high-quality cohort studies High-quality cohort study‡ Outcomes study or ecological study Lower-quality RCT¶	Systematic review of retrospective cohort study Lower-quality prospective cohort study High-quality retrospective cohort study Consecutive cohort Outcomes study or ecological study	Systematic review of exploratory diagnostic studies or consecutive cohort studies High-quality exploratory diagnostic studies Consecutive retrospective cohort	Systematic review of studies that allows relevant estimate Lower-quality cross-sectional study	Systematic review of lower-quality prospective cohort studies Lower-quality prospective cohort study

III	Systematic reviews of case-control studies High-quality case-control study Lower-quality cohort study	Lower-quality retrospective cohort study High-quality cross-sectional study Case-control study	Lower-quality exploratory diagnostic studies Nonconsecutive retrospective cohort	Local nonrandom study	High-quality cross-sectional study
IV	Case series	Case series	Case-control study		Lower-quality cross-sectional study
V	Expert opinion	Expert opinion	Expert opinion	Expert opinion	Expert opinion

**Adapted from Phillips et al (http://www.cebm.net/index.aspx?o=1025). See also* APPENDIX E*.*
Abbreviation: RCT, randomized clinical trial.
†*High quality includes RCTs with greater than 80% follow-up, blinding, and appropriate randomization procedures.*
‡*High-quality cohort study includes greater than 80% follow-up.*
§*High-quality diagnostic study includes consistently applied reference standard and blinding.*
‖*High-quality prevalence study is a cross-sectional study that uses a local and current random sample or censuses*
¶*Weaker diagnostic criteria and reference standards, improper randomization, no blinding, and less than 80% follow-up may add bias and threats to validity.*

APPENDIX E– Procedures for Assigning Levels of Evidence

Quality Assessment

The quality and strength of evidence for each study included for data extraction was analyzed. OCEBM has outlined a strategy for assessing the level of evidence for studies. OCEBM Levels of Evidence are assigned based on the nature of the research question and study design. OCEBM Levels of Evidence range from I to V with I representing the highest Level of Evidence (e.g. systematic review of high-quality RCTs) and V representing the lowest Level of Evidence (e.g. expert opinion). (*pending CEBM 2009 reference).* Articles may be downgraded according to the OCEBM criteria, if the quality of the study is poor. Decisions regarding the assignments of Levels of Evidence were determined through discussion and consensus between members of the GDG.

Each recommendation was assigned a grade based on the OCEBM Level of Evidence for the studies that were used to formulate the guidance statement. Strength of recommendation is graded A-F, with A representing the highest Level of Evidence (e.g. consistent Level 1 studies), and F representing the lowest Level of Evidence (Level 5 studies or inconclusive evidence). (*pending McDonough reference).* Grades of recommendation were utilized to determine how well the scientific literature collectively supports (or refutes) the guidance statements.

Heuristic Decision-Making

A heuristic decision-making approach was used to guide the process of formulating recommendations, assessing the quality of evidence, and assigning the Grades of Recommendation. While this is an imperfect method, it is both practical and sensible for a number of reasons, including the fact that patient values and preferences and clinician expertise and experience are the foundation of evidence-based practice. Quality was not specifically scored, but weighted based on the low/high quality in each level of evidence with consideration of relevant elements such as follow up, attrition rate, sample size, design, data variance, and consensus. Grades of Recommendation were based on the preponderance of evidence that either supported or refuted the guidance statement. A preponderance of evidence had to be either supporting or refuting the guidance statement in question. Because the goal of this research was to help guide physical therapy practice rather than provide a prescription for treatment, a heuristic-driven approach was determined to be the best way to present the outcomes.

Internal Group Review Phase

The recommendation statements were sent to the WORK-CPGDG for internal review. A series of teleconferences to review the guidance statements were held. Team members performed quality assurance by means of having two people independently review and provide comments for each guidance statement and the corresponding set of evidence.

APPENDIX F – Evidence Tables

Client Presentation

Age

Author	Year	Study Design	CEBM Level	Support - (Higher age negatively impacts outcomes)	Refute – No difference with age	Conflicting
Abegglen et al[7]	2017	Prospective Cohort	I	X		
Clausen et al[72]	2011	Prospective Cohort	I		X	

Hou et al[159]	2008	SLR of RCTs	I		X	
Oyeflaten et al[250]	2014	Prospective Cohort	I	X		X
Roesler et al[265]	2013	Prospective Cohort	I		X	
Stapelfeldt et al[287]	2011	RCT Analysis	I		X	
Abásolo et al[6]	2008	RCT Analysis	II			X
Armijo-Olivo et al[18]	2016	Retrospective Validation Study	II		X	
Busse et al[54]	2015	Retrospective Cohort	II	X		
deBuck et al[46]	2006	RCT Analysis	II		X	
Hebert and Ashworth[144]	2006	Retrospective Cohort	II			X
Heymans et al[148]	2009	Prospective Cohort	II		X	
Joy et al[174]	2001	Cohort Observational Study	II		X	
Kuijpers et al[193]	2006	Prospective Cohort Study	II		X	
Lydell et al[210]	2009	Prospective Cohort	II	X		
Marchand et al[212]	2015	RCT	II	X		
Milidonis and Greene[224]	2005	Retrospective Cohort	II	X		
Rinaldo and Selander[261]	2016	SLR	II	X		
Street and Lacey[294]	2015	SLR	II	X		
Salzwedel et al[270]	2019	Prospective Observational	II	X		
Grossi et al[133]	1999	Cross Sectional	III	X		
Halimah et al[21]	2017	Retrospective Cohort	III	X		
Moshe et al[231]	2015	Retrospective Cohort	III		X	
Poulain et al[258]	2010	Prospective Cohort	III	X		
Turi et al[305]	2019	Retrospective Cohort	III	X		

Sex

Author	Year	Study Design	CEBM Level	Support – (gender	Refute – no	Conflicting

				impacts work outcomes negatively)	difference w/gender	
Abegglen et al[7]	2017	Prospective Cohort	I	X male		
Oyeflaten et al[250]	2014	Prospective Cohort	I			X
Stapelfeldt et al[287]	2011	RCT Analysis	I		X	
Storheim et al[293]	2005	Prospective Cohort	I		X	
Aas et al[3]	2018	Prospective Cohort	II	X male		
Abásolo et al[6]	2008	RCT Analysis	II	X female		
Heymans et al[148]	2009	Prospective Cohort	II	X female		
Keeney et al[181]	2013	Prospective Cohort	II	X male		
Kvam et al[194]	2015	Prospective Cohort	II			X
Lydell et al[210]	2009	Prospective Cohort	II			X
Milidonis and Greene[224]	2005	Retrospective Cohort	II	X women		
Rinaldo and Selander[261]	2016	SLR	II			X
Street and Lacey[294]	2015	SLR	II	X female		
Grossi et al[133]	1999	Cross-Sectional	III	X male		
Halimah et al[21]	2017	Retrospective Cohort	III	X female		
Moshe et al[231]	2015	Retrospective Cohort	III		X	
Poulain et al[258]	2010	Prospective Cohort	III			X
Turi et al[305]	2019	Retrospective Cohort	III		X	

Worker's Expectations and Beliefs

Author	Year	Study Design	CEBM Level	Support	Refute	Conflicting
Palmlof et al[252]	2019	Prospective Cohort	I	X		
Schultz et al[277]	2002	Prospective Cohort	I	X		
Schultz et al[276]	2004	Prospective Cohort	I	X		
Xu et al[330]	2007	Prospective Cohort	I	X		
Abegglen et al[7]	2017	Prospective Cohort	I	X		
Clausen et al[72]	2011	Prospective Cohort	I			X
Carlsson et al[61]	2019	Prospective Cohort	II	X		
Gross and Battie[125]	2010	Prospective Cohort	II			X
Rinaldo and Selander[261]	2016	SLR	II	X		

Author	Year	Study Design	CEBM Level	Support	Refute	Conflicting
Salzwedel et al[270]	2019	Prospective Observational	II	X		

Fear of Movement

Author	Year	Study Design	CEBM Level	Support	Refute	Conflicting
Fritz and George[105]	2002	Prospective Cohort	I	X		
Staal et al[285]	2008	RCT	I	X		
Storheim et al[293]	2005	Prospective Cohort	I	X		
Wideman and Sullivan[327]	2011	Prospective Cohort	I	X		

