NEW YORK STATE OF OPPORTUNITY.
Workers' Compensation Board

Medical Treatment Guidelines

Complex Regional Pain Syndrome

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The NYS Workers' Compensation Board would like to thank the members of the New York Workers' Compensation Board Medical Advisory Committee (MAC). The MAC served as the Board's advisory body to adapt the American College of Occupational and Environmental Medicine (ACOEM) Practice Guidelines to a New York version of the Medical Treatment Guidelines (MTG). In this capacity, the MAC provided valuable input and made recommendations to help guide the final version of these Guidelines. With full consensus reached on many topics, and a careful review of any dissenting opinions on others, the Board established the final product.

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Guiding Principles

A. General Guideline Principles

The principles summarized in this section are key to the intended application of the New York State Medical Treatment Guidelines (MTG) and are applicable to all Workers' Compensation Medical Treatment Guidelines.

A.1 Medical Care

Medical care and treatment required as a result of a work-related injury should be focused on restoring functional ability required to meet the patient's daily and work activities with a focus on a return to work, while striving to restore the patient's health to its pre-injury status in so far as is feasible.

A.2 Rendering Of Medical Services

Any medical provider rendering services to a workers' compensation patient must utilize the Treatment Guidelines as provided for with respect to all work-related injuries and/or illnesses.

A.3 Positive Patient Response

Positive results are defined primarily as functional gains which can be objectively measured. Objective functional gains include, but are not limited to, positional tolerances, range of motion, strength, endurance, activities of daily living (ADL), cognition, psychological behavior, and efficiency/velocity measures which can be quantified. Subjective reports of pain and function may be considered and given relative weight when the pain has anatomic and physiologic correlation in proportion to the injury.

A.4 Re-Evaluate Treatment

If a given treatment or modality is not producing positive results within a well-defined timeframe, the provider should either modify or discontinue the treatment regime. The provider should evaluate the efficacy of the treatment or modality 2 to 3 weeks after the initial visit and 3 to 4 weeks thereafter. These timeframes may be slightly longer in the context of conditions that are inherently mental health issues, and shorter for other non-musculoskeletal medical conditions (e.g. pulmonary, dermatologic etc.). Recognition that treatment failure is at times attributable to an incorrect diagnosis a failure to respond should prompt the clinician to reconsider the diagnosis in the event of an unexpected poor response to an otherwise rational intervention.

A.5 Education

Education of the patient and family, as well as the employer, insurer, policy makers and the community should be a primary emphasis in the treatment of work-related injury or illness. Practitioners should develop and implement effective educational strategies and skills. An education-based paradigm should always start with communication providing reassuring information to the patient. No treatment plan is complete without addressing issues of individual and/or group patient education as a means of facilitating self-management of symptoms and prevention of future injury.

Timeframes

A.6 Acuity

Acute, Subacute and Chronic are generally defined as timeframes for disease stages:

- Acute – Less than one month
- Subacute - One to three month
- Chronic - greater than three months

A.7 Initial Evaluation

Initial evaluation refers to the acute timeframe following an injury and is not used to define when a given physician first evaluates an injured worker (initial encounter) in an office or clinical setting.

A.8 Diagnostic Time Frames

Diagnostic time frames for conducting diagnostic testing commence on the date of injury. Clinical judgment may substantiate the need to accelerate or decelerate the time frames discussed in this document.

A.9 Treatment Time Frames

Treatment time frames for specific interventions commence once treatments have been initiated, not on the date of injury. It is recognized that treatment duration may be impacted by disease process and severity, patient compliance, as well as availability of services. Clinical judgment may substantiate the need to accelerate or decelerate the time frames discussed in this document.

A.10 Delayed Recovery

For those patients who fail to make expected progress 6-12 weeks after an injury and whose subjective symptoms do not correlate with objective signs and tests, reexamination in order to confirm the accuracy of the diagnosis and re-evaluation of the treatment program should be performed. When addressing a clinical issue that is not inherently a mental health issue, assessment for potential barriers to recovery (yellow flags/psychological issues) should be ongoing throughout the care of the patient. At 6-12 weeks, alternate treatment programs, including formal psychological or psychosocial evaluation should be considered. Clinicians must be vigilant for any pre-existing mental health issues or subsequent, consequential mental health issues that may be impacting recovery. For issues that are clearly and inherently mental health issues from the outset (i.e. when it is evident that there is an underlying, work-related, mental health disorder as part of the claim at issue), referral to a mental health provider can and should occur much sooner. Referrals to mental health providers for the evaluation and management of delayed recovery do not indicate or require the establishment of a psychiatric or psychological condition. The evaluation and management of delayed recovery does not require the establishment of a psychiatric or psychological claim.

Treatment Approaches

A.11 Active Interventions

Active interventions emphasizing patient responsibility, such as therapeutic exercise and/or functional treatment, are generally emphasized over passive modalities, especially as treatment progresses. Generally, passive and palliative interventions are viewed as a means to facilitate progress in an active rehabilitation program with concomitant attainment of objective functional gains.

A.12 Active Therapeutic Exercise Program

Active therapeutic exercise program goals should incorporate patient strength, endurance, flexibility, range of motion, sensory integration, coordination, cognition and behavior (when at issue) and education as clinically indicated. This includes functional application in vocational or community settings.

A.13 Diagnostic Imaging And Testing Procedures

Clinical information obtained by history taking and physical examination should be the basis for selection of imaging procedures and interpretation of results. All diagnostic procedures have characteristic specificities and sensitivities for various diagnoses. Usually, selection of one procedure over others depends upon various factors, which may include: relative diagnostic value; risk/benefit profile of the procedure; availability of technology; a patient's tolerance; and/or the treating practitioner's familiarity with the procedure.

When a diagnostic procedure, in conjunction with clinical information, provides sufficient information to establish an accurate diagnosis, a second diagnostic procedure is not required. However, a subsequent diagnostic procedure including a repeat of the original (same) procedure can be performed, when the specialty physician (e.g. physiatrist, sports medicine physician or other appropriate specialist) radiologist or surgeon documents that the initial study was of inadequate quality to make a diagnosis. Therefore, in such circumstances, a repeat or complementary diagnostic procedure is permissible under the MTG.

It is recognized that repeat imaging studies and other tests may be warranted by the clinical course and/or to follow the progress of treatment in some cases. It may be of value to repeat diagnostic procedures (e.g., imaging studies) during the course of care to reassess or stage the pathology when there is progression of symptoms or findings, prior to surgical interventions and/or therapeutic injections when clinically indicated, and post-operatively to follow the healing process. Regarding serial imaging, (including x-rays, but particularly CT scans), it must be recognized that repeat procedures result in an increase in cumulative radiation dose and associated risks.

A given diagnostic imaging procedure may provide the same or distinctive information as obtained by other procedures. Therefore, prudent choice of procedures(s) for a single diagnostic procedure, a complementary procedure in combination with other procedures(s), or a proper sequential order in multiple procedures will ensure maximum diagnostic accuracy, minimize the likelihood of adverse effect on patients, and promote efficiency by avoiding duplication or redundancy.

A.14 Surgical Interventions

Consideration of surgery should be within the context of expected functional outcome. The concept of "cure" with respect to surgical treatment by itself is generally a misnomer. All operative interventions must be based upon positive correlation of

clinical findings, clinical course and imaging and other diagnostic tests. A comprehensive assimilation of these factors must lead to a specific diagnosis with positive identification of pathologic condition(s). For surgery to be performed to treat pain, there must be clear correlation between the pain symptoms and objective evidence of its cause. In all cases, shared decision making with the patient is advised. The patient should be given the opportunity to understand the pros and cons of surgery, potential for rehabilitation as an alternative where applicable, evidence-based outcomes, and specific surgical experience.

A.15 Pre-Authorization

All diagnostic imaging, testing procedures, non-surgical and surgical therapeutic procedures, and other therapeutics within the criteria of the Medical Treatment Guidelines and based on a correct application of the Medical Treatment Guidelines are considered authorized, with the exception of the procedures listed in section 324.3(1)(a) of Title 12 NYCRR. These are not included on the list of pre-authorized procedures. Providers who want to perform one of these procedures must request pre-authorization from the carrier before performing the procedure.

Second or subsequent procedures (the repeat performance of a surgical procedure due to failure of, or incomplete success from the same surgical procedure performed earlier, if the Medical Treatment Guidelines do not specifically address multiple procedures) also require pre-authorization.

A.16 Psychological/Psychiatric Evaluations

In select patients, mental health evaluations are essential to make, secure or confirm a diagnosis. Of course, the extent and duration of evaluations and/or interventions by mental health professionals may vary, particularly based on whether: the underlying clinical issue in the claim is inherently a mental health issue; or there is a mental health issue that is secondary or consequential to the medical injury or illness that is at issue in the claim in question; or there is a pre-existing, unrelated mental health issue that has been made worse by, or is impeding the recovery from (or both) the medical injury or illness that is at issue in the claim in question.

Tests of psychological function or psychometric testing, when indicated, can be a valuable component of the psychological evaluation in identifying associated psychological, personality and psychosocial issues. Although these instruments may suggest a diagnosis, neither screening nor psychometric tests are capable of making a diagnosis. The diagnosis should only be made after careful analysis of all available data, including from a thorough history and clinical interview.

A professional fluent in the primary language of the patient is strongly preferred. When such a provider is not available, services of a professional language interpreter must be provided.

Frequency: When assessing for a pre-existing, unrelated mental health issue that has been made worse by, or is impeding the recovery from (or both) a work-related, medical injury or illness, then a one-time visit for initial psychiatric/psychological encounter should be sufficient, as care would normally be continued by the prior treating provider. If psychometric testing is indicated by findings in the initial encounter,

time for such testing should not exceed an additional three hours of professional time. For conditions in which a mental health issue is a central part of the initial claim, or in which there is a mental health issue that is secondary or consequential to the work-related, medical injury or illness, that is part of the claim in question, then more extensive diagnostic and therapeutic interventions may be clinically indicated, and are discussed in detail in the Medical Treatment Guidelines for such mental health conditions.

A.17 Personality/Psychological/Psychosocial Intervention

Following psychosocial evaluation, when intervention is recommended, such intervention should be implemented as soon as possible. This can be used alone or in conjunction with other treatment modalities. For all psychological/psychiatric interventions, there must be an assessment and treatment plan with measurable behavioral goals, time frames and specific interventions planned**.**

- Time to produce effect: two to eight weeks.
- Optimum duration: six weeks to three months.
- Maximum duration: three to six months.
- Counseling is not intended to delay but rather to enhance functional recovery.

For PTSD Psychological Intervention:

- Optimum duration three to six months.
- Maximum duration: nine to twelve months.

For select patients, longer supervision and treatment may be required, and if further treatment is indicated, documentation of the nature of the psychological factors, as well as projecting a realistic functional prognosis, should be provided by the authorized treating practitioner every four weeks during the first six months of treatment. For treatment expected to last six to twelve months, such documentation should be provided every four to eight weeks. For long-term treatment beyond twelve months, such documentation should be provided every eight to twelve weeks. All parties should strive for ongoing and continuous communications, in order to facilitate seamless, continuous and uninterrupted treatment.

A.18 Functional Capacity Evaluation (FCE)

Functional capacity evaluation is a comprehensive or more restricted evaluation of the various aspects of function as they relate to the patient's ability to return to work. Areas such as endurance, lifting (dynamic and static), postural tolerance, specific range-of-motion, coordination and strength, worker habits, employability, as well as psychosocial, cognitive, and sensory perceptual aspects of competitive employment may be evaluated. Components of this evaluation may include: (a) musculoskeletal screen; (b) cardiovascular profile/aerobic capacity; (c) coordination; (d) lift/carrying analysis; (e) job-specific activity tolerance; (f) maximum voluntary effort; (g) pain assessment/psychological screening; (h) non-material and material handling activities; (i) cognitive and behavioral; (j) visual; and (k) sensory perceptual factors.