Non-Organic Signs/Symptom Magnification

Author	Year	Study Design	CEBM Level	Support	Refute	Conflicting
Fritz et al[106]	2000	Prospective Cohort	I		X	
Chapman-Day et al[66]	2011	Prospective Cohort	II			X

History of Restricted Work and Prior Sick Leave

Author	Year	Study Design	CEBM Level	Support (risk impacts work outcomes)	Refute/ Conflict
Oyeflaten et al[250]	2014	Prospective Cohort	I	Long term sick leave prior to referral, diagnosis other than mental or MSK	
Schultz et al[277]	2002	Prospective Cohort	I	Pain behavior, pain, disability, expectation of recovery	

Injury Type and Severity

Author	Year	Study Design	CEBM Level	Support (risk impacts work outcomes)	Refute/ Conflict
Hou et al[159]	2008	Prospective Cohort	I		Injury severity hospital stay (Traumatic upper/lower extremity)

Aas et al[3]	2018	Prospective Cohort	II	Comorbid conditions	Mild/moderate cognitive impairment
Hebert and Ashworth[144]	2006	Retrospective Cohort	II	Amputation level, number of surgical procedures, days of acute care stay	
Street and Lacey[294]	2015	SLR	II	Higher injury severity, mechanism of injury (lifting, muscular stress, repetitive lifting, sitting), negative outcome perceptions	

Pain and Symptom Patterns

Author	Year	Study Design	CEBM Level	Support (risk impacts work outcomes)	Refute/ Conflicting
Heymans et al[151]	2006	RCT Analysis	I	Back pain, radiating pain, pain intensity, function, kinesiophobia	
Schultz et al[277]	2002	Prospective Cohort	I	Pain behavior, pain, disability, expectation of recovery	
Storheim et al[293]	2005	Prospective Cohort	I	Cardiovascular fitness, pain, physical performance	
vander Weide et al[323]	1999	Prospective Cohort	I	Radiating pain, high functional disability	
Werneke and Hart[324]	2001	Consecutive Cohort	I	pain pattern classification (observe over time), leg pain/ centralization predicts chronic pain/ disability	
Baldwin et al[25]	2007	Prospective Cohort	II	Severity measures such as degree of leg pain, baseline physical/ health function (MSK)	Back pain intensity (Mental health problems)
Cougot et al[76]	2015	Prospective Cohort	II	Duration of absence, smoking, range of motion (Chronic back pain)	
Fransen et al[104]	2002	Prospective Cohort	II	Radiating lower limb, moderate ODI severity	
Gauthier et al[112]	2006	Prospective Cohort	II	Pain catastrophizing, pain severity	
Mngoma et al[226]	2008	Prospective Cohort	II	Pain profiles	
Heymans et al[148]	2009	Prospective Cohort	II	Higher pain intensity at baseline, longer duration complaints	

Lydell et al[210]	2009	Prospective Cohort	II	Duration of sick leave before intervention (at 5 yrs., not 10)	Self-rated physical capacity/pain at 10years
Rinaldo and Selander[261]	2016	SLR	II	More pain, function disability more time since injury (Neck, shoulder, back)	

Self-Reported Function

Author	Year	Study Design	CEBM Level	Support (risk impacts work outcomes)	Refute/ Conflicting
Margison and French[213]	2007	Prospective Cohort	I	OMPQ > 147 were "not fit to work"	
Baldwin et al[25]	2007	Prospective Cohort	II	Severity measures such as degree of leg pain, baseline physical/ health function (MSK)	Back pain intensity (Mental health problems)
Butler and Johnson[55]	2008	Prospective Cohort	II	Satisfaction with health provider	
Fransen et al[104]	2002	Prospective Cohort	II	Radiating lower limb, moderate ODI severity	
Heymans et al[149]	2007	Retrospective Cohort	II		Short duration of complaint, better functional ability initially
Lydell et al[210]	2009	Prospective Cohort	II	Duration of sick leave before intervention (at 5 yrs., not 10)	Self-rated physical capacity/pain at 10years
Milidonis and Greene[224]	2005	Retrospective Cohort	II	Difficulty lifting 10 and 25 lbs., climbing 10 steps, walking ¼ mile, number activities limited	Pain not strongly associated with work status

Multiple Concurrent Risks

Author	Year	Study Design	CEBM Level	Support (risk impacts work outcomes)	Refute/ Conflicting
Abegglen et al[7]	2017	Prospective Cohort	I	Age, gender, job design, somatic condition/pain	
Haahr and Andersen[134]	2003	RCT	I	High level of pain/dysfunction	
Heymans et al[151]	2006	RCT Analysis	I	Pain intensity/radiation, workers self-predicted timing of RTW, job satisfaction, expectations	

Hunt et al[163]	2002	Prospective Cohort	I	Non-medical factors (psychosocial, work and economic) more powerful than medical
Roesler et al[265]	2013	Prospective Cohort	I	Traumatic hand problems
Van der Weide et al[323]	1999	Prospective Cohort	I	Radiating pain, high functional disability
Vendrig[308]	1999	Prospective Cohort	I	Perceived disability, pain
Abásolo et al[6]	2008	RCT Analysis	II	Peripheral OA, inflammatory disease, sciatica and duration
Armijo-Olivo et al[18]	2016	Retrospective Validation Study	II	Factors following UE injury: prior claims, extensive visits, pain and disability scores
De Buck et al[46]	2006	RCT Analysis	II	Complete sick leave
Ernstsen and Lillefjell[93]	2014	Retrospective Cohort	II	Musculoskeletal pain, depression, self-reported physical functioning (muscle strength, mobility, endurance capacity, and balance)
Kuijpers et al[193]	2006	Prospective Cohort	II	Longer sick leave prior to consult, higher pain intensity, overuse strain
Stromberg et al[295]	2019	Cross Sectional Psychometic Study	III	Duration of post traumatic amnesia at 3-4 weeks negatively impacts employment outcomes following closed brain injury
Turi et al[305]	2019	Retrospective Cohort	III	Stroke patients worse RTW if older, depressed anxious

Socioeconomic and Work Environment Factors

Education Level

Author	Year	Study Design	CEBM Level	Support – (Education impacts work outcomes)	Refute	Conflicting
Hou et al[159]	2008	Prospective Cohort	I	X		
Storheim et al[293]	2005	Prospective Cohort	I		X	X
Armijo-Olivo et al[18]	2016	Validation Study	II		X	

Kvam et al[194]	2015	Prospective Cohort	II		X	
Lydell et al[210]	2009	Prospective Cohort	II			X
Milidonis and Greene[224]	2005	Retrospective Cohort	II			X
Street and Lacey[294]	2015	SLR	II	X		
Grossi et al[133]	1999	Cross Sectional	III	X		
Hankins and Reid[138]	2015	Cross Sectional	III	X		
Moshe et al[231]	2015	Retrospective Cohort	III		X	

Work Demands, Culture, and Policy

Author	Year	Study Design	CEBM Level	Support (Factor impacts RTW outcomes) (-) negative impact (+) positive impact	Refute	Conflicting
Haahr and Andersen	2003	RCT	I	High physical strain, manual tasks (-)		
Heymans (867)	2006	RCT	I			Bending, rotation at univariate level
Kapoor (1370)	2006	Prospective Cohort	I	More physical work (-)		
Kuijpers (815)	2006	Prospective Cohort	I		No impact of workload	Overuse, decision authority
Oyeflaten (404)	2014	Prospective Cohort	I	Manual work (-)		
Roesler (2826)	2013	Prospective Cohort	I		Job classification	
Schultz (773)	2002	Prospective Cohort	I	Workplace factor/s (-)	Less physical demand and skill discretion	
Schultz (775)	2004	Propsective Cohort	I	Low coworker support, low skill discretion (-)		
Stapelfeldt (676)	2011	RCT Analysis	I	Low job satisfaction (-), low influence on work planning (-), high perception of risk of losing job (-)		

Vander Weide (169)	1999	Prospective Cohort	I	Problems in colleague relationships (-), high work tempo and work quality (-)		
Abásolo (2393)	2008	RCT	II	Unemployed or self-employed (-)		
Armijo-Olivo (1624)	2016	Retrospective Cohort	II	Modified work (+)		
Busse (1481)	2015	Retrospective Cohort	II	RTW programs (+)		
Franche (2918)	2005	SLR	II	Work modification (+), contact w/health team (+), early ergo (+), RTW coordination (+)		
Fransen (1122)	2002	Prospective Cohort	II	Need to lift ¾ of day, workplace no light duty (-)		
Heymans (870)	2009	Retrospective Cohort	II	Low satisfaction (-)		
Keeney (1365)	2013	Prospective Cohort	II	High amounts of heavy lifting, physical demands, vibration (-)		
Lydell (531)	2009	Prospective Cohort	II		Sitting, bending, heavy lifting	Light physical labor (predicts RTW at 5 years, not 10)
Muenchberger (1066)	2008	SLR	II	Workplace policies and accommodations, modified work (-)	.	
Rinaldo (2402)	2016	SLR	II	Less locus of control (-)	Being able to influence RTW	
Street (2711)	2015	SLR	II	Manual job, lower wages, less time with employer or <50 employees (-)		
Grossi (936)	1999	Cross Sectional	III	manual job, higher job strain (-)		

Hankins (2861)	2015	Cross	III	Longer job tenure, higher weekly wage

Job Satisfaction, Locus of Control at Work, or Perceived Satisfaction

Author	**Year**	Study Design	**CEBM Level**	**Support**	**Refute**	**Conflicting**
Brouwer et al[42]	2010	Prospective Cohort	I	X		
Clausen et al[72]	2011	Prospective Cohort	I	X		
Abegglen et al[7]	2017	Prospective Cohort	I	X		
Stapelfeldt et al[287]	2011	RCT Analysis	I	X		
Svedmark et al[299]	2018	RCT Longitudinal Study	II	X		

Clinical Course

Care Delivery Patterns

Author	Year	Study Design	CEBM Level
Blanchette (5006)	2017	Retrospective Cohort	II
Stephens (658)	2007	Retrospective Cohort	II
Carlsson (1459)	2013	RCT	II
Bernacki (5898)	2020	Retrospective Cohort	III

Therapeutic Alliance

Author	Year	Study Design	CEBM Level	Support (Worker experience impacts outcomes)	Refute	Conflicting
Kapoor (1370)	2006	Prospective Cohort	I	X		
Butler (1479)	2008	Prospective Cohort	II			X
Kilgour (3169)	2015	SLR	II	X		
Muenchberger (1066)	2008	SLR	II	X		
Azoulay (1612)	2005	Prospective Cohort	II			X
Kirsch (3165)	2003	Cross Sectional	IV	X		

Temporary Workers as a Vulnerable Population

Author	Year	Study Design	CEBM Level

Vermeulen (134)	2009	Prospective Cohort	II
Vermeulen (1756)	2011	RCT	II
Vermeulen (136)	2009	Intervention Mapping	V

3

4

5 **Examination**

6

7 *Body Functions and Structures*

8

Author	Year	Study Design	CEBM Level	Support	Refute	Conflicting
Hunt (825)	2002	Prospective Cohort	I			X
Werneke (73)	2004	Prospective Cohort	I			X

9

10 *Self-Report Measures*

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Author	Year	Study Design	CEBM Level	Support	Refute	Conflicting
Abegglen et al[7]	2017	Prospective Cohort	I	X		
Bergström et al[26]	2014	Prospective Cohort	I	X		
Gabel et al[108]	2012	Prospective Cohort	I	X		
Gatchel et al[111]	2006	Prospective Cohort	I	X		
Roelen et al[263]	2014	Prospective Cohort	I			X
Roy et al[267]	2013	Prospective Cohort	I			X
Shaw et al[280]	2009	Prospective Cohort	I	X		
Trippolini et al[303]	2018	Prospective Cohort	I	X		
Armijo-Olivo et al[18]	2016	Retrospective Cohort	II	X		
Backman et al[23]	2008	Prospective Cohort	II	X		
Dale et al(1233)	2015	Prospective Cohort	II	X		
Ross (275)	2006	Prospective Cohort	II			X
Van Schaajik (156)	2018	Consecutive Cohort	II	X		
Wastberg (93)	2009	Cohort for Psychometrics	II			X
Bethge (5082)	2015	Cross Sectional	III	X		
Braathen	2013	Cross Sectional	III	X		
Denis (1196)	2007	Cross Sectional	III	X		
Haraldsson (904)	2016	Multiple Location Cross Section	III	X		
Kinnunen (1339)	2018	Cross Sectional	III	X		
Moshe (1070)	2015	Retrospective Cohort	III	X		
Notenbomer (1010)	2015	Cross Sectional	III	X		
Park (3820)	2018	Cross Sectional	III	X		

Velozo (2643)	1999	Cross Sectional	III			X

Physical Performance Measures

Author	Year	Study Design	CEBM Level	Support	Refute	Conflicting
Gross (942)	2006	Prospective Longitudinal Cohort	I			X
Gouttebarge (958)	2009	Prospective Cohort	I		X	
Kuijer (816)	2006	Prognostic Cohort	I		X	
Lechner (602)	2008	Prospective Cohort	I	X		
Branton (1516)	2010	Prospective Cohort	I			X
Caron (1457)	2015	Retrospective Cohort	II	X		
Chapman-Day et al[66]	2011	Prospective Cohort	II			X
Cheng (1437)	2011	Retrospective Cohort	II		X	
Gross (938)	2004	Retrospective Cohort	II	X		
Gross (937)	2012	Prospective Cohort	II	X		
Gross (944)	2004	Prospective Cohort	II		X	
Gross (939)	2007	Cluster RCT	II	X		
Gross (943)	2005	Propsective Cohort	II		X	
Gross (947)	2014	Cluster RCT	II	X		
Gross et al[122]	2014	Cluster RCT	II	X		
Haldorsen et al[136]	2002	RCT	II	X		
Lemstra et al[199]	2004	RCT	II		X	
Matheson et al[218]	2002	Retrospective Cohort	II			X
Scheman et al[273]	2000	Prospective Cohort	II		X	
Brubaker et al[44]	2007	Cross section of RCT	II	X		
Denis (1196)	2007	Cross Sectional	III	X		
Gross et al[128]	2006	Psychometric Study	III	X		
Gross and Battie[126]	2002	Psychometric Study, Test-retest cohort	IV	X		
Mitchell et al[225]	2015	Cross Sectional	IV			X
Tuckwell et al[304]	2002	Prospective Cohort, Test-retest	IV			X
Gross[120]	2006	Literature Review	V			X

Psychosocial Factors

Author	Year	Study Design	Level	Support	Refute	Conflict
Abegglen et al[7]	2017	Prospective Cohort	I	X		
Fritz et al[106]	2000	Prospective Cohort	I		X	
Fritz and George[105]	2002	Prospective Cohort	I	X		
Margison and French[213]	2007	Prospective Cohort	I	X		

Author	Year	Study Design	Level	Support	Refute	Conflict
Schultz et al[274]	2005	Prospective Cohort	I	X		
Shaw et al[280]	2009	SLR	I	X		
Wideman and Sullivan[326]	2012	Prospective Cohort	I	X		
Carleton et al[59]	2009	Retrospective Cohort	II	X		
Ernstsen and Lillefjell[93]	2014	Retrospective Cohort	II		X	
Franche et al[102]	2007	SLR	II	X		
Haldorsen et al[136]	2002	RCT	II	X		
Iles et al[166]	2019	Prospective Cohort	II	X		
Holden et al[156]	2010	Retrospective Cohort	II	X		
Park et al[255]	2018	Cross Sectional	III	X		
Velozo et al[307]	1999	Cross Sectional	III		X	
Gross[120]	2006	Literature Review	V		X	

Job Demands

Author	Year	Study Design	CEBM Level
Baker and Jacobs[24]	2008	Prospective Cohort	I
Backman et al[23]	2014	Prospective Cohort	II
Velozo et al[307]	1999	Cross Sectional	III
Escorpizo et al[94]	2014	Psychometric Study	IV
Michel et al[223]	2018	Descriptive	V

Economic and Administrative Outcomes

Author	Year	Study Design	CEBM Level
Cheng et al[70]	2002	Retrospective Cohort	III
Vogel et al[317]	2011	Psychometric Cross Sectional	IV
Wasiak et al[320]	2007	Literature Review	II

INTERVENTIONS

Communication and Coordination of Services

Author	Year	Study Design	CEBM Level	Support	Refute/No Difference	Conflicting
Loisel et al[208]	2002	RCT	I	X		
Myhre et al[233]	2014	RCT	I		X	
Jensen et al[169]	2011	RCT	I		X	
Jensen et al[170]	2013	RCT Analysis	I		X	