In most cases, the question of whether a patient can return to work can be answered without an FCE.

An FCE may be considered at time of MMI, following reasonable prior attempts to return to full duty throughout course of treatment, when the treating physician is unable to make a clear determination on work status on case closure. An FCE is not indicated early during a treatment regime for any reason including one to support a therapeutic plan.

When an FCE is being used to determine return to a specific job site, the treating physician is responsible for understanding and considering the job duties. FCEs cannot be used in isolation to determine work restrictions. The authorized treating physician must interpret the FCE in light of the individual patient's presentation and medical and personal perceptions. FCEs should not be used as the sole criteria to diagnose malingering.

A.19 Return To Work

For purposes of these guidelines, return to work is defined as any work or duty that the patient is able to perform safely. It may not be the patient's regular work. Ascertaining a return to work status is part of medical care, and should be included in the treatment and rehabilitation plan. It is normally addressed at every outpatient visit. A description of the patient's status and task limitations is part of any treatment plan and should provide the basis for restriction of work activities when warranted. Early return to work should be a prime goal in treating occupational injuries. The emphasis within these guidelines is to move patients along a continuum of care and return to work, since the prognosis of returning an injured worker to work drops progressively the longer the worker has been out of work.

A.20 Job Site Evaluation

The treating physician may communicate with the employer or employer's designee, either in person, by video conference, or by telephone, to obtain information regarding the individual or specific demands of the patient's pre-injury job. This may include a description of the exertional demands of the job, the need for repetitive activities, load lifting, static or awkward postures, environmental exposures, psychological stressors and other factors that would pose a barrier to re-entry, risk of re-injury or disrupt convalescence. When returning to work at the patient's previous job tasks or setting is not feasible, given the clinically determined restrictions on the patient's activities, inquiry should be made about modified duty work settings that align with, the patient's condition in view of proposed work activities/demands in modified duty jobs. It should be noted, that under certain circumstances, more than one job site evaluation may be indicated.

Ideally, the physician would gain the most information from an on-site inspection of the job settings and activities; but it is recognized that this may not be feasible in most cases. If job videos/CDs/DVDs are available from the employer, these can contribute valuable information, as can video conferences, conducted from the worksite and ideally workstation or work area.

Frequency: one or two contacts

- 1st contact: Patient is in a functional state where the patient can perform some work.
- 2nd contact: Patient has advanced to state where the patient is capable of enhanced functional demands in a work environment.

The physician shall document the conversation.

Other

A.21 Guideline Recommendations and Medical Evidence

The Workers' Compensation Board and its Medical Advisory Committee have not independently evaluated or vetted the scientific medical literature used in support of the guidelines, but have relied on the methodology used by the developers of various guidelines utilized and referenced in these Guidelines.

A.22 Experimental/Investigational Treatment

Medical treatment that is experimental/investigational and not approved for any purpose, application or indication by the FDA is not permitted under these Guidelines.

A.23 Injured Workers As Patients

In these Guidelines, injured workers are referred to as patients recognizing that in certain circumstances there is no doctor-patient relationship.

A.24 Scope Of Practice

These Guidelines do not address scope of practice or change the scope of practice.

Complex Regional Pain Syndrome

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B. Overview of Chronic Regional Pain Syndrome

Complex regional pain syndrome (CRPS) is a severely painful condition that is most often associated with recent trauma or injury. It has been variously defined by the International Association for the Study of Pain and the "Budapest Criteria" as generally including the presence of diffuse moderate to severe non-dermatomal pain, usually with allodynia.

B.1 CRPS Diagnostic Criteria

Most of the diagnostic criteria reported include common characteristics for the diagnosis of CRPS. However, there have been some differences in case definition criteria. The below has what may be the most used and supportable criteria.

CRPS-I (a.k.a. "Reflex Sympathetic Dysthrophy" or "RSD") general definition: a painful condition that develops after an initiating noxious event, not limited to the distribution of a single peripheral nerve. The syndrome shows variable progression over time. In **CRPS-II (a.k.a. "Causalgia")**, a specific nerve is involved and pain is within the distribution of the damaged nerve.

To make the clinical diagnosis, the following criteria must be met:

1. Continuing pain, which is disproportionate to any inciting event.
2. Must report at least one symptom in three of the four following categories:
    a. Sensory: Reports of hyperesthesia and/or allodynia
    b. Vasomotor: Reports of temperature asymmetry and/or skin color changes and/or color asymmetry.
    c. Sudomotor/Edema: Reports of edema and/or sweating changes and/or sweating asymmetry.
    d. Motor/Trophic: Reports of decreased range of motion and/or motion dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nail, skin).
3. Must display at lease one sign at time of evaluation in two or more of the following categories:
    a. Sensory: Evidence of hyperalgesia and/or allodynia.
    b. Vasomotor: Evidence of temperature asymmetry (>1 degree centigrade) and/or skin color changes and/or asymmetry.
    c. Sudomotor/Edema: Evidence of edema and/or sweating changes and/or sweating asymmetry.
    d. Motor/Trophic: Evidence of decreased range of motion and/or motor dysfunction (weakness, tremor, dystonia) and/or trophic changes (hair, nail, skin).
4. There is no other diagnosis that better explains the signs and symptoms.

These criteria are recommended for diagnosing CRPS, but may be challenging, as objective measurements and equipment such as infrared temperature probes, volumetry, goniometers and pain scales are required. For patients not meeting the diagnostic criteria, or if CRPS either continues or progresses, the diagnosis of CRPS should be confirmed by an appropriately trained Physician (MD or DO), typically trained in such specialties including, but not necessarily limited to: Pain Medicine; Neurology; Physical Medicine & Rehabilitation; or Occupational Medicine. Such a referral examination should particularly focus on the exclusion of another explanatory diagnosis, the presence of a temporal inciting event, the historical information particularly from a credible patient, objective evidence (e.g., bone scan), presence of a known nerve injury (CRPS II), and application and comparisons with the diagnostic criteria. In those cases where electrodiagnostic studies are indicated, they should be conducted in accordance with the practice parameters of the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM). It is recommended and preferred that electrodiagnostic studies in the out-patient setting be performed and interpreted by physicians board-certified in Neurology or Physical Medicine and Rehabilitation.

The threshold for concomitant psychological consultation and psychometric testing in such circumstances should be quite low. [Please also see Medical Treatment Guidelines for Non-Acute Pain, Work-Related Depression and Depressive Disorders, and PTSD].

Recommendations on assessing and treating adults with Complex Regional Pain Syndrome (CRPS) are presented herein. [For diagnosis and treatment of non-acute pain not due to CRPS, please see the Medical Treatment Guideline for Nan-Acute Pain.] Topics include the initial assessment and diagnosis of patients with CRPS, identification of red flags that may suggest the presence of a serious underlying medical condition, initial clinical evaluation, management, diagnostic considerations, and special studies to identify clinical pathology, work-relatedness, modified duty and activity, rehabilitative strategies, return to work, psychological evaluation, behavioral treatments, and further management considerations including delayed recovery.

C. Risk and Causation

CRPS is reported most frequently after a traumatic insult, central nervous system insults including strokes, myocardial infarction, or other major system insult. CRPS Type II involves an overt nerve lesion. There are relatively infrequent occasions where the cause is unknown (approximately 5 to 15%). CRPS has a reported prevalence of 20.6 to 113.5 per 100,000 adults. It has sometimes been categorized into subtypes, including warm and cold. Females are diagnosed with CRPS 3.4 times more frequently than males, and incidence is highest among the 50- to 70-year age range. Upper-extremity injuries are more commonly associated with CRPS as compared to lower extremities, and a fracture is the most common injury type associated with CRPS. The risk of CRPS has been estimated at 1% among patients with distal radius fractures.

D. Initial Assessment

The initial assessment requires a thorough history and physical examination with somewhat different emphases compared with most chronic pain patient evaluations. This includes a

history of symptoms, trauma, purported cause of the symptoms, treatments attempted, and exercises performed. The history and physical examination require particular attention to differences in use of the limb, strength, color, and temperature. Selective testing may be needed to confirm the clinical impression. The most important emphasis is to exclude other potential explanatory conditions.

The clinician performing an initial evaluation of a patient with chronic pain has the particularly difficult task of ascertaining whether there is (are) other treatable, explanatory condition(s) present. Yet it is also critical to avoid over-testing which may result in increased morbidity (e.g. iatrogenic impairment) through either direct adverse effects of the tests themselves, or more likely through creating and contributing to a mind frame of endless searching for a potential lesion to be "cured."

Findings of the medical history and physical examination may alert the clinician to other pathology that can present with pain or some of the other constitutional symptoms with which the patient with chronic pain may present. Certain findings, referred to as red flags, raise suspicion of serious underlying medical conditions (see Table 1). Potentially serious disorders include infections, tumors, and systemic rheumatological disorders.

A careful, thorough history is required. The approach generally needs to be comprehensive, exploring all aspects of the physical complaints. A relevant review of symptoms is necessary. It is critical to evaluate psychological and social factors. Equally important is the evaluation of occupational and environmental functions, with particular emphases on psychological, physical and social barriers that may be addressed to limit the impacts of the condition

Absent red flags, most patients with common forms of chronic non-malignant pain may be described as having one or more of the following conditions:

- Complex regional pain syndrome (CRPS): Type I or Type II;
- Neuropathic pain: central, peripheral, or radicular;
- Trigger points/myofascial pain;
- Tender points/fibromyalgia;
- Degenerative joint disease, including osteoarthrosis or osteoarthritis;
- Chronic spine pain;
- Chronic pain syndrome;
- Chronic lower abdominal/pelvic pain;
- Chronic non-specific pain syndrome; and/or
- Psychological disorders (most common are the affective disorders, anxiety, depression).

Please also see Medical Treatment Guidelines for Non-Acute Pain, if applicable.

It should be noted that patients with chronic pain syndromes may have one or more of several psychological disorders. Depressive disorders are particularly prominent factors. Please also see Medical Treatent Gudeline for Work-Related Depression and Depressive Disorders.

D.1 Red Flags

Physical evidence of an underlying medical or psychological problem that correlates with the medical history and test results may suggest a need for immediate consultation. A history of malignancy, infection, endocrinological or systemic disorder may suggest the possibility of an underlying serious condition. A medical history that suggests pathology originating in a location other than that originally injured may require investigations that would not appear to be related to the work injury but would nonetheless need to be performed (e.g., shoulder pain from gall bladder or cervical spine; joint complaints from rheumatological disorders). Psychosocial red flags include dangerousness to self or others, acute intoxication, psychosis, and homelessness. Evidence of risk factors for delayed recovery may also be of concern, and may be considered "yellow" flags. Table 1 focuses primarily on systemic conditions that may have been missed in a patient with complaints of chronic pain. However, if the person has no past history, then the professional should still evaluate, assess and query about current psychological issues due to the high co-morbidity rate with chronic pain.