Moll et al[228]	2018	RCT	I		X		
Ntsiea et al[241]	2015	RCT	I	X			
Pedersen et al[257]	2018	RCT	I		X		
Stapelfeldt et al[287]	2011	RCT	I			X	
Van Vilsteren et al[316]	2015	SLR	I			X	
Vogel et al[318]	2017	SLR	I		X		
Vermeulen et al[313]	2009	RCT	I	X			
Arnetz et al[19]	2003	RCT	II	X			
Bultmann et al[49]	2009	RCT	II	X			
Franche et al[103]	2005	SLR	II	X			
Lambeek et al[196]	2009	RCT	II			X	
Marchand et al[212]	2018	RCT	II		X		
Saha et al[268]	2019	RCT	II	X			
Schultz et al[275]	2008	Prospective Cohort	II			X	
Vermeulen et al[312]	2011	RCT	II	X			
Bernacki et al[28]	2000	Cross Sectional	III	X			

Graded, Modified, Transitional Work as Part of the Plan of Care

Author	Year	Study Design	CEBM Level	Support	Refute	Conflicting
Ntsiea et al[241]	2015	RCT	I	X		
Roels et al[264]	2016	SLR	I	X		
Van Vilsteren et al[316]	2015	SLR	I			X
Bethge[30]	2016	Retrospective Cohort	II	X		
Khan et al[185]	2009	SLR	II		X	
Van Dujin et al[92]	2005	Prospective Cohort	II		X	
Van Dujin and Burdorf[91]	2008	Prospective Cohort	II	X		
Viikari-Juntura et al[315]	2012	RCT	II	X		
Williams et al[328]	2007	SLR	II			X

Ergonomics/Participatory Ergonomics

Author	Year	Study Design	Level	Support	Refute	Conflicting
Anema et al[16]	2007	RCT	I	X		
Arnetz et al[19]	2003	RCT	II	X		
Franche et al[103]	2005	SLR	II	X		
Martimo et al[216]	2010	RCT	II			X
Steenstra et al[289]	2006	RCT	II	X		
Verhagen et al[309]	2013	SLR	II			X

Psychologically Informed Practice

Author	Year	Study Design	Level	Support	Refute	Conflicting
Anema et al[16]	2008	RCT	I		X	
Gross et al[132]	2017	Cluster RCT	I	X		
Hara et al[139]	2018	RCT	I	X		
Kool et al[191]	2005	RCT	I	X		
Kool et al [190]	2007	RCT	I	X		
Li et al[201]	2006	RCT	I	X		
Linton et al[202]	2005	RCT	I	X		
Meyer et al[222]	2005	RCT	I		X	
Palmer et al[251]	2012	SLR	I			X
Staal et al[286]	2004	RCT	I			X
Staal et al[285]	2008	RCT	I	X		
Vendrig[308]	1999	Prospective Cohort	I	X		
Bethge et al[31]	2011	RCT	II			X
Brendbekken et al[41]	2017	RCT	II			X
Campello et al[56]	2012	RCT	II			X
Doda et al[87]	2015	RCT	II			X
Godges et al[114]	2008	RCT	II	X		
Heinrich et al[146]	2009	RCT	II		X	
Jensen et al[171]	2005	RCT	II			X
Lambeek et al[195]	2010	RCT Economic Evaluation	II	X		
Leon et al[200]	2009	RCT	II			X
Marchand et al[212]	2015	RCT	II		X	
Marin et al[215]	2017	SLR	II			X
Park et al[254]	2018	RCT	II	X		
Rasmussen et al[260]	2016	RCT	II			X
Schweikert et al[278]	2006	RCT	II	X		
Steenstra et al[289]	2006	RCT	II		X	
Steenstra et al[288]	2006	RCT	II		X	
Suni et al[298]	2013	RCT	II	X		
Van den Hout et al[161]	2003	RCT	II	X		
Verhagen et al[309]	2013	SLR	II			X

Wisenthal et al[329]	2018	Prospective Cohort	II	X	
Hartzell et al[141]	2014	Consecutive Cohort	III	X	
Sullivan and Stanish[296]	2003	Prospective Cohort	III	X	
Taylor et al[302]	2001	Prospective Cohort	III	X	
De Jong et al[172]	2012	Case Series	IV	X	

Education

Author	Year	Study Design	Level	Support	Refute/No Difference	Conflicting
Chaleat-Valayer et al[65]	2016	RCT	I		X	
Kajiki et al[176]	2017	RCT	I		X	
Macedo et al[211]	2009	RCT	I	X		
Esmaeilzadeh et al[96]	2014	RCT	II			X
Hagen et al[135]	2000	RCT	II	X		
Hagen et al[227]	2003	RCT	II			X
Hazard et al[142]	2000	RCT	II		X	
Ketelaar et al[183]	2017	RCT	II		X	
Rasmussen et al[260]	2016	RCT	II			X

Progressive/Graded Exercise

Author	Year	Study Design	Level	Support	Refute	Conflicting
Andersen et al[12]	2015	RCT	I	X		
Andersen et al[13]	2016	RCT	I		X	X
Schaafsma et al[271]	2013	SCR of RCTs	I			X
Sundstrup et al[297]	2014	RCT	I	X		
Heinrich et al[146]	2009	RCT	II		X	

Care Involving Multiple Components

1. Exercise plus behavioral interventions are clinic based and may include education, general or non-specific exercise such as strengthening, stretching, conditioning and a psychosocial or behavioral component.
2. Work-focused interventions are clinic based and target achieving goals related to RTW such as the inclusion of graded work specific activities (i.e., lift, push, carry, squat, etc.) and developing a RTW plan, which may include contact with the workplace.

3. Job site interventions include active involvement of the worker, the employer, and rehabilitation professionals in the workplace

Author	Year	Study Design	Level of Evidence	Support	Refute	Conflicting
Andersen et al[11]	2017	RCT	I		3	
Carroll et al[64]	2010	RCT	I	3		
Heathcote et al[143]	2019	RCT	I	2		
Hegewald et al[145]	2019	SLR	I			2
Karjalainen et al[179]	2003	SLR	I	3		
Kool et al[191]	2005	RCT	I	2		
Kool et al[190]	2007	RCT	I	2		
Loisel et al[208]	2002	RCT Economic Evaluation	I	3		
Palmer et al[251]	2012	SLR	I			2
Pedersen et al[257]	2018	RCT	I		2	
Poulsen et al[259]	2014	RCT	I			2
Roche et al[262]	2007	RCT	I			2
Skagseth et al[283]	2020	RCT	I		2	
Verhoef et al[310]	2020	SLR	I	2		
Wegrzynek et al[322]	2020	SLR	I			2
Aas et al[4]	2011	SLR of RCTs	II			2
Aasdahl et al[5]	2018	RCT	II		1	
Anderson et al[14]	2007	RCT	II			1
Bethge et al[31]	2011	RCT	II			2
Brendbekken et al[41]	2017	RCT	II			1
Bultmann et al[49]	2009	RCT	II	2		
Campello et al[56]	2012	RCT	II			1
Carlsson et al[60]	2013	RCT	II		1	
Cheng and Hung[69]	2007	RCT	II	3		
Cullen et al[78]	2018	SLR	II	3		
Dellve et al[81]	2011	RCT	II	1		
Gismervik et al[113]	2020	RCT	II	2		
Haldorsen et al[136]	2002	RCT	II			1
Ijzelenberg et al[164]	2007	RCT	II		3	
Jensen et al[171]	2005	RCT	II			1
Lambeek et al[195]	2010	RCT Economic Evaluation	II	3		
Lambeek et al[197]	2010	RCT	II	3		
Lambeek et al[196]	2009	RCT Process Evaluation	II	3		
Leon et al[200]	2009	RCT	II			1
Loisel et al[207]	2001	Prospective Cohort	II	3		
Marin et al[215]	2017	SLR	II	2		