Table 1. Red Flags for Potentially Serious Conditions Associated with Chronic Pain*

Disorder	Medical History	Physical Examination
Tumor and Neoplasia	• Severe localized pain, often deep seated, non-radiating unrelenting boney pain • History of cancer (at *any* point in a lifetime) • Age >50 years • Symptom consistent with disease in a specific organ system • Cough • Change in bowel habit, epigastric pain, early satiety • Pain that worsens with use of specific body part • Constitutional symptoms, such as recent unexplained weight loss, fatigue • Pain that continues at night or at rest • Development of new symptoms at a distant site to the original complaint not readily explained by that original problem (e.g., development of cough in a patient with shoulder pain) • Pain non-responsive to usually effective treatments (e.g., low back pain not responding to evidence-based treatment guidance)	• Pallor, reduced blood pressure, diffuse weakness • Tenderness over boney landmark(s) and percussion tenderness corresponding to pain complaints • Decreased range of motion due to protective muscle spasm • New mass or tenderness • Abnormal pulmonary examination (rales, rhonchi, decreased breath sounds) • New findings at a distant site to the original complaints
Infection	• Constitutional symptoms, such as recent fever, chills, or unexplained weight loss • Recent bacterial infection (e.g., urinary tract infection); IV drug abuse; diabetes mellitus; or immunosuppression (due to corticosteroids, transplant, or HIV) • History of recurring infections treated with antibiotics (e.g., repeated urinary tract infections) • Foreign travel with exposure potential • Insect bites	• Fever, tachycardia, tachypnea, hypotension • Elevated white blood cell count (may be decreased in elderly, immunocompromised or sepsis) • Shift in the WBC differential towards immature cells ("left shift") • Abnormal urinalysis • Abnormal body part examination (e.g., pulmonary) • Tenderness over boney landmarks
Progressive Neurologic Deficit	• Severe spine and/or extremity pain • Progressive numbness or weakness • Complaints of new clumsiness of gait or impairment of hand function	• Significant and progressive dermatomal and/or myotomal (motor) involvement

		• Evidence of cauda equina syndrome– urinary retention or bowel incontinence • Hyper-reflexia or other evidence of myelopathy
Intracerebral Pressure Increase or Mass or Vascular Lesion	• Persistent or variable headache present on awakening • Episodic severe headache • Subtle loss of coordination or balance • Cognition or other mentation difficulties • History of cerebrovascular accident, or stroke-like symptoms, including transient	• Papilledema upon fundoscopic exam. • Possible mild neurologic findings • Possible mental status changes
Rheumatologic Disease	• Diffuse arthralgias, either a/symmetrical • Joint swelling and/or prolonged morning stiffness • Skin changes, lesions, or ulcers • Oral ulcers • Gastrointestinal diseases • Fatigue, malaise • Subtle mental status changes	• Polyarticular joint effusions (usually with warmth) • Synovitis, joint tenderness • Range of motion reductions • X-ray abnormalities consistent with erosive or degenerative pathology • Elevated sedimentation rate [50] or C-reactive protein (CRP) • Hematuria, proteinuria • Other specific abnormalities as appropriate (e.g., ANA, RF, anti-DNA, C3, anti-Ro, anti-La, oral ulcers, pulmonary abnormalities, ophthalmological involvement, dermal abnormalities)
Psychosocial	• Suicidal ideation • Violent ideation • Psychosis • Substance abuse/opioid dependence • Homelessness	• Positive signs on psychological screening/testing • Patient interview

*This list is not meant to be comprehensive; it is a review of the most common suggestive historical and examination findings.

In the absence of red flags, the evaluation of the patient with chronic pain may progress as noted below. The evaluation is recommended to be centered on function, while not ignoring pain.

D.2 Symptoms and Signs May Include

- Constant severe burning or throbbing pain typically isolated to one limb
- Trauma often precedes symptoms, and symptoms are disproportionate to the trauma
- Non-radiating pain
- Significantly worsening pain with activity
- Sensitivity to touch, unusual sensitivity and pain to minor pressure or palpation
- Sensitivity to cold
- Skin coloration changes, including blanching and mottling
- Swelling of the affected limb
- Skin texture changes
- Changes in hair and nails
- Muscle spasms
- Hyperesthesia and/or allodynia
- Temperature asymmetry and/or skin color changes and/or color asymmetry

- Edema and/or sweating changes and/or sweating asymmetryDecreased range of motion and/or motion dysfunction (weakness, tremor, dystonia)
- trophic changes (hair, nail, skin).

D.3 History

Because CRPS most commonly starts with an injury or event, the medical history naturally starts with the details of that event. Characteristics of pain are then elicited that are unusual and disproportionate compared with the degree of the injury. Excessive sensitivity to normally nonpainful stimuli, such as pressure on the skin develops. Unusual and asymmetric temperature differences between the limbs occur frequently. Cold intolerance is common. Edema occurs. Later changes include skin texture, nails and hair. Disuse and weakness of the limb becomes nearly universal, especially if the condition is not recognized early and strengthening and conditioning exercises not prescribed.

A focus on the potential for a treatable condition is mandatory for an initial evaluation of a patient with CRPS or chronic pain. Nevertheless, it is recommended that the initial evaluation of patients with CRPS or chronic pain also start with a focus on function, both at work and home. This sets the focus on function that is essential for the vast majority of CRPS, while maintaining a focus on confirmation that prior examiners did not miss a treatable disorder.

Collecting information about occupational history and patterns of daily living and interests assists in understanding patient priorities and targeted outcomes. Responses frequently also provide powerful clues to activities the patient is interested in resuming that may ultimately provide the motivational tools to facilitate the patient's functional restoration. The provider should ask typical questions focused on pain symptoms. Current pain treatments, whether medical or non-medical, should be recorded. Past pain treatments should be reviewed with a careful discernment and documentation of meaningful, lasting functional improvements.

After the function-based and pain histories are obtained, the history should next include a thorough medical history, past medical history, medication history, surgical history, accident history, current psychological history, and past psychological history.

Approach pain complaints as an integral element of each history and physical examination. However, the primary focus should be on function, rather than pain to avoid an undue focus on pain and pain ratings. This includes assessing pain complaints relative to casual patient observations, the physical examination and observation of the patient's functions both while actively examined and ideally outside of the context of the performance of a physical examination. Obtaining a history of functional activities from family members or friends may sometimes be useful.

D.4 Physical Examination

The physical examination of a patient with well-established signs of CRPS is almost always straight-forward particularly for the examiner familiar with CRPS. However, early findings are often clinically subtle and the diagnosis may be more tentative. Still the primary intervention is the same: education and directed specialized physical/occupational therapy with primary emphasis on strengthening, functional active use, and aerobic components to prevent dysfunction. Early psychological interventions may benefit selected individuals as well, particularly if there is concomitant post-traumatic stress disorder, other psychological/behavioral disorders, and/or poor coping. Often the patient will be observed limiting use of the extremity, including protecting and avoiding use of the limb. This can include not shaking hands or weight bearing on the affected limb.

A key feature of this condition is that objective findings in the affected extremity contrast significantly with those of the unaffected extremity. The skin temperature may differ, usually being cooler in the affected extremity, although it can be warmer. If advanced, the skin may have a smooth, thinned, atrophic appearance. Skin temperature should be measured with infrared equipment and should be at least 1°C different for CRPS. Skin coloration changes are also generally present, including mottling. Livido reticularis (a mottled purplish discoloration of the skin) may be present. The extremity may become edematous. With passage of time, the nails may also become atrophic. A distinguishing characteristic is allodynia, or the experience of pain with something that normal individuals would not consider painful. Examples include pain with light touch, shaking hands, or even the weight of the clothing on the extremity. Circumferences of the affected extremity may differ. They may be increased in edematous states (generally earlier), and reduced if there is disuse dystrophy in chronic states. Water displacement volumes may be measured to attempt to ascertain degrees of swelling, although the baseline measures will not be comparable with the pre-morbid state, which is unknown. Additional findings reported include misperceiving the correct finger that is being touched, inability to identify an object solely with tactile input (astereognosis), and hand laterality identification with motor imagery. While occasional measurements may be acceptable, there is a tendency towards preoccupation with those measures by some, which has the potential to draw attention away from active therapy, towards symptoms and signs, and may inadvertently promote delayed recovery.

A well-performed physical examination is indicated for the evaluation of a patient with CRPS. Components of the physical examination should follow those of the relevant body part involved and will not be detailed in this section (see other Medical Treatment Guidelines). The examination of individuals with somatoform disorders or other behavioral/psychological disorders is often indistinguishable from that of psychologically normal individuals. The threshold for psychological referral, including psychometric testing should be quite low.

Observation of the patient is believed to be the most important aspect of the physical examination. It should begin at the start of the visit - or better still, through a report from the medical assistant who put the patient in an examining room. It should include an evaluation of the patient’s ability to arise from a seated position (and other positional changes), gait in the hallway (e.g., for all lower extremity complaints), utilization of limbs for tasks, and facial expressions in the course of performing those functions. Synergistic and dys-synergistic history and physical examination findings should be recorded.

Particularly in the setting of CRPS, signs that are inconsistent with symptoms should be sought. It should be noted that positive results with these maneuvers are sometimes erroneously taken to be definitive of factitious illness and/or malingering. That may or may not be true. More commonly, it is believed that these may be positive when patients in pain subconsciously exhibit a need for further attention to the painful disorder or sometimes may represent psychological dysfunction. In the context of CRPS, they may simply be part of the clinical presentation. Nevertheless, their presence may indicate the need for psychosocial evaluation or consultation with other specialists, particularly when multiple signs are present in the context of significant delayed recovery.

Making an accurate diagnosis in the context of possible CRPS can be very difficult, because there are many diagnoses that can present similar to CRPS, and the subjectively reported symptoms in CRPS very often are not consistent with either the presenting history, or initial objective findings. The differential diagnosis of CRPS may include but not necessarily be limited to: neuropathic pain syndromes (peripheral [poly] neuropathy, nerve entrapment, radiculopathy, post-herpetic neuralgia, plexopathy and motor neuron disease); vascular diseases (thrombosis, atherosclerosis and Raynaud's phenomenon); inflammation (erysipelas, bursitis, seronegative arthritis and rheumatologic diseases); myofascial pain syndromes (overuse, disuse, repetitive strain injury, fibromyalgia); psychiatric or psychosocial problems (somatoform pain disorders, Munchhausen syndrome, compensation neurosis, malingering and factitious disorder); thyroid disorders; diabetes mellitus; or alcoholic polyneuropathy. This list is not intended to be exhaustive but merely intended to illikstrate the complexity of the differential diagnosis. Moreover, inclusion of such diagnoses as compensation neurosis, malingering or factitious disorder should not be misconstrued as undermining the legitimacy of the pain complaints of patients who actually have CRPS.

In the CRPS setting, it is frequently helpful to obtain measurements of the patient's capabilities in the clinic to then follow in subsequent clinic visits while the patient is undergoing rehabilitation services. These may include the following:

- Walking distance (observe in the hallway or outdoors and subsequently simultaneously interview the patient about their progress if a longer walking ability is demonstrated)
- Ability to climb stairs (walking to the nearest stairwell with the patient and observing capabilities)
- Dynamometer grip strength measurements
- Pinch strength
- Repeated toe raises (number able to perform)
- Distance of heel walking
- Squats (number)
- Sensory examination findings (e.g., monofilaments)
- Movement inconsistent with pain/injury problem while in exam room

This allows more informed decision making exercise and other physical activity benchmarks, and is believed to be quite helpful to facilitate the patient's recovery. The use of validated functional assessment tools to follow patient progress is another recommended approach.

E. Biopsychosocial Approach to CRPS

The “biopsychosocial model” which emphasizes the need to account for the unique interactions between biological, psychological, and social factors in order to better understand health and illness, is now commonly utilized to explain and manage CRPS and other chronic pain, since the traditional medical model of acute injury resulting in pain and tissue damage does not explain chronic pain syndromes. Central nervous system (CNS) factors may explain the experience of pain in the absence of tissue damage or after healing has taken place. Genetic factors may also play roles in the perception and responses to pain. Psychological and social factors are also involved in the perception and interpretation of pain symptoms and their effects on home and work life. Psychological factors may be prominent in the management of patients with CRPS, and may profoundly influence the individual’s ability to modulate pain and distress, and are better managed after earlier identification.

In settings of acute pain (e.g., trauma), brief inactivity may reduce pain. However, in subacute to chronic problems, inactivity either results in no improvement or more pain, delays recovery, and is accompanied by deconditioning. Thus, increased activity is indicated for essentially every chronic condition associated with persistent pain. For select, acute pain conditions, reduced activity limitations to facilitate recovery may be appropriate. Yet, in the chronic context, recovery is usually dependent on performing those specific activities that may elicit the pain on a gradually increased basis in order to return to as near normal function as possible. There is increasing consensus to implement increased activity levels earlier and earlier in the acute and subacute phases to prevent delayed recovery.

E.1 Palliate or Rehabilitate

A related untoward outcome from the failure of successful restoration of normal function during the initial phases of treatment is the decision to make palliation the main focus of subsequent interventions. To palliate rather than rehabilitate is a profound clinical, ethical, and medico-economic decision that should not be taken lightly. While a patient’s complaints of pain should be acknowledged, both patient and provider should remain focused on the ultimate goal of rehabilitation leading to optimal functional recovery.

This guideline focuses primarily on chronic pain due to CRPS, and its evaluation and treatment. Complete pain relief is clearly a highly desirable endpoint, especially in acute pain states, yet it is usually unattainable in patients with chronic pain due to CRPS. Pain treatment should emphasize functional restoration and pain relief. Emphasizing only pain relief may reinforce negative psychological, environmental, and dependent psychosocial factors that predispose progression to chronic pain states and addiction(s). In chronic pain states, emphasis on functional restoration should focus on improving function while reducing pain or limiting flare-ups to manageable levels. Patient education is also an important component to achieve the goals, as without the patient joining the treatment team, progress is typically very slow and the goals may not be achieved.

Pain that cannot be adequately explained by specific physical findings raises many questions: When does acute pain become chronic? Is the diagnosis correct? Is there a second diagnosis? Are changes in the patient’s central nervous system creating pain hypersensitivity? What else is going on in the patient’s life, either at home or at work,

which may be aggravating his or her pain or reinforcing pain or illness behavior? Does the current treatment improve function? What role should patients play in promoting optimal function in everyday living and enabling meaningful family, workplace, and social relationships? What is the patient's emotional response to pain? The following discussion sheds light on these questions and suggests an interdisciplinary model to address the multiple components of the patient's CRPS.

E.2 Psychological Issues

Please also see Medical Treatment Guidelines for Work-Related Depression and Depressive Disorders, and PTSD.

Pain-related fear is believed to contribute to pain and disability in several ways. While pain avoidance is natural, persons who exhibit greater pain-related fear tend to avoid more situations than would be normal due to their belief that they may cause pain, leading to greater activity avoidance. Thus, pain-related fear and associated avoidance of activity may contribute to disability independently of the pain itself. This may lead to greater physical deconditioning, but may also lead to musculoskeletal abnormalities such as muscle guarding while bending, which in turn may directly contribute to pain behavior.

Pain-related fear is significantly related to greater perceived disability. Gradually exposing patients to fearful activities as a pathway to reduce or extinguish pain-related fear can be a powerful intervention for chronic pain due to CRPS. A decline in pain-related fear may reduce pain hypervigilance, resulting in a decline in reported pain intensity. Reductions in pain-related fear may be partially responsible for improvement seen in functional restoration programs.

The Biopsychosocial Model

The biopsychosocial model (BPS) views health as including optimism, social support, good coping, positive mood, motivation, and work ethic. The model views disorders such as chronic pain due to CRPS as the result of a dynamic interaction among physiologic, psychological, and social factors which perpetuate and may worsen the clinical presentation. Thus, the model explains some patients with severe injuries who have profound perseverance, motivation and superior recovery.

The BPS model recognizes that each individual experiences pain uniquely, with a range of psychological and socioeconomic factors interacting with physical pathology to modulate a patient's report of symptoms and subsequent disability.

These in turn are hypothesized to lead to neurochemical changes at the central level, with the central nervous system altered by chronic pain to increase sensitivity to incoming impulses that amplify pain. Activation is believed to lead to further physiological changes, the extent of which are hypothesized to depend on intrinsic (genetic and physiological) and extrinsic factors, which exacerbate and perpetuate a syndrome in which the experience of pain increases despite a lack of objective reasons for this to occur.

In the BPS Model, pain is defined as a noxious sensory AND emotional experience. Pain is known to have components designated as nociception, pain, suffering, emotional and pain behavior. The perception of pain may occur in the absence of nociception (or neuropathy) and vice versa.

In clinical contexts, *pain behavior* may be defined as "any response or set of responses which communicates the concept of pain to another person." The concept may be broadened to the notion of *illness behavior,* which involves other health related complaints and responses. Pain behaviors may be considered symptoms in acute pain presentations, however over time they may come under control of various psychosocial or learning influences. There is a common misconception that such behaviors may represent consciously "exaggerated" or "magnified" symptoms. This is not possible to assess directly, and such conceptions are often pejorative. Pain or illness behaviors may evolve in persons with chronic pain due to CRPS that are secondary to a wide range of psychosocial antecedents and learning or conditioning influences.

Because there is no known relationship between nociception, pain, and pain behavior when a condition becomes such as with CRPS, such behavior should be conceptualized as a clinical finding. Pain behavior is also not equivalent to "secondary gain". While the latter is generally based on presumptively seeking reward or other desirable consequences of an injury, pain behavior may be learned or conditioned, shaped, and maintained by subtle reinforcement in persons about whom such psychological inferences may be inappropriate. There is evidence that persons with non-acute pain abd CRPS may be uniquely sensitive to operant and classical conditioning in the learning of pain responses. Chronic non-malignant pain may foster psychosocial and behavioral dysfunction, as well as magnify pain. The distinctions between these situations become important in the development of interventions to address them.

In persons with non-acute pain due to CRPS, many permutations of these concepts are possible. For example, significant and disabling pain and illness behavior may evolve and become a clinical problem, even in the absence of clinically meaningful nociception or pain. Pain behavior may be noted in the presence of nociception or neuropathy, but the patient may not be suffering in clinically meaningful ways and may not be disabled. It is important to view the patient in this context and evaluate and treat these components appropriately, which requires a more complex evaluation and treatment plan than required for the patient with uncomplicated acute pain.

F. Diagnostic Testing

Diagnostic testing considerations are defined by the clinical entity and body part being investigated. Testing commonly used for the identification of other disorders is often required to assure that other diagnoses are not present. This should not be considered as justification for ordering tests indiscriminately. Tests should instead, be ordered if there is a reasonable probability that the diagnosis is present. Sometimes, the threshold for ordering a test is lower if the adverse effects from missing the diagnosis are considerable. Imaging studies can identify abnormalities such as edema, demineralization, or osteoporosis that are consistent with one of the diagnoses associated with chronic pain, but mostly these are non-specific findings. There are different lines of clinical investigation of potentially useful technologies that purportedly assist in objectively diagnosing underlying pathology.

F.1 Psychological Evaluation for CRPS Patients

Recommended - as part of the evaluation and management of patients with chronic pain in order to identify psychosocial barriers that are contributing to disability and inhibiting function and to assess whether psychological factors will need to be considered and treated as part of the overall treatment plan.

Indications: Moderate to severe CRPS in certain clinical circumstances. (Please see Behavioral Interventions section below for a more detailed discussion).

F.2 Laboratory Tests for Peripheral Neuropathic Pain

Recommended - as a screen to evaluate specific disorders (e.g., diabetes mellitus, alcohol) that may cause or contribute to peripheral neuropathic pain.

Indications: Patients with peripheral neuropathies without prior diagnostic evaluations. Diagnostic testing should generally include fasting glucose and either hemoglobin A1c and/or 2-hour glucose tolerance testing. The threshold for testing for signs of alcohol should also be quite low (i.e., CBC with Mean Cell Volume, GGTP, AST and ALT). Testing is advisable even if other diagnostic testing finds another disorder (e.g., occupational neurotoxin) to assure there is not another, treatable, contributing factor.

Frequency/Dose/Duration: One evaluation. A second evaluation may be indicated when either there is a significant change in exposure (e.g., substantial weight gain) or symptoms change.

F.3 Antibodies for Diagnosing Chronic Pain with Suspicion of Rheumatological Disorder

Recommended – as a screen to confirm specific disorders (e.g., rheumatoid arthritis, lupus) and for assessing patients with suspicion for rheumatological disorder.

Indications: Undiagnosed patients with either systemic arthropathies and/or peripheral neuropathies, or patients have had incomplete evaluations. Diagnostic testing should generally include sedimentation rate. Other tests may include rheumatoid factor, antinuclear antibody level, and others. Testing is advisable even if other diagnostic testing finds another disorder (e.g., occupational neurotoxin in presence of peripheral neuropathy) to assure there is not another, treatable, contributing factor, especially if explanation of the symptoms is incomplete.

Frequency/Dose/Duration: One evaluation. A second evaluation may be indicated with a significant change in symptoms. It is also reasonable to repeat testing after a period of a year or two as initial testing is known to occasionally become positive with the passage of time.

They are recommended for focused testing of a few diagnostic considerations. However, ordering of a large, diverse array of antibody levels without diagnostically targeting a few specific disorders is not recommended.

F.4 Antibodies to Confirm Specific Rheumatological Disorders

Recommended - as a screen to confirm specific rheumatological disorders (e.g., rheumatoid arthritis) and for assessing patients with possible myofascial pain syndrome, especially with other symptoms.

They are recommended for focused testing of a few diagnostic considerations. However, ordering of a large, diverse array of antibody levels without diagnostically targeting a few specific disorders is not recommended.

F.4.a Diverse Array of Antibody Level

Not Recommended - without targeting a few specific disorders diagnostically.

F.5 Electrodiagnostic Studies ("EDS", e.g. Nerve Condiction Velocities and Needle Electromyelography)

Recommended – in select patients with CRPS-II.

Indications: In select patients for whom making a diagnoss is difficult, in order to diagnose CRPS-II (as differientiated from CRPS-I, in which EDS are typically normal). These are typically patients for whom laborory testing to detect peripheral neuropathies (as discussed above) wil be normal.

Frequency/Dose/Duration: One evaluation. A second evaluation may be indicated when either there is a significant change in symptoms or function.

Note: In those cases where electrodiagnostic studies are indicated, they should be conducted in accordance with the practice parameters of the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM). It is recommended and preferred that electrodiagnostic studies in the out-patient setting be performed and interpreted by physicians board-certified in Neurology or Physical Medicine and Rehabilitation.

F.6 Autonomic Nervous System and Respiration (ANSAR) Testing for Diagnosing CRPS

Not Recommended - to assist in diagnosing CRPS. ANSAR has not been shown to alter the clinical management of patients with CRPS.

F.7 Bone Scanning for Diagnosing CRPS (Triple-Phase)

Recommended - in select patients to confirm the diagnosis of CRPS of over six months duration.

Indications: Symptoms of possible CRPS generally for at least three to six months, with an uncertain diagnosis.

Frequency/Dose/Duration: One evaluation. A second would be rarely indicated, e.g., concerns about occult fracture.

Evidence for Bone Scanning

F.8 X-rays for Diagnosing CRPS

Recommended - to assist in the diagnosis of CRPS of over six months duration, although they are primarily used to rule-out other disorders.

Indications: Symptoms of possible CRPS generally for at least three to six months, with an uncertain diagnosis. May be obtained early than three months for diagnosing other conditions.

Frequency/Dose/Duration: One evaluation. A second would be rarely indicated, e.g., concerns about occult fracture.

F.9 Non-specific Inflammatory Markers for Screening for Inflammatory Disorders

Recommended - Erythrocyte sedimentation rate and other inflammatory markers for screening for signs of systemic inflammation, particularly in assessing patients with ill-defined pain conditions.

Indications: Undiagnosed patients with symptoms consistent with either systemic rheumatological diseases and/or patients have had incomplete evaluations. Subsequent, additional tests may be needed, including rheumatoid factor, antinuclear antibody level, and others. Testing is advisable even if other diagnostic testing finds another disorder (e.g., occupational neurotoxin) to assure there is not another, treatable, contributing factor, especially if explanation of the symptoms is incomplete.

Frequency/Dose/Duration: One evaluation. A second evaluation may be indicated with a significant change in symptoms. It is also reasonable to repeat testing after a period of a year or two as initial testing is known to occasionally become positive with the passage of time.