Meijer et al[221]	2006	RCT	II			2
Momsen et al[229]	2016	RCT	II		2	
Park et al[254]	2018	RCT	II	3		
Rasmussen et al[260]	2016	RCT	II			1
Schweikert et al[278]	2006	RCT	II			1
Van den Hout et al[161]	2003	RCT	II	1		
Vermuelen et al[314]	2009	Prospective Cohort	II	2		
Voss et al[319]	2019	Outcome Study	II	2		
Williams et al[328]	2007	SLR	II	3		
Hartzell et al[141]	2014	Consecutive Cohort	III	1		
Gagnon et al[109]	2013	Retrospective Cohort	III	1		
Mayer et al[220]	2013	Prospective Cohort	III	1		
Poulain et al[258]	2010	Prospective Cohort	III	1		

APPENDIX G – General Level of Evidence Table

Author	Study Design	LOE	Rationale
Aas et al[4]	SLR of RCTs	II	Intervention effectiveness, low quality RCTs due to lack of blinding via "GRADE"
Aas et al[3]	Prospective Cohort	II	Prognosis, follow-up data not included, risk factor study, N=137, lower quality
Aasdahl et al[5]	RCT	II	Intervention, RCT with parallel groups, decent N, low quality
Abásolo et al[6]	Analysis of RCT	II	Prognosis, not an RCT, no blinding in the original study, large N
Abegglen et al[7]	Prospective Cohort	I	Exam/validation psychometric study and prognosis, >80% follow-up, large N, screening tool
Alexy and Webb[9]	Psychometric Study	II	Validation, prognosis, consecutive cohort, >80% follow-up, N=109, high quality
Andersen et al[13]	RCT	I	Intervention, >80% follow-up, single-blind
Andersen et al[12]	RCT	I	Intervention, efficacy, >80% follow-up, single-blind, N=141
Andersen et al[11]	RCT	I	Intervention, >80% follow-up, examiner-blind, N=66, allocation concealment
Anderson et al[14]	RCT	II	Intervention, <80% follow-up, N=52 (predominantly women)

Anema et al[15]	Prospective Cohort	III	Intervention, <80% follow-up (77% @ 2 years), N=1631
Anema et al[16]	RCT	I	Intervention, >80% follow-up, single-blind, N=196
Armijo-Olivo et al[18]	Validation Study	II	Prognosis, retrospective study, N=3036, >80% data available, high quality
Arnetz et al[19]	RCT	II	Intervention, no blinding, <80% follow-up, N=137
Azoulay et al[22]	Prospective Cohort	II	Clinical course, >80% follow-up, N=35, concealed assessment of control group, not possible for those with MSDs, high quality
Backman et al[23]	Prospective Cohort	II	Exam development, N=19
Baker and Jacobs[24]	Psychometric Study	I	Exam, prospective cohort, N=30
Baldwin et al[25]	Prospective Cohort	II	Prognosis, validation study, <80% follow-up, large N, low quality
Bergström et al[26]	Psychometric Study	I	Exam, validity study, prospective cohort, follow-up with cohort at 2 year- 89%, N=105, high quality
Bernacki et al[28]	Outcome Study	III	Comparative intervention effectiveness, cross sectional, use of retrospective data for comparison, no attrition noted
Bernacki et al[27]	Retrospective Cohort	III	Course of care, comparison cohort, high N but limited study design/relevance
Besen et al[29]	Retrospective Cohort	III	Prognosis, <50% of initial cohort, N=241, low quality
Bethge et al[31]	RCT	II	Intervention, <80% follow-up, N=118
Bethge[30]	Retrospective Cohort	II	Intervention, no drop-outs, large N, high quality
Bethge et al[32]	Cross-Sectional Study	III	Prognosis/clinical course, large N, high quality
Bhatia et al[33]	Retrospective Cohort	III	Prognosis, <80% follow-up, N=78, low quality
Blanchette et al[34]	Retrospective Cohort	II	Course of care, large N, ~3% loss to follow-up, high quality
Blangsted et al[35]	RCT	II	Intervention, 71% follow-up, large N
Bogefeldt et al[36]	RCT	I	Intervention, randomization, blinding, 100% follow-up, N=160
Bondesson et al[37]	Cross-Sectional Study	III	Course of care, 83% follow-up, large N, high quality
Bontoux et al[38]	Prospective Cohort	III	Intervention, 70% follow-up, N=87, low quality
Braathen et al[39]	Psychometric Study	III	Examination, cross-sectional study, >80% follow-up, N=193, high quality

Branton et al[40]	Psychometric Study	I	Examination, prospective cohort, >80% follow-up, N=147, high quality
Brendbekken et al[41]	RCT	II	Intervention, no blinding, N=284, >80% follow up
Brouwer et al[42]	Prospective Cohort	I	Prognosis, clinical course, >80% follow-up, large N
Brox and Frøystein[43]	RCT	II	Intervention, <80% follow-up, N=119
Brubaker et al[44]	Psychometric Study	III	Exam, (subset of RCT) randomized, single blinded, N=49, cross sectional-test only outcome design
Brusco et al[45]	Analysis of RCT	I	Intervention, >80% follow-up, single blind, N=137, adequate randomization
Buijs et al[48]	Qualitative Study	V	Course of care, expert opinion, N=20
Bultmann et al[49]	RCT	II	Intervention, economic analysis, <80% Follow-Up, N=119
Burns et al[50]	Prospective Cohort	II	Risk, clinical course, <80% follow-up, N=71 (predominantly male)
Busch et al[53]	Retrospective Cohort	III	Intervention, <80% follow-up, large N
Busse et al[54]	Retrospective Cohort	II	Clinical course, >80% follow-up, large N, systematic review of prospective cohorts/outcomes
Butler and Johnson[55]	Prospective Cohort	II	Course of care, f<80% follow-up, large N
Campello et al[56]	RCT	II	Intervention, <80% follow-up, N=33, single blind
Cancelliere et al[57]	SLR	I	Prognosis/clinical course, SLR of 56 SLRs
Carlesso et al[58]	Cross-Sectional Design	III	Prognosis, large N, high quality
Carleton et al[59]	Retrospective Cohort	II	Prognosis/clinical course, adequate follow-up, N=108, high quality
Carlsson et al[60]	RCT	II	Course of care, no blinding, N=36
Carlsson et al[61]	Prognosis	II	Longitudinal design from 2 RCTs, prospective cohort, large N, randomization, no mention of blinding, < 80% f/u, low quality
Caron et al[62]	Psychometric Study	II	Exam/diagnosis, retrospective cohort, nonconsecutive, N=149, lower quality
Carriere et al[63]	Prospective Cohort	II	Prognosis: >80% follow-up - 109/140 had full data
Carroll et al[64]	SLR	I	Intervention, economic evaluation, predominately RCTs 8/13 (others moderate quality), heterogeneity of interventions, no meta-analysis

Chaleat-Valayer et al[65]	RCT	I	Intervention, 2 arm, Single blinded, > 80% follow up, high N
Chapman-Day et al[66]	Prospective Cohort	II	Prognosis, N=99, 63% follow-up, low quality
Chen et al[67]	Case-Control Study	III	Prognosis, N=80
Cheng[70]	Retrospective Cohort	III	Outcomes, <80% follow-up, N=221
Cheng[68]	Psychometric Study	II	Exam, validation study, retrospective cohort, >80% follow up, N=194
Cheng and Hung[69]	RCT	II	Intervention, no blinding, N=94
Chop-Hurley et al[71]	RCT	I	Intervention, >80% follow-up, N=24, assessor blinded
Clausen et al[72]	Prospective Survey Cohort	I	Clinical course/risk factor, large N, administratively followed all of those with extended work absence
Cochrane et al[73]	SLR	I	Intervention, SLR of RCTs with meta-analysis, large N
Cochrane et al[74]	Cross-Sectional Study	III	Prognosis, risk, cross sectional, N=155
Comper et al[75]	RCT	I	Intervention, adequate randomization/blinding, N=491, >80% follow-up
Cougot et al[76]	Prospective Cohort	II	Prognosis, 78% follow-up, N=217, low quality
Cullen et al[78]	SLR	II	Intervention, med>high quality RCTs (36 studies)
Dale et al[79]	Psychometric Study	II	Examination, prospective cohort, <80% follow-up, N=551
DeBuck et al[47]	SLR	II	Intervention effectiveness, no RCTs (N varied from 52 to >4 million)
DeBuck et al[46]	Analysis of RCT	II	Prognosis, no blinding (N=140 start), 80% follow up
DeJong et al[172]	Case Series	IV	Intervention, case series, N=8, sequential randomized and replicated single case experimental phase design
Dellve et al[81]	RCT	II	Intervention, no blinding, <80% follow-up, N=633, predominantly female
Demou et al[82]	Prospective Cohort	III	Intervention, <80% follow-up, large N
Denis et al[83]	Cross-Sectional Study	III	Prognosis, N=100 (nursing, all female)
Dersh et al[84]	Consecutive Retrospective Cohort	II	Prognosis, large N, 91% completion