F.10 Cytokine Tests for Diagnosing CRPS

Not Recommended - to diagnose CRPS and chronic pain.

F.11 Surface EMG for Diagnosing CRPS

Not Recommended - for the differential diagnosis of CRPS and chronic pain.

Evidence for Surface EMG

F.12 Functional MRIs for Diagnosing CRPS

Not Recommended - for diagnosing CRPS.

F.13 Local Anesthetic Injections for Diagnosing CRPS

Recommended - selectively recommended for evaluations in CRPS patients.

Indications: Chronic persistent pain in a specific nerve distribution (e.g., ilioinguinal, genitofemoral) that is otherwise unexplained by other investigation, including imaging, EMG/NCS.

Frequency/Dose/Duration: Once.

Table 2. Benefits and Adverse Effects of Injections

Benefits	• Identify treatable lesion. (e.g., nerve that is successfully blocked and results in identifying a treatable compression of that nerve.
General complications of neuraxial injections, and of injections near the paravertebral muscles	• Infection at site and remote (meningitis found in one German study following trigger point, facet, and epidural injections). • Bleeding, including hematoma causing nerve compromise. • Direct trauma to nerve, causing permanent damage or increased pain. • Injection into the wrong space (artery, vein, inadvertent intrathecal, or thoracic cavity). • This can lead to respiratory compromise, cardiac arrest, or pneumothorax.
Complications specifically related to the substance and amount injected (in addition to possible anaphylaxis)	• Local anesthetics – seizures, cardiac collapse. • Sympatholytics – hypotension, tachycardia, cardiac dysrhythmias. • Corticosteroids* – endocrine dysfunction, diabetes, hypertension, dysphoria, immune compromise, phlebitis, muscle pain, osteoporosis, dependency, rarely nerve damage, etc. • Baclofen* – anxiety, blurred vision, ataxia, coma, depression, dizziness, dysarthria, dystonic reaction, hallucinations, headache, respiratory depression, seizures, stroke, etc. • Botulinum toxins – weakness, paralysis, respiratory compromise, diplopia, dizziness, injection site reaction.

*These adverse effects are mostly temporary aggravations and dependent on dose and frequency.

F.14 QSART for Diagnosing CRPS

Not Recommended - to assist in the diagnostic confirmation of CRPS.

F.15 SPECT/PET for Diagnosing CRPS

Not Recommended - to evaluate patients with CRPS (aside from use in cases of suspected inflammatory arthropathies not diagnosed by more common tests). The use of PET scanning is also not recommended to evaluate patients with CRPS.

F.16 Thermography for Diagnosing CRPS

Not Recommended - for diagnosing CRPS.

Evidence for the Use of Thermography

G. Management of CRPS

G.1 Initial Care

In general, interventions for treating pain should be time-limited and functional goal-oriented. Persons returning to work and life functions sooner after injury tend to have the best outcomes. Persons with equivalent diagnoses who are out of work for three months have worse return-to-work outcomes than those out one month, while those away for one year do worse than those out six months. Thus, there is a strong basis to return to a functional status sooner rather than later, including to work.

As noted previously (see Medical History), identification of psychosocial issues should be part of the initial evaluation or consultation for a new patient with CRPS. A few of these issues include current or past mental health issues, family, friends, co-workers, supervisor relationships and support, and drug-related issues.

A comprehensive history and physical will generally identify at-risk individuals, after which referral to a psychologist or pain specialist can be considered. Referral to a psychologist or psychiatrist experienced in pain evaluation is often appropriate, especially when the pain is ill-defined, not well explained by anatomic or physiological abnormalities, associated with disability in excess of what would be expected based upon objective findings, or depression or anxiety are present. An additional consideration in the initial care of the patient with CRPS is whether a multidisciplinary approach should be instituted to minimize disability and maximize function. This is described later in this document.

The following is a short outline or overview of the therapeutic approach.

- Identify remediable generators of nociception or neuropathy (e.g., aggressive treatment of diabetes for diabetic neuropathy; aggressive rehabilitation exercises for CRPS).
- When there is no *readily resolvable* pain generator, the focus should be on functional restoration.
- Treatments should be individualized, taking into account co-morbidities and preferences.
- Address co-morbid mental health conditions with appropriate behavioral modification or medications.
- Medications or other treatments that have not been of clear benefit with an adequate trial should be discontinued prior to institution of alternative options. Treatments that are of some benefit should be continued while alternatives are weighed and checked to attain a reasonable chronic pain modulation (as a partial control is better than none in this population) to prevent them from seeking potentially detrimental treatment schemes. Medication effectiveness and adverse effects should be reviewed regularly with the patient and well documented in the medical record. Providers should periodically assess the appropriateness of dose reductions, tapering and

deprescribing where cinically appropropriate (NonAcute Pain Medical Treatment Guideline).

- Interventions with the potential for serious adverse effects should be employed only if pain reduction and functional improvement will reasonably outweigh potential harms to the patient, and only continued if this is demonstrated to be the case. Such interventions should be preceded by an adequate trial of conservative care. However, there are times when judicious interventional or medication therapy may be more appropriate than other strategies with potential to reduce pain and overall costs.

Treatment of CRPS consists of a combination of therapies and interventions. Physical and psychosocial aspects should be considered when developing a treatment plan to suit the patient's needs, reduce their pain, and improve their function. Most importantly, the patient must actively participate in the treatment plan. This often requires substantial and continued patient educational efforts.

G.2 Activities and Activity Alteration

The overwhelming theme in the management of most patients with CRPS is to keep them as physically active as possible. There is no reason to avoid using the affected body part even in severe cases. All patients require advancement of activity levels and education because inactivity is detrimental despite the temporary relief of symptoms that often accompanies it. While acute pain from an acute injury (not an acute manifestation of disease) may at times be successfully treated through a reduction in activity (e.g., casting a fractured extremity), subacute and chronic pain are best treated in exactly the opposite manner. In the late acute phase of subacute and chronic pain, the patient is generally best treated by performing gradually increased or graded activities to incrementally regain a fully functional status (i.e., usually requiring tolerating pain with each graded increase in occupational and non-occupational activity) or as full a functional status as possible.

In general, patients with mild symptoms should be encouraged to perform all activities as normally as possible. They likely will require education and exercises. Those with moderate symptoms may or may not be able to work. If not, they should be in a therapy program, including daily home exercises, and gradually advancing activity levels outside of work within a program that targets return to work and meaningful productivity as a main treatment goal. Transition into the workplace is often useful for patients with CRPS who are not working, particularly those with severe problems. Such transitioning usually requires careful coordination between the patient, treatment team, supervisor and co-workers. It may involve beginning on a modified duty job for 2 hours a day, then gradually advancing job physical requirements and/or length of time on the job until the individual is back to work full time. This process may take many weeks for those more severely affected, but is usually a highly effective method to both provide treatment and actively rehabilitate the patient with CRPS.

Precise numbers of physical and occupational therapy appointments are difficult to predict, due to the complexities of diagnosis, severity of the condition, degree of impairment and individual factors involving ability to tolerate and exercise through pain. The key questions involve the documentation of ongoing, progressive, objective

functional gains (e.g., return to work status, reducing work limitations, more repetitions of a rehabilitative exercise, walking further, etc.). As long as there is meaningful functional progress, additional therapy appointments may be warranted until a plateau in function is reached, at which time a transition to a long-term home exercise program is indicated. In general, prescribing therapy appointments for CRPS patients in increments of 10-12 appointments and then reassessing for functional gain prior to further prescriptions of additional appointments is recommended. A common approach is to gradually lengthen time between visits. These approaches also allow for the development and implementation of a home exercise program. A similar process for other appointments is also recommended regarding documentation of functional gain.

In general, activities causing a *significant* increase in symptoms should be reviewed with the patient and modifications advised when appropriate. Home and work activities may require at least temporary modification. An increase in pain does not represent or document damage. Instead, an increase in short-term pain as a result of increased activity levels in patients with CRPS is actually believed to be normal and not detrimental to recovery. While the patient is being treated for CRPS, activities that do not aggravate symptoms should nearly always be maintained, and exercises to prevent debilitation due to inactivity should be advised. Aerobic exercise may be beneficial as a part of a therapeutic management technique that includes strengthening exercises as the cornerstone for management of patients with CRPS (see Exercise). Stretching and flexibility exercises are particularly required where there is a significant limitation in range of motion and sometimes must precede strengthening exercises depending on the severity of the deficits. The patient should be informed that activities might temporarily increase symptoms but that such exacerbations are normal.

G.3 Work Activities

Work activity modification is an important part of many treatment regimens. Advice on how to avoid substantially aggravating activities that at least temporarily increase pain includes a review of work duties to decide whether or not modifications can be accomplished without employer notification and to determine whether modified duty is appropriate and available. Making every attempt to maintain patients at the maximal levels of activity, including work activities, is strongly recommended as it is in their best clinical and functional interest.

The analysis of work ability requires an assessment of “risk,” “capacity,” and “tolerance.” Risk refers to what a patient can do, but should not do, due to the substantial risk of significant harm, considering probability and severity of potential adverse events. Providers impose work restrictions based on estimates of risk. Capacity refers to what a patient is physically capable of doing, as measured by concepts such as range of motion, exercise ability in metabolic equivalents (METs), etc. Tolerance for chronic symptoms is the basis for a patient (not a provider) to decide whether the rewards of work are worth the cost of the symptoms.

The first step in determining whether work activity modifications are required usually involves a discussion with the patient regarding whether he/she has control over the job tasks. In such cases where the worker can, for example, get assistance from someone else, there may be no requirement to write any restrictions even if the pain is limiting. Assessment of work activities and potential for modifications may also be

facilitated by a worksite visit and analysis by a health care provider with appropriate training.
Work modifications should be tailored taking into account two main factors: 1) the job physical requirements; and 2) the safety of the tasks, in the context of case-specific factors. Sometimes it is necessary to write limitations or prescribe activity levels that are above what the patient feels he/she can do, particularly when the patient feels that complete rest or similar non-activity is advisable. In such cases, education about CRPS and the need to remain active should be provided.

Common limitations involve modifying the weight of objects lifted, degree of stereotypical activity allowed (low, medium, high), frequency of lifts, and posture, all while taking into account the patient's capabilities. As noted above, there are many variables that must be incorporated into prescriptions of physical activities, thus they require individualization. These are clinical judgments. For *severe* cases of CRPS involving an upper extremity, frequent initial limitations for occupational and non-occupational activities might potentially include:

- Working two hours a day;
- No lifting over five pounds; and
- No highly repetitive or high force activities (e.g., push/pull) involving the affected hand.

For severe CRPS involving a lower extremity or the spine, frequent initial limitations for occupational and non-occupational activities might potentially include:

- Working two hours a day;
- No lifting over ten pounds; and
- Alternate sitting and standing as needed.

These work and home activity guidelines are generally reassessed every week in the early rehabilitation process with graded increases in activity recommended so that patients with CRPS may maintain or regain their highest level of function.

It is best to communicate early in the treatment that limitations will be progressively reduced as the patient progresses. Experienced providers communicate the intended changes in restrictions for the coming week (similar to forecasting increases in exercise program components) at the current visit to reduce the element of surprise and help actively facilitate the patient's most important elements of an active, functional restoration program. Tailoring of restrictions is required in nearly all patients with CRPS as there is great variability in symptoms and dysfunction. The employer should also be consulted while developing strategies to expedite and support integration of the patient into the workplace.

The provider can assist patients and employers in explaining that:

- The patients usually have increased pain performing almost any function in the early rehabilitation timeframe, even if "light" duty;
- Increases in pain do not equate to injury for patients with CRPS;
- Increases in symptoms should be heard with a sympathetic ear and the factors which are associated with significant increases in pain should be addressed;
- Any restrictions are intended to allow for time to build activity tolerance through exercise; and

- Where appropriate, it may be helpful to mention to the patient that this rehabilitative plan will also help him/her to regain normal non-occupational life functions.