Desmeules et al[85]	SLR	II	Intervention, 10 RCTs (no meta-analysis), low quality
Doda et al[87]	RCT	II	Intervention, N=242, 40% Attrition, low quality
Donceel et al[88]	RCT	II	Course of care, large N, no mention of blinding, no drop outs
Driessen et al[90]	Cluster RCT	II	Intervention, follow-up <80%, large N
Driessen et al[89]	RCT	II	Intervention, follow-up <80%, large N
Ernstsen and Lillefjell[93]	Retrospective Cohort	II	Intervention, >80% follow up, N=92
Escorpizo et al[94]	Psychometric Study	IV	Exam, SLR for measures related to productivity matched to ICF. content validity, utility, reliability agreement of measures and ICF (kappa/CI)
Esmaeilzadeh et al[96]	RCT	II	Intervention, follow-up <80%, N=84
Evanoff et al[97]	Prospective Cohort	III	Intervention, follow-up varied from 66-80% (<80%)
Faber et al[98]	SLR	II	Intervention, all RCTs: 6/18 high quality studies
Feuerstein et al[101]	Prospective Cohort	I	Intervention, <80% follow-up, N=131
Franche et al[102]	Psychometric Study	II	Examination, prospective cohort, <80% follow-up, large N
Franche et al[103]	SLR	II	Intervention effectiveness, <50% RCTs, large N
Fransen et al[104]	Prospective Cohort	II	Prognosis, <80% follow-up, large N
Fritz and George[106]	Psychometric Study	I	Examination, prospective cohort, 100% follow-up at 4 weeks, N=69
Fritz et al[105]	Prospective Cohort	I	Examination, prognosis, prospective cohort >80% follow-up, N=78
Gabel et al[108]	Psychometric Study	I	Examination, prospective cohort >80% follow-up, N=143
Gagnon et al[109]	Retrospective Cohort	III	Intervention, <80% completion, N=101
Ganesh et al[110]	Prospective Cohort	III	Intervention, <80% follow-up, N=51
Gatchel et al[111]	Prospective Cohort	I	Prognosis, clinical course, N=150, >80% follow-up
Gauthier et al[112]	Prospective Cohort	II	Risk, prognosis, N=255, >80% follow-up
Gismervik et al[113]	RCT	II	Intervention, open label parallel RCT, N=166, 78% follow up, intention to treat, partial blinding

Godges et al[114]	RCT	II	Intervention, no randomization or blinding noted, N=36, low quality
Gouin et al[115]	Analysis of Case Studies	V	Course of care, secondary analysis, interviews, N=27
Gouttebarge et al[117]	Psychometric Study	IV	Examination, validation study, cross-sectional, N=72, low quality
Gouttebarge et al[116]	Psychometric Study	I	Examination, prospective cohort, prognosis/outcomes, N=60, 83% follow-up
Gram et al[118]	RCT	II	Intervention, no blinding, N=67
Gray and Howe[119]	SLR	II	Course of care, 15 studies, generally low quality (2 RCT), risk of bias in some studies and a number of low-quality studies included
Gross[131]	Prospective Cohort	II	Prognosis, exam, 69% had functional data, N=582, low quality
Gross et al[130]	Retrospective Cohort	III	Prognosis, 76% from initial sample had complete data sets
Gross[129]	Psychometric Study	II	Examination, N=372, cluster RCT, <80% follow up, no blinding
Gross[128]	Psychometric Study	II	Exam/outcome, N=good, retrospective cohort study, high follow up
Gross[125]	Prospective Cohort	II	Prognosis, N=1040, 56% had complete data, 100% data for those included, lower quality
Gross[123]	Longitudinal Cohort	I	Prognosis/risk, prospective, N=336, 85% with complete data, high quality
Gross[124]	Prospective Cohort	II	Prognosis, N=130, 54% response rate, low quality
Gross[127]	Retrospective Cohort	II	Prognosis, N=226, 81% with complete data
Gross and Battie[126]	Psychometric Study	IV	Examination, cohort, N=28, 75% participation in both days (test-retest), low quality
Gross[121]	Prognosis/ Outcome	II	Examination, N=225, cluster RCT, 73% complete follow-up
Gross et al[122]	Cluster RCT	II	Outcomes, examination, N = 203, cluster RCT, 54% participation in follow-up interviews
Gross[120]	Lit Review	V	Examination, qualitative literature review, expert opinion
Gross[132]	Cluster RCT	I	Intervention, adequate follow-up, large N, randomization, blind assessors
Grossi et al[133]	Cross-Sectional	III	Prognostic, N=586, high quality
Haahr and Andersen[134]	RCT	I	Prognostic, N=266, >80% follow-up
Hagen et al[227]	RCT	II	Intervention, economic, no blinding, N=457

Hagen et al[135]	RCT	II	Intervention, no blinding, N=457, <80% Follow-Up
Haldorsen et al[136]	RCT	II	Prognosis, risk, economic, large N, no blinding
Halimah et al[20]	Retrospective Cohort	III	Prognosis, N=9850, <80% included in analysis
Hankins and Reid[138]	Cross-Sectional	III	Prognostic, large sample size, high quality
Hara et al[139]	RCT	I	Intervention, single blind, randomization, N=213, >80% follow-up, high quality
Haraldsson et al[140]	Psychometric Study	IV	Exam, tool development, validation study, convenience study, limited response rate, (Content Validity Index), large N
Hartzell et al[141]	Consecutive Cohort	III	Intervention, N=1113, 76% follow-up
Hazard et al[142]	RCT	II	Intervention, no blinding, N=489
Heathcote et al[143]	SLR	I	Intervention, SLR and meta-analysis, primarily RCTs (19/21 high quality)
Hebert and Ashworth[144]	Retrospective Cohort	II	Prognosis, N=88, high quality
Hegewald et al[145]	SLR	I	Intervention, Cochrane meta-analysis, 39 SLR - primarily RCTs (although some lower quality RCTs- certainty of evidence low to moderate for various interventions/outcomes)
Heinrich et al[146]	RCT	II	Intervention, N=254, no blinding, >80% follow-up
Heymans et al[149]	Retrospective Cohort	II	Intervention/prognosis, 100% data available, large N, high quality
Heymans et al[151]	Analysis of RCT	I	Prognosis, high quality with >80% follow-up, large N
Heymans et al[150]	RCT	I	Intervention, prognosis, >80% for primary outcomes (RTW)
Heymans et al[148]	Prospective Cohort	II	Prognosis, CPR validation study, N=628, <80% follow-up
Hirth et al[152]	Retrospective Cohort	II	Intervention, N=134, >80% follow-up, high quality
Hlobil et al[155]	RCT	I	Intervention, costs, blinding, >80% follow-up, randomization
Hlobil et al[154]	RCT	I	Intervention, N=134, blinding, >80% follow-up, randomization
Hlobil et al[153]	SLR	I	Intervention, SLR of RCTs (high and low quality)
Holden et al[156]	Psychometric Study	II	Examination, prognosis, retrospective cohort, N=117, high quality

Hoosain et al[157]	SLR	I	Intervention, SLR - primarily RCTs (9 high quality, 7 medium, 1 low)
Hou et al[159]	Prospective Cohort	I	Prognosis, N=154, >80% follow-up at 6 months
Hou et al[158]	SLR of RCTs	I	Intervention, Cochrane review
Houben et al[160]	Psychometric Study	IV	Examination, prognosis, cross-sectional study, low quality, N=297, 49% response rate
Hoving et al[162]	SLR	II	Intervention, non-controlled studies, 100% female/breast cancer
Hunt et al[163]	Prospective Cohort	I	Prognosis, N=159, 83% follow-up
Ijzelenberg et al[164]	RCT	II	Intervention, N=489, <80% follow-up
Ikezawa et al[165]	Psychometric Study	IV	Reliability study, N=36, cross sectional, 31% response rate
Iles et al[166]	Prospective Cohort	II	Risk evaluation/exam, < 80% follow up, large N
Jensen[171]	RCT	II	Intervention, N=214, <80% follow-up
Jensen[169]	RCT	I	Intervention, large N, 100% follow up for primary outcome (RTW), 71% for secondary follow up (pain, perceived disability, fear avoidance)
Jensen[168]	Prospective Cohort	III	Course of care, intervention, non-randomized, large N, 74% follow-up, low quality
Jensen[170]	Analysis of RCT	I	Intervention, economic analysis, large N, >80% follow-up
Jousset et al[173]	RCT	II	Intervention, no blinding, N=84
Joy et al[174]	Descriptive Cohort Study	II	Prognosis, N=115, observational data from a cohort, 100% follow up
Kajiki et al[176]	RCT	I	Intervention, blinding, randomization, large N, >80% follow-up
Kapoor et al[177]	Prospective Cohort	I	Course of care, large N, >80% follow-up
Karjalainen et al[179]	SLR	I	Intervention, SLR of high quality RCTs
Karjalainen et al[180]	SLR	II	Intervention, SLR of low quality RCTs
Karjalainen et al[178]	RCT	II	Intervention, N=164, adequate follow-up, no blinding
Keeney et al[181]	Prospective Cohort	II	Prognosis, large N, <80% follow-up, low quality
Ketelaar et al[183]	RCT	II	Intervention, large N, <80% follow-up, low quality

Keyes et al[184]	Low Quality Cohort	III	Course of care, prognosis, large N, response rate <80% (44%), low quality
Khan et al[185]	SLR	II	Intervention, 1 RCT, 1 controlled trial
Kilgour et al[186]	SLR	II	Course of care, SLR of non-RCT, qualitative studies
Kinnunnen et al[187]	Psychometric Study	III	Exam, prognosis, cross-sectional large N, administrative data, high quality
Kirsh et al[188]	Participatory Research Study	IV	Prognosis, survey, cross sectional, limited response, N=290, non-random
Kishino et al[189]	Prospective Cohort	I	Intervention, N=68, 100% follow-up, high quality
Kool et al[190]	RCT	I	Intervention, randomization, blinding, N=174, >80% follow-up
Kool et al[191]	RCT	I	Intervention, randomization, single blinding, >80% follow-up
Kuijer et al[192]	Psychometric Study	I	Exam, prognosis, explorative prognostic cohort, small N=18, high quality
Kuijpers et al[193]	Prospective Cohort Study	II	Prognosis, risk, N=350, 30% response rate at 6-month follow-up
Kvam et al[194]	Prospective Cohort Study	II	Prognosis, N=270, <80% Follow-Up (69%)
Lambeek et al[196]	Process Evaluation within RCT	II	Intervention, follow-up 65-100%, low quality
Lambeek et al[197]	RCT	II	Intervention, >80% follow-up, no blinding
Lambeek et al[195]	Economic Evaluation Alongside RCT	II	Intervention, cost effectiveness, N=134, >80% follow-up, no blinding
Lechner et al[198]	Psychometric Study	II	Examination, prospective cohort, consecutive sample of convenience, low quality
Lemstra et al[199]	Randomized Trial	II	Diagnostic/exam, blinding, N=90
Leon et al[200]	RCT	II	Intervention, no blinding, N=181
Li et al[201]	RCT	I	Intervention, blinding, randomization, N=582, >80% follow-up
Linton et al[202]	RCT	I	Intervention, N=185, 85% follow-up, randomization
Loisel et al[207]	Part of RCT - Prospective Cohort	II	Intervention, N=37, >80% follow-up, high quality
Loisel et al[208]	Economic Evaluation Alongside RCT	I	Course of care, intervention, N=104, >80% follow-up
Loisel et al[206]	Case Series	V	Course of care, qualitative review of 22 charts to determine process review values

Lötters et al[209]	Prospective Cohort	I	Prognosis, N=252, >80% follow-up
Lydell et al[210]	Prospective Cohort	II	Prognosis, N=110, <80% follow-up
Macedo et al[211]	RCT	I	Prognosis/intervention, blinding, N=32, randomization, >80% follow-up
Marchand et al[212]	RCT	II	Intervention, N= 405, <80% follow up
Margison and French[213]	Prospective Cohort	I	Prognosis, N= 211, no loss to follow-up, high quality
Marhold et al[214]	RCT	II	Intervention, no blinding, N=72, follow-up not specified
Marin et al[215]	SLR	II	Intervention, low quality RCTs via GRADE
Martimo et al[216]	RCT	II	Intervention, no blinding, N=177, predominantly female
Matheson et al[218]	Psychometric Study	II	Examination, retrospective cohort, large N, 100% follow-up
Mayer et al[220]	Prospective Cohort	III	Intervention, large N, <80% follow-up
Mayer et al[219]	Prospective Cohort	II	Intervention, N=202, >80% follow-up
Meijer et al[221]	RCT	II	Intervention, no blinding, N=34
Meyer et al[222]	RCT	I	Intervention, blinding, randomization, N=33, >80% follow-up
Michel et al[223]	Descriptive Study	V	Course of care, descriptive
Milidonis and Greene[224]	Retrospective Cohort	II	Risk, N=286, 92% response rate for phase 1, 91% for phase 2
Mitchell et al[225]	Psychometric Study	IV	Examination, prevalence, cross-sectional study, case series, small sample (n=12), low quality
Mngoma et al[226]	Prospective Cohort	II	Prognosis, N=147, <80% completion
Moll et al[228]	RCT	I	Intervention, N=168, <80% follow-up for secondary outcomes: 1 for primary outcome of RTW, 2 for secondary (pain, disability)
Momsen et al[229]	RCT	II	Intervention, large N, <80% follow-up, no blinding
Moshe et al[231]	Retrospective Cohort	III	Prognosis/interdisciplinary, low N, primarily men
Muenchberger et al[232]	SLR/ Prognostic study	II	Prognosis, high quality SLR process (some retrospective studies) and text analysis, followed by expert rating of identified categories related to practical use with inter-rater agreement.
Myhre et al[233]	RCT	I	Intervention, large N, blinding, randomization, >80% follow-up

Nemes et al[235]	Prospective Cohort	III	Intervention/outcomes, large N, <80% follow-up
Nicholas et al[236]	Prospective Cohort	III	Intervention, controlled, non-randomized prospective design, N=113, intention to treat, 82% final analysis by intention to treat analysis
Nilsson et al[237]	Prospective, Non-Controlled	II	Prognosis, N=366, >80% follow-up
Norbye et al[238]	RCT	II	Intervention, N=48, <80% follow-up (75%), no blinding
Norlund et al[239]	SLR	II	Intervention, predominately RCTs: low quality
Notenbomer et al[240]	Cross-Sectional Study	III	Prognosis, large N
Ntsiea et al[241]	RCT	I	Intervention, single-blind, randomized, N=80, >80% follow-up
Nurminen et al[242]	RCT	I	Intervention, large N, >80% follow-up
Odeen et al[243]	RCT	I	Intervention, single-blind, randomized, >80% follow-up
Oleske et al[246]	RCT	I	Intervention, prognosis, large sample, single-blind, randomized
Olsson et al[247]	Prospective Cohort	II	Intervention, longitudinal single cohort, n=86, >80% follow up questionnaire, <80% for final analysis
OudeHengel et al[147]	RCT	II	Intervention, prevalence, cluster RCT, no Blinding, large N, <80% follow-up, predominantly male
Oyeflaten et al[250]	Prospective Cohort	I	Course of care, prognosis, large N, >80% follow-up
Palmer et al[251]	SLR	I	Intervention, 42 studies, predominantly RCTs
Palmlof et al[252]	Prospective Cohort	I	Risk, clinical course/outcomes, N=7868, follow up not available
Park et al[254]	RCT	II	Intervention, no blinding, large N, >80% follow-up
Park et al[255]	Psychometric Study	III	Exam, prognosis, cross-sectional, large N
Paulsen et al[256]	RCT	I	Intervention, randomization, blinding,>80% follow up, N=146
Pedersen et al[257]	RCT	I	Intervention, adequate blinding, randomized, >80% follow-up
Poulain et al[258]	Prospective Cohort	III	Intervention/prognosis, N=105, <80% follow-up
Poulson et al[259]	RCT	I	Intervention, large N, >80% follow-up