Every attempt should be made to maintain the patient at maximal levels of activity, including work activities, as it is in the patient's best short term, as well as long term interest. *Work activity limitations should be written whether the employer is perceived to have modified duty available or not. Written activity limitations guidance communicates the status of the patient, and also gives the patient information on what he/she should or should not do at home.* Table 3 provides recommendations on activity modification and duration of absence from work for CRPS. These guidelines are intended for patients without comorbidity or complicating factors, including serious prior injuries. They are targets to provide a guide from the perspective of physiologic recovery. Individual cases will vary.

Table 3. Guidelines for Modification of Work Activities and Duration of Restrictions

Disorder	Activity Modifications and Accommodtion	Recommended Target for Duration of Restrictions*	
		Modified Duty Available	Modified Duty Not Available
Complex Regional Pain Syndrome (includes Types I and II)	Use extremity as normally as possible. Avoid aggravating activities involving extremity (e.g., forceful prolonged use, heavy lifting, walking or standing). Advance activities as soon as possible for better outcomes. Must be strongly individualized based on the severity of CRPS.	• Mild 0-30 days • Moderate 30-60 days • Severe 60-90 days	• Mild 0-30 days • Moderate 60-90 days • Severe 90-180 days

*Mild, moderate, and severe are defined by the degree to which the condition affects ADLs; e.g., mild involves little to no impairment in the impact on the patient's ability to perform ADLs, while severe involves marked impairment in the ability to perform ADLs. Durations of activity limitations may vary based on case-specific details.

H. General Principles of Treatment

The major principle is that CRPS almost always represents an interaction among some level(s) of physical pathology (current or previous), pain beliefs, pain responses, genetics, prior or concurrent psychological problems, socioenvironmental factors, and work-site issues. To focus on one of these to the exclusion of others in treating patients is usually inappropriate and inadequate. The management of patients with CRPSchronic pain, hinges on supporting those activities and treatments which will improve overall function while remaining realistic about timelines and wide variations in reaching a functional recovery. It is important to explain the relevant anatomy and possible pain sources (or lack thereof) and seek to provide the optimal care to manage the pain and minimize dysfunction. Impairing pharmaceuticals and interventional treatments outside of those with probabilities of substantial or complete recovery (or for short term exacerbations responsive to treatment) should be avoided. Their use should be seriously questioned in those cases when there are no evidence based medicine demonstrating efficacy. This is especially true given the extensive body of literature indicating that the placebo effect, expectation bias, and attention bias may be responsible for a significant amount of the benefit that is seen in conjunction with the use of many new interventions or adaptations of interventions used for other conditions.

The patient should be transitioned to work or modified work at the earliest date and highest level of function possible. He or she should be supported during that transition, and told of the likelihood of increased symptoms in conjunction with being reassured that pain does not equate to injury in the CRPS. Should it appear unlikely that there will be anything that can be done to cure the patient's pain, he or she should be informed of that fact, which should be followed with advice that does not equate to disability or hopelessness by stressing that many people have similar conditions yet go to work every day, and take care of their family, leading normal (or nearly normal) lives. The providers' "fear-avoidance beliefs" regarding the relationship between pain complaints and patients' ability to return to work have been shown to affect their treatment practices. It is therefore imperative that the treating provider understand exactly what factors are or are not important in developing an appropriate "return-to-work prescription."Providers should consider referral for further evaluation and perhaps cooperative treatment if:

- Specific clinical findings suggest previously undetected clinical pathology requiring other expertise to adequately address it.
- The clinical course does not follow generally expected patterns.
- Pain distribution is non-anatomic or described in a bizarre or atypical manner. Examples include glove- or stocking-like pain or paresthesias, shock-like pain, pain that radiates up and down the neck and back, burning pain, and pain that is present constantly regardless of position, medication use, or physical treatments.
- Medication use does not decrease pain as expected, or increases pain.
- Appropriate active physical therapy does not appear to be improving function as expected.
- Complaints of pain or dysfunction start to involve other body areas, including instances in which the patient:
    - Ceases to discuss returning to work in a specific time frame but rather in relation to a "cure."
    - Fails to benefit from any, or all, rational therapeutic interventions.
    - Experiences increased pain, or at the very least, pain does not decrease, over time.
    - Is unwilling to discuss his or her family situation.
    - States that the illness or injury has caused all of his or her problems.
    - Directs excessive anger at the employer or coworkers, the provider, or an insurer and/or demonstrates an attitude of revenge or wanting to prove that he or she is sick.
    - Is less interested in the home therapy program or even in recovery of function.
- There appear to be indications of significant psychosocial dysfunction or psychiatric comorbidity.

Judicious referral may be warranted to corroborate the absence of physical pathology and to assure the patient that increased participation in usual activities will not be detrimental to his or her overall physical status. This must be a referral to a well-qualified provider whose practice patterns are consistent with evidence-based medicine, as the potential to do harm by obtaining an MRI or other diagnostic study labeled "abnormal" based upon the presence of anatomic but clinically irrelevant findings is high. Such labeling may further reduce function and increase disability even if there is nothing abnormal for that person's age group.

H.1 Specific Treatment Interventions

Studies evaluating the efficacy of a variety of treatments in the management of various chronic pain disorders sometimes test interventions, especially medications, in patients with heterogeneous chronic pain disorders. The evidence base for these interventions is discussed in general terms, with individualized indications for use in management of a specific pain state provided when warranted. Treatment of specific disorders is discussed in other guidelines and that specific guidance takes precedent over this guidance.

The emphasis and management of patients with CRPS is far different than that for acute pain from new physical injuries. For patients with CRPS rather than acute pain patients, the concentration on pain treatment with medications and invasive interventions is de-emphasized, while the focus should be on functional restoration. The three most important aspects of functional restoration include active patient engagement through interventions that: 1) change the patient's focus to functional recovery; 2) include aerobic and strengthening exercises; and 3) apply psychological interventions that include enhancing self-modulation of pain and distress. There are some invasive interventions with efficacy in limited circumstances.

Treatments widely used in the management of CRPS, regardless of etiology, are medications, physical therapy, and occupational therapy (active and judicious use of passive interventions), coordinated multidisciplinary medical and psychological specialty programs, and certain types of injections. The following is the overall discussion of each intervention and information regarding the evidence-basis for recommendations.

I. Treatment of CRPS

I.1 Activity Modification and Exercise

I.1.a Bed Rest for CRPS

Not Recommended – for treatment of CRPS

I.1.b Aerobic Exercise for CRPS

Recommended – for treatment of CRPS

Indications: All phases of CRPS. Consider aquatic therapy if largely or completely non-weight bearing status (see below). However, those with significant cardiac disease or significant potential for cardiovascular disease should be evaluated prior to instituting vigorous exercises, following the American College of Sports Medicine's *Guidelines for Exercise Testing and Prescription,* 9th ed., in regards to health screening and risk stratification.

Frequency/Dose/Duration: Start with three to four visits a week to also include other exercises; demonstrate evidence of functional improvement within first two weeks to justify additional visits. Simultaneous home exercise prescription. Transition to home-based exercise program. Target minimum of 30 to 45 minutes/day at one time. When at 30 to 45minutes, increase pace.

I.1.c Strengthening Exercises for CRPS

Recommended – for the treatment of CRPS

Indications: All CRPS patients.

Frequency/Dose/Duration: Typically start with three to five visits a week, with more visits for those more severely affected. Most severe CRPS patients will require daily treatments at first to encourage increased activity, progress exercises and address fear avoidant beliefs ("kinesiophobia"). Mild to moderate cases may be reasonably treated twice to three times weekly.

Should have demonstrable evidence of functional improvement within first two weeks to justify additional visits. Supervised treatment frequency and duration is dependent on symptom severity and acuity and the presence of comorbid conditions. Transition to home exercises.

Even in severe cases, active treatment regimens are recommended to be initiated at the first appointment (sometimes termed "stress loading"), merely supplemented with passive modalities as indicated. Those initiating treatment may well have increased symptoms for the first few days of treatment, however pain and edema should decrease within a few days. It is believed to be critical for the entire treatment team as well as the family to be aware of this and to continue to encourage the patient to continue to progress, rather than decrease or eliminate active program elements.

There are many potential strengthening exercises and these are believed to be the most important programmatic elements in the treatment of a CRPS patient. A few examples of these activities include scrubbing, repeated forceful grasp, carrying of progressively heavier objects, distance walked, and repeated toe raises. Patients should be instructed that strengthening exercises are the most important aspects of the treatment program, such exercises should be initiated at the first appointment, and home exercises should be strongly encouraged. It may be particularly helpful to monitor and graph the patient's progress through treatment sessions to demonstrate graphically that the endurance of pain is having meaningful benefits and used for motivational benefit. Activities that can be graphed include grip strength, amount or time of weight carry, time of scrubbing activity, numbers of repeated toe raises, and/or distance walked.
Evidence for the Use of Exercise

I.1.d Stretching Exercises for CRPS

Recommended - for treatment of CRPS.

Indications: Severe, chronic CRPS. May be indicated especially if the patient avoids all use of the extremity. Otherwise, better options are progressive strengthening and mirror and image therapy. Consider aquatic therapy if largely or completely non-weight bearing status (see below).

Frequency/Dose/Duration: Start with three to four visits a week; advance exercises and demonstrate evidence of functional improvement. Quickly

advance to inclusion of strengthening exercises, aerobic exercises, mirror or image therapy or other functional exercise. Simultaneous home exercise prescription. Transition to home-based exercise program.

I.1.e Mirror Therapy and Guided Imagery for CRPS

Recommended - for motivated patients with moderate and severe CRPS who are willing to comply with the treatment.

Indications: Moderate and severe cases of CRPS. May be particularly helpful for those having difficulty complying with progressive strengthening exercises.

Frequency/Dose/Duration: Home exercises requiring an estimated ten minutes of each waking hour for six weeks. Best results obtained from viewing unaffected limb and performing activities as fast and accurately as possible with affected hand. Clinic appointments are needed and are estimated at least three times a week for six weeks in addition to home exercises. In the event of ongoing improvements and need for additional appointments, additional treatments to continue the therapy would be indicated in two to three week increments provided there was continuing objective evidence of ongoing improvement after each additional increment.

Evidence for the Use of Motor Imagery Programs

I.1.f Aquatic Therapy for CRPS

Recommended - for patients with CRPS to develop increasing tolerance to graded activities.

Indications: Moderate to severe CRPS patients. Includes those with underlying morbidity making weight bearing problematic (e.g., severe lower extremity degenerative joint disease) or those who previously exercised by swimming etc. Particularly includes those with lower extremity CRPS that is severe with weight bearing difficulty. May also include those with severe upper extremity CRPS.

Frequency/Dose/Duration: Appointments initially three times a week, but five times a week if severe CRPS. Home exercises should be simultaneously prescribed.

I.1.g Desensitization Techniques for CRPS

Recommended – for the treatment of CRPS.

Indications: Moderate to severe CRPS patients with significant hyperalgesia. Should be primarily engaged in a core program of graded strengthening exercises or for whom there is a plan to implement such exercises shortly after or in conjunction with desensitization techniques. (Desensitization techniques are unlikely to be successful for functional restoration and are not recommended as a sole exercise or therapy intervention.)

Frequency/Dose/Duration: Appointments initially three times a week, but five times a week if severe CRPS. Home exercises should be simultaneously prescribed.

Evidence fo Desensitization Techniques for CRPS

I.1.h Yoga for CRPS

Recommended - for treatment of CRPS.

Indications: Moderate to severe CRPS patients. Particularly indicated for those who are motivated and interested in yoga.

Frequency/Dose/Duration: Appointments initially three times a week, but five times a week if severe CRPS. Daily home exercises should be simultaneously prescribed.

J. Medications for the Treatment of CRPS

J.1 Oral NSAIDs

Recommended – for the treatment of CRPS.

Indications: CRPS sufficiently severe to require medication. NSAIDs are recommended as an adjunct to strengthening, conditioning and aerobic exercises. Generally, generic ibuprofen, naproxen or other older generation NSAIDs are recommended as first-line medications. Acetaminophen is a reasonable alternative, or can be used as an adjunct, although evidence suggests it is modestly less efficacious. Over-the-counter (OTC) agents may suffice and shouldbe tried first. Second-line medications may include other generic medications. COX-2 selective agents are recommended as a third- or fourth-line medications when there are contraindications for other NSAIDs and/or there are risks of GI complications; however, concomitant treatment with misoprostol, sucralfate, and proton pump inhibitors are also options for gastro-protection. Please see warnings related to NSAIDs in the Non-Acute Pain Medical Treatment Guideline.

Frequency/Dose/Duration: For most patients, scheduled dosage, rather than as needed, is preferred to avoid adverse effects of other treatment options, but prescribing NSAIDs as needed is reasonable for mild or moderate symptoms. Due to the potential adverse effects from chronic use (more than two months) of NSAIDs, patients should be periodically monitored for adverse effects such as hypertension, blood loss, renal insufficiency (as manifested by an increased creatinine), and hepatic enzyme elevations. Older patients and those with co-morbidities may require more frequent monitoring. Use of an adjunctive cytoprotective agent may also be warranted.

J.2 Acetaminophen for CRPS

Recommended – for treatment of CRPS, particularly if NSAIDs are contraindicated.

Indications: CRPS sufficiently severe to require medication. Acetaminophen is recommended as an adjunct to strengthening, conditioning and aerobic exercises. Generally, generic ibuprofen, naproxen or other older generation NSAIDs are recommended as first-line medications. Acetaminophen is a reasonable alternative, or can be used as an adjunct, although evidence suggests it is modestly less efficacious.

Frequency/Dose/Duration: Generally prescribed up to 3.5g/day in divided doses, usually four times a day dosing.

Evidence for the Use of NSAIDs and Acetaminophen

J.3 Intravenous NSAIDs for CRPS

Recommended - as intravenous adjuncts for regional blockades that also include lidocaine and clonidine for treatment of CRPS.

Indications: Severe CRPS that has responded insufficiently to progressive strengthening exercises, aerobic exercises and oral medications, generally including bisphosphonates.

Frequency/Dose/Duration: Three injections at weekly intervals.

J.4 Norepinephrine Reuptake Inhibitor Anti-depressants for CRPS

Recommended - tricyclic anti-depressants (includes norepinephrine reuptake inhibitor anti-depressants) for treatment of CRPS.

Indications: Chronic pain not fully treated with progressive strengthening, aerobic exercises and generally NSAIDs. May be particularly helpful if there is nocturnal sleep disruption and mild dysthymia, which may allow for nocturnal dosing of a mildly sedating tricyclic anti-depressant.

Frequency/Dose/Duration: Prescribe at a low dose at night and gradually increase (e.g., amitriptyline 25mg QHS, increase by 25mg each week) until a sub-maximal or maximal dose is achieved, sufficient effects are achieved, or adverse effects occur. Generally, lower doses (e.g., amitriptyline 25 to 75mg a day) to avoid adverse effects and necessity of blood level monitoring, particularly as there is no evidence of increased pain relief at higher doses. For CRPS, duration may be indefinite, although most patients do not require indefinite treatment as the condition usually improves or resolves spontaneously. Imipramine is less sedating, thus if there is carryover daytime sedation, it may be a better option. If the patient cannot sleep, amitriptyline is recommended as the initial medication to prescribe.

J.5 Duloxetine for CRPS

Recommended - a trial of duloxetine for treatment of CRPS after attempting other treatments (e.g., strengthening exercises, aerobic exercise, bisphosphonates) and if TCAs are not tolerated, and if treatment efficacy can be documented.

Indications: CRPS that is sufficient to require medication. Generally should also have failed multiple other modalities including progressive strengthening exercise, aerobic exercise, NSAIDs, tricyclic anti-depressants, and anti-convulsant agents.

Frequency/Dose/Duration: 60mg daily. There appears to be either a minimal or no advantage of the twice daily dosing over the 60mg daily dosing. Duration for patients with CRPS pain may be as long as indefinitely, although some patients do not require indefinite treatment, particularly if they are compliant with a functional restoration program.

J.6 Selective Serotonin Reuptake Inhibitors (SSRIs), Bupropion, or Trazodone for CRPS

Not Recommended - for treatment of CRPS without depression. (They may be recommended to treat depression, please see Medical Treatment Guideline for Work-Related Depression and Depressive Disorders.)

J.7 Antipsychotics for CRPS or CRPS-Related Neuropathic Pain

Not Recommended - for treatment of CRPS or CRPS-related neuropathic pain.

J.8 Anti-Convulsant Agents for CRPS

Recommended - for treatment of severe CRPS is selectively recommended after attempted management with NSAIDs, other medications, and a progressive exercise program, and if treatment efficacy can be documented.

Indications: Generally not indicated, but may be a consideration for severe chronic CRPS as a fourth- or fifth-line agent, and initiated by practitioners familiar with their use and able to monitor patients closely for adverse effects.

Treatments that should be attempted first include progressive strengthening and aerobic exercises that should be continued. Other prior treatment considerations include other exercises, NSAIDs, bisphosphonates and anti-depressants (TCA and SNRI).

Frequency/Dose/Duration: Frequency and dosing per manufacturer. Duration for CRPS patients may be indefinitely, although most of these patients do not require indefinite treatment as the condition usually improves or resolves spontaneously.

J.9 Gabapentin / Pregabalin (Short Term) for CRPS

Recommended - for treatment of moderate to severe CRPS if other therapies have proven insufficient to control symptoms.

Indications: CRPS in whom other methods to control symptoms have been proven to be unsuccessful, including strengthening exercises, aerobic exercises, other exercises, NSAIDs, physical therapy/occupational therapy, bisphosphonates, clonidine, and tricyclic anti-depressants. Should be used as an adjunct to a functional restoration

program to facilitate the program advancement for the four weeks that the medication shows some evidence of efficacy. There is no recommendation for ongoing treatment beyond one course.

Frequency/Dose/Duration: One suggested regimen is: gabapentin 600mg daily for two days, then 600mg twice daily for two days, then 600mg three times a day for days five to 21. Dose escalation should be cautiously done to avoid adverse effects which may outweigh benefits. Duration of use for CRPS patients is usually limited as most of these patients do not require indefinite treatment. The condition usually improves or resolves spontaneously. However, the efficacy of gabapentin has been labeled as "mild" for CRPS and quality evidence suggests that benefits are short-term.

Evidence for the Use of Gabapentin or Pregabalin for CRPS

J.10 Bisphosphonates for CRPS

Recommended - for patients with CRPS after physical therapy interventions have been trialed.

Indications: Moderate or severe CRPS, including in acute to subacute as well as chronic phases. Should be included as part of functional restoration plan where strengthening, aerobic and other functional exercises are central foci of prescriptions.

Frequency/Dose/Duration: Taken in oral or parenteral formulations. Recommended treatment regimens have included: Alendronate 40mg daily for eight weeks; Clodronate 300mg IV daily for ten days; Alendronate 7.5mg IV daily for three days; Pamidronate 60mg IV for one dose; Neridronate 100-mg IV every ten days for 40 days.

Duration for oral treatment of CRPS patients may be indefinite, although most do not require indefinite treatment as the condition usually gradually improves or in some cases resolves spontaneously.

Evidence for the Use of Bisphosphonates

J.11 Calcitonin for CRPS

Recommended - as a treatment option for CRPS patients.

Indications: Severe CRPS with inadequate symptom relief with strengthening, aerobic exercise, NSAIDs, corticosteroids, tricyclic anti-depressants, active physical and/or occupational therapy, and bisphosphonates.

Frequency/Dose/Duration: Dosing in the quality trials were intranasal calcitonin: 100IU three times a day for three weeks, 400IU daily for four weeks, and 200 IU daily plus calcium 500mg a day. Duration of use for CRPS patients may be indefinite, although most do not require this as the condition usually improves or resolves spontaneously.

Evidence for the Use of Calcitonin

J.12 Clonidine for CRPS

Recommended - administered by oral or regional blockade for treatment of moderately severe CRPS that is not responsive to rehabilitative therapy, NSAIDs, tricyclic anti-depressants, or glucocorticosteroids.

Indications: Severe CRPS that is not responsive to strengthening exercises, aerobic exercise, other exercise, NSAIDs, bisphosphonates, tricyclic anti-depressants, and glucocorticosteroids.

Frequency/Dose/Duration: Three injections at weekly intervals. The single quality study used: 30µg clonidine plus 1mg/kg lidocaine plus 0.9% saline solution plus 5mg parecoxib. As parecoxib is not available in the US, other NSAIDs could be considered.

Evidence for the Use of Clonidine

J.12.a Intravenous Regional Anesthesia with Clonidine for Preventive Administration Prior to Surgery

Recommended - for administration prior to surgery to prevent recurrence of CRPS in patients who have previously had CRPS. It may also be considered in patients undergoing surgery who are considered at increased risk for CRPS.

Indications: Patients undergoing surgery who have a prior history of CRPS. May be considered for those at high risk for CRPS.

Evidence for Intravenous Regional Anesthesia with Clonidine

J.13 Oral Glucocorticosteroids for CRPS

Recommended - for short-term treatment of CRPS.

Indications: Moderate to severe CRPS with symptoms insufficiently controlled with progressive strengthening, aerobic and other active exercises, and NSAIDs. Bisphosphonates are another reasonable option at this stage. Few patients with mild CRPS may be candidates, especially if there is a lack of progress or worsening of symptoms.

Frequency/Dose/Duration: One regimen used was Prednisolone 40mg orally daily for 14 days and then 10 mg/week taper. A second regimen was prednisone 10mg orally three times a day for up to 12 weeks. There is no comparative evidence to suggest which regimen is superior. If there is significant improvement in objective findings and an additional treatment is felt to be indicated, it appears reasonable to continue treatment for an additional two months. Subsequent treatment should be individualized based on ongoing improvements, and inadequacy of progressive exercises, and after risk/benefit considerations have been made regarding continued glucocorticosteroid therapy.

Evidence for the Use of Oral Glucocorticosteroids

J.14 Intrathecal Glucocorticosteroids for CRPS

Not Recommended - for treatment of CRPS.

Evidence fo the Use of Intrathecal Glucocorticosteroids

J.15 Ketamine Infusion for CRPS

Not Recommended - for treatment of CRPS.

J.16 Ketanserin for CRPS

Not Recommended - for treatment of CRPS.

J.17 Magnesium Sulfate for CRPS

Not Recommended - for treatment of CRPS.

Evidence for the Use of Magnesium Sulfate

J.18 NMDA Receptor/Antagonists for CRPS

Not Recommended - including dextromethorphan, are not recommended for treatment of CRPS.

J.19 Muscle Relaxants for CRPS

Not Recommended - for treatment of CRPS.

J.20 Thalidomide and Lenalidomide for CRPS

Not Recommended - for the treatment of CRPS or any other chronic pain syndrome.

Evidence for The Use of Lenalidomide

J.21 Capsicum Creams for CRPS

Not Recommended - for treatment of CRPS.

J.22 DMSO for CRPS

Recommended - for treatment of CRPS.

Indications: CRPS that is sufficient to require medication. Generally should also have failed multiple other modalities including progressive strengthening exercise, aerobic exercise, NSAIDs, tricyclic anti-depressants, bisphosphonates, and anti-convulsant agents.

Frequency/Dose/Duration: DMSO applied 50% five times a day to affected extremity. Duration in the highest quality study was 17 weeks. Some patients do not require lengthy treatment, particularly if they are compliant with a functional restoration program which should be the key focus of the treatment program.