Rasmussen et al[260]	RCT	II	Intervention, stepped wedge cluster RCT, large N, <80% follow-up
Rinaldo and Selander[261]	SLR	II	Prognosis, mix of high/low quality studies, methods not of high quality
Roche et al[262]	RCT	I	Intervention outcomes, good N, >80% follow-up
Roelen et al[263]	Psychometric Study	I	Examination, prospective cohort, good N, >80% follow-up
Roels et al[264]	SLR	I	Intervention, SLR of RCT and NSR
Roesler et al[265]	Prospective Cohort	I	Prognosis/risk, Clinical course, >80% follow-up
Ross et al[266]	Prospective, Non-Randomized	II	Outcome, <80% follow-up, N=179
Roy et al[267]	Psychometric Study	I	Exam/diagnosis (CPG), prospective cohort, large N, >80% follow-up
Saha et al[268]	RCT	II	Intervention, cluster RCT, no blinding, >80% follow up, N=352
Saltychev et al[269]	Prospective Cohort	I	Course of care/prognosis, risk, large N, no loss to follow-up reported
Salzwedel et al[270]	Prospective Observational	II	Prognosis, clinical course, >80% follow-up, bicentric design, N=401
Schaafsma et al[271]	SLR	I	Intervention, SLR of RCTs, reporting on 25 RCTs (N=4404 combined)
Scheman et al[273]	Psychometric Study	II	Examination, prospective cohort, N=130, 60%, follow-up
Schultz et al[275]	Prospective Cohort	II	Intervention, N=72, 100% follow-up, lacking full RCT, deviations from standard protocol, high quality
Schultz et al[277]	Prospective Cohort	I	Prognosis, N=247, 83% follow-up
Schultz et al[276]	Prospective Cohort	I	Prognosis/risk, N=253, 83% follow-up
Schultz et al[274]	Prospective Cohort	I	Prognosis, longitudinal, N=111, 90.9% follow-up at 3 months
Schweikert et al[278]	RCT	II	Outcomes, prospective economic evaluation, large N, no blinding, <80% follow-up
Shaw et al[280]	Psychometric Study	I	Exam/prognosis/outcomes, prospective cohort N=519, >80% follow-up
Shaw et al[279]	SLR	I	Intervention/risk, SLR of reviews
Sheehan et al[282]	Cross Sectional Survey	III	Course of care, response rate 80% in 2013 and 2014, 82% in 2016, N=8808
Skagseth et al[283]	RCT	I	Intervention, single blinded, randomized, >80 % follow up, n=175
Staal et al[286]	RCT	I	Intervention, >80% follow-up, blinding, randomization

Staal et al[285]	RCT	I	Prognosis, risk, N=134, >80% follow-up, blinding, randomization
Stapelfeldt et al[287]	RCT Analysis	I	Prognostic, subgroup RCT Analysis, randomization, N=351
Steenstra et al[289]	RCT	II	Intervention, no blinding
Steenstra et al[288]	RCT	II	Intervention, <80% follow-up, limited blinding (not for allocation, worker informed after first data collection, questionnaires mailed to minimize bias)
Steenstra et al[290]	RCT	II	Intervention moderators, N=196, no blinding
Stephens and Gross[291]	Retrospective Cohort	II	Intervention/course of care, large N, >80% full data follow up, high quality
Storheim et al[293]	Prospective Cohort	I	Prognosis/risk, N=93, >80% follow-up
Street and Lacey[294]	SLR	II	Risk, prognosis, 6/9 studies retrospective cohorts
Stromberg et al[295]	Psychometric Study	III	Exam/prognosis, classification tree methodology and validation, cross sectional, N=7861 year 1, N=4927 year 3, follow up 86% at 1 year, 60% at 5 years
Sullivan and Stanish[296]	Prospective Cohort	III	Intervention, N=104, <80% follow-up
Sundstrup et al[297]	RCT	I	Intervention, blinding, relatively small N (66), >80% follow-up, randomization
Suni et al[298]	RCT	II	Intervention, large N, <80% follow-up
Svedmark et al[299]	Longitudinal Study of Prior RCT	II	Intervention, outcomes, N= 97, no blinding specified
Swaen et al[300]	Prospective Cohort	I	Risk, 80% follow-up at 12 months, N=108
Taylor et al[302]	Prospective Cohort	III	Intervention, 79% follow-up, low quality
Trippolini et al[303]	Psychometric Study	I	Exam, prospective cohort, diagnostic, N=62, >80% follow up
Tuckwell et al[304]	Psychometric Study	II	Exam, test-retest, reliability, prospective, convenience sample N=24, >80% follow up
Turi et al[305]	Retrospective cohort	III	Prognosis, secondary analysis, retrospective cohort, follow up not clear – appears to be 100%, N=121
Van den Hout et al[161]	RCT	II	Intervention, N=84, <80% retention
Van der Weide et al[323]	Prospective Cohort	I	Prognosis, 89% follow-up, good N, high quality

Van Duijn and Burdorf[91]	Prospective Cohort	II	Clinical course/prognosis/risk, longitudinal, N=167, >80% follow-up
Van Dujin et al[92]	Prospective Cohort	II	Clinical course/intervention, >80% follow-up
Van Schaajik et al[272]	Psychometric Study	II	Examination, reliability study, consecutive cohort, >80% follow-up, N=104, good quality, convenience sample
Van Vilsteren et al[316]	SLR of RCTs	I	Intervention, 14 RCTs with mixed quality of evidence and variable risk of bias assessed (moderate quality of evidence for musculoskeletal disorders, low quality for individuals with mental health problems and cancer, 6 of the studies low risk of bias)
Velozo et al[307]	Psychometric Study	III	Examination, prospective cohort for study 1 and 2, for this study retrospective cross section N=42, <80% follow-up, low quality
Vendrig[308]	Prospective Cohort	I	Prognosis, N=143, 3% drop-out, high quality
Verhagen et al[309]	SLR	II	Intervention, high N, 35/44 (79.54%), studies had high risk of bias
Verhoef et al[310]	SLR	I	Intervention, SLR of higher quality RCTs
Vermeulen et al[314]	Prospective Cohort	II	Course of care, prognosis, large N, low response rate (34%)
Vermeulen et al[311]	Intervention Mapping	V	Expert opinion
Vermeulen et al[312]	RCT	II	Intervention, no blinding, >80% follow-up
Vermeulen et al[313]	Economic Evaluation alongside RCT	I	Clinical course/intervention/cost effectiveness, >80% follow-up, no blinding in initial study, N=163
Viikari-Juntura et al[315]	RCT	II	Intervention, no blinding, N=62, primarily female
Vogel et al[317]	Psychometric Study	IV	Exam/outcomes, N=414, 73% response rate
Vogel et al[318]	SLR	I	Intervention, RCTs 10/14 with low risk of bias
Voss et al[319]	Outcome Study	II	Intervention, >80% follow up data, lack of control/randomization, good N=495
Wasiak et al[320]	SLR	II	Outcome, to identify whether outcome dimension had been instrumented, review of 2500 abstracts
Wastberg et al[321]	Psychometric Study	II	Examination, psychometric assessment - reliability, validity, utility, internal consistency, sensitive to change, slight ceiling effect noted and some dropouts in group, N=106

Wegrzynek et al[322]	SLR	I	Intervention, 16 papers, 13 RCT, study heterogeneity, risk of bias analysis was completed but unclear what the overall outcome of quality analysis was per study; overall it appears there were more low risk of bias factors, but there were a number of unknown/unable to assess,
Werneke and Hart[325]	Psychometric Study	I	Exam, validation study, prospective cohort, N=171, >80% follow up, blinded data collected (1 yr.)
Werneke and Hart[324]	Psychometric Study	I	Exam/prognosis, validation study, consecutive cohort 83.9% follow-up, large N
Wideman and Sullivan[326]	Psychometric Study	I	Exam/risk/prognosis, prospective cohort, 14% lost to follow-up (>80% follow up), large N
Wideman and Sullivan[327]	Psychometric Study	I	Exam/prognosis, prospective cohort, 14% lost to follow-up, large N
Williams et al[328]	SLR	II	Intervention, primarily prospective cohort studies
Wisenthal et al[329]	Prospective Cohort	II	Intervention, >80% follow-up, small n=21
Xu et al[330]	Prospective Cohort	I	Prognosis, >80% follow-up, n=67
Young et al[331]	Retrospective Cohort	II	Clinical course, 100% data follow up, large N

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