Evidence for the Use of DMSO

J.23 N-Acetylcysteine (NAC) for CRPS

Recommended - for treatment of CRPS as an adjunct to an active therapy and exercise program.

Indications: CRPS that is sufficient to require medication. Generally should also have failed multiple other modalities including progressive strengthening exercise, aerobic exercise, NSAIDs, tricyclic anti-depressants, bisphosphonates, and anti-convulsant agents.

Frequency/Dose/Duration: N-Acetylcysteine 600mg orally three times a day. Duration in the quality trial was 17 weeks. Some patients do not require lengthy treatment, particularly if they are compliant with a functional restoration program which should be the key focus of the treatment program.

Evidence for the Use of Dimethyl Sulfoxide, N-Acetylcysteine, and EMLA Cream

J.24 EMLA Cream for CRPS

Not Recommended - for treatment of CRPS.

J.25 Tumor Necrosis Factor-alpha Blockers for CRPS

Not Recommended - for treatment of CRPS.

J.26 Intravenous Immunoglobulin (IVIG) for CRPS

Recommended - selectively for treatment of CRPS.

Indications: Severe CRPS had pain intensity greater than four on an 11 point (0 to 10) numerical rating scale; having had CRPS for six to 30 months; refractory to treatment with all of: strengthening exercises, aerobic exercises, acetaminophen, NSAIDS, tricyclic antidepressants, and either gabapentin or pregabalin.

Frequency/Dose/Duration: IVIG, 0.25 g/kg for one day and the same dose repeated on the following day. Frequency of a second course is unclear, as the sole quality trial lasted one month and the data suggest at least some of the benefits were still present at 30 day.

Evidence for the Use of Intravenous Immunoglobulin (IVIG)

J.27 Vitamin C for Prevention of CRPS in Patients with Distal Radius, Wrist, Hand, Ankle and Foot Fractures

Recommended - for the prevention/treatment of CRPS in select patients with fractures of the distal radius, wrist, hand, ankle and foot.

Evidence for the Use of Vitamins

J.28 Mannitol for Treatment of CRPS

Not Recommended - for treatment of CRPS.

Evidence for the Use of Mannitol

K. Other Interventions

K.1 Hyperbaric Oxygen for CRPS

Not Recommended - for treatment of CRPS.

Evidence for the Use of Hyperbaric Oxygen

K.2 Magnets and Magnetic Stimulation for CRPS

Not Recommended - for treatment of CRPS.

Evidence for the Use of Magnets and Magnetic Stimulation

K.3 Occlusal Splint for CRPS

Not Recommended – for the treatment of CRPS.

Evidence for the Use of Occlusal Splints

K.4 Taping and Kinesiotaping for CRPS

Not Recommended - for the treatment of CRPS.

K.5 Acupuncture for CRPS

Not Recommended – for the treatment of CRPS.

Evidence for the Use of Acupuncture

K.6 Diathermy for CRPS

Not Recommended – for the treatment of CRPS.

K.7 Open Sympathectomy and External Radiation for Sympathetic Blockade for CRPS

Not Recommended – for the treatment of CRPS.

K.8 Open Sympathectomy, including by external radiation for sympathetic blockade

Not Recommended – for the treatment of CRPS.

Evidence for the Use of External Irradiation for Sympathectomy

K.9 Infrared Therapy for CRPS

Not Recommended – for the treatment of CRPS.

K.10 Low-level Laser Therapy for CRPS

Not Recommended – for the treatment of CRPS.

K.11 Manipulation for CRPS

Not Recommended – for the treatment of CRPS.

K.12 Massage for CRPS

Not Recommended – for the treatment of CRPS.

K.13 Myofascial Release for CRPS

Not Recommended – for the treatment of CRPS.

K.14 Reflexology for CRPS

Not Recommended – for the treatment of CRPS.

K.15 Hot and Cold Therapies

K.15.a Cryotherapies for CRPS

Not Recommended – for the treatment of CRPS.

K.15.b Self-application of Heat Therapy for CRPS

Recommended – for the treatment of CRPS.

Indications: CRPS sufficient to require treatments beyond exercises and potentially medication. Applications should be home-based as there is no evidence for efficacy of provider-based heat treatments. Primary emphasis should generally be on compliance with progressive strengthening and aerobic exercises as part of a functional restoration program elements, rather than on passive treatments in patients with chronic pain which could be detrimental.

Frequency/Dose/Duration: Self-applications may be periodic, generally up to a few times a day. Education regarding home heat application should be part of the treatment plan if heat has been effective for reducing pain.

K.16 Electrical Therapies

K.16.a High-Voltage Galvanic Therapy for CRPS

Not Recommended – for the treatment of CRPS.

K.16.b H-Wave® Device Stimulation for CRPS

Not Recommended – for the treatment of CRPS.

K.16.c Interferential Therapy for CRPS

Not Recommended – for the treatment of CRPS.

K.16.d Iontophoresis for CRPS

Not Recommended – for the treatment of CRPS.

K.16.e Microcurrent Electrical Stimulation for CRPS

Not Recommended – for the treatment of CRPS.

K.16.f PENS for CRPS

Not Recommended – for the treatment of CRPS.

K.16.g Sympathetic Electrotherapy for CRPS

Not Recommended – for the treatment of CRPS.

K.16.h TENS for CRPS

Not Recommended – for the treatment of CRPS.

K.17 Injection Therapies

K.17.a Botulinum Injections for CRPS

Not Recommended – for the treatment of CRPS.

K.17.b Intrathecal Baclofen for CRPS

Recommended - selectively for treatment of dystonia associated with CRPS.

Indications: Highly limited indication of severe dystonia accompanying severe CRPS.

Evidence for the Use of Intrathecal Baclofen

K.17.c Intrapleural Bupivacaine Infusions for CRPS

Not Recommended – for the treatment of CRPS.

K.17.d Lidocaine Infusion for CRPS

Not Recommended – for the treatment of CRPS.

K.17.e Stellate and Other Ganglion Blocks for CRPS

Recommended - corresponding to the body region afflicted by CRPS are recommended for treatment of acute or an acute flare-up of CRPS as an adjunct to a functional restoration approach.

Indications: Acute CRPS or an acute flare up of CRPS that has not responded or is inadequately controlled with progressive strengthening, graded exercise, physical therapy/occupational therapy and medications. Should be performed when it is integrated into a comprehensive treatment program emphasizing functional restoration.

Frequency/Dose/Duration: For a second block, should demonstrate measured temperature changes post-injection of at least 1°C. Benefits are nearly always identified within one to three blocks. Subsequent additional blocks if clear objective evidence of ongoing, incremental functional improvement. If applicable, should also generally show reduction of opioids by three to five blocks.

Evidence for the Use of Regional Sympathetic Blocks

K.17.f Guanethidine Bier Blocks for CRPS

Not Recommended - for the treatment of CRPS.

K.17.g Phentolamine Bier Blocks for CRPS

Not Recommended – for the treatment of CRPS.

K.17.h Bretylium Bier Blocks for CRPS

Recommended - for treatment of severe cases of CRPS.

Indications: Severe CRPS that has not responded or is inadequately controlled with progressive exercise, bisphosphonates, glucocorticosteroids, NSAIDs, active exercise, physical therapy/occupational therapy, and potentially mirror therapy. It may be reasonable to attempt control with clonidine, anti-convulsants, tricyclic anti-depressants, or hyperbaric oxygen prior to consideration of bretylium. Should be performed as an adjunct to improve physical capabilities through a functional restoration program.

Frequency/Dose/Duration: Lidocaine 40ml with bretylium 1.5mg/kg. For a second block, should demonstrate measured temperature changes post-injection of at least 1°C. Benefits are nearly always identified within one to three blocks. Subsequent additional blocks if clear objective evidence of ongoing, incremental functional improvement. If applicable, should also generally show reduction of opioids by three to five blocks. Additional blockades should be based on objective evidence of progressive improvement.

K.17.i Methylprednisolone Bier Blocks for CRPS

Not Recommended – for the treatment of CRPS.

K.17.j Reserpine Bier Blocks for CRPS

Not Recommended – for the treatment of CRPS.

K.17.k Brachial Plexus Blocks and Infusions for CRPS

Not Recommended – for the treatment of CRPS.

Evidence for the Use of Guanethidine, Bretylium, Methylprednisolone, Phentolamine, or Reserpine Bier Blocks

K.17.l Intrathecal Drug Delivery Systems for Chronic Persistent Pain

Recommended – as a treatment of last resort for the treatment of CRPS in select patients who have proven refractory to multiple other (generally more conservative and less invasive) modalities.

Targeted drug delivery (Pain Pumps) is not included on the list of pre- authorized procedures.

- Providers who want to perform this procedure must request pre- authorization from the carrier before performing the procedure.

- To be pre-authorized, the patient must be evaluated and have the recommendation of at least one physician certified in chronic pain management in consultation with the primary treating physician.

- The procedure must be performed by a physician with documented experience in the performance of this procedure.

Indications: Targeted drug delivery using intrathecal pump can be considered as a treatment of last resort in CRPS patients with severe, chronic, intractable pain recalcitrant to all conservative treatment options. The small eligible sub-group of patients must meet all of the following indications:

- A diagnosis of CRPS has been made on the basis of objective findings; andAll reasonable surgical and non-surgical treatment has been exhausted including failure of conservative therapy including active and/or passive therapy, medication management, or therapeutic injections; and
- There are no practical issues that might interfere with device placement, maintenance, or assessment (e.g., morbid obesity, body size insufficient to support the size and weight of the implanted device, severe cognitive impairment); and

- Pre-trial psychiatric or psychological evaluation has been performed (as for SCS) and should demonstrate the following:
    - No primary psychiatric risk factors or red flags;
    - Motivation and adherence to prescribed treatments;
    - There is no evidence of current addictive behavior (tolerance and dependence to opioid analgesics are not addictive behaviors and do not preclude implantation).

- Recommend that before a pain pump trial is considered, the patient be offered treatment at a functional restoration program if available.

All the evaluation criteria must be successfully met before a screening trial is scheduled.

K.17.m Pain Pump Screen Trial

A successful trial of continuous infusion by a percutaneous spinal infusion pump for a minimum of 24 hours or a bolus trial as an outpatient is required to ascertain effectiveness and make sure there are no side effects.

A screening test is considered successful if the patient:

- Experiences a 50% decrease in pain, which may be confirmed by VAS, and
- Demonstrates objective functional gains or decrased utilization of pain medications, and
- Objective functional gains should be evaluated and documented prior to and before discontinuationof the trail.

K.17.n Pain Pump Implantation

If the screening trial is successful, the treating physician must request pre-authorization from the carrier to implant a permanent pain pump.

L. Surgical Considerations

L.1 Spinal Cord Stimulators for Short- to Intermediate-term Relief of CRPS

Recommended - as an option for highly select CRPS patients who understand that this intervention has no quality evidence of greater than 3 year benefit during which time there is unequivocal patient commitment.

Indications: See Table 4.

Frequency/Dose/Duration: N/A

Evidence for the Use of Spinal Cord Stimulators

Table 4 Selection Criteria for Implantable Spinal Cord Stimulation in a CRPS Patient*

1.	Clear diagnosis of CRPS based on criteria that include objective measures, such as the Consensus Criteria.
2.	Poor response to conservative treatment generally for at least 6 months,** including treatment in an experienced interdisciplinary clinic with proven good outcomes that included elements of a functional restorative program and for which the patient demonstrated good motivation.
3.	Remedial surgery inadvisable or not feasible.
4.	Major psychiatric disorders have been treated with expected responses. Somatization disorder not amenable to treatment will disqualify the patient for use of invasive procedures, as the risk of the procedure is higher than the expected success rate. The candidate should have a successful independent, psychological evaluation and a structured interview performed by a psychologist specialized in chronic pain management including appropriate psychometric testing. (The psychological evaluation should be performed by a practitioner who is not employed by the requesting or treating physicians).***
5.	Willingness to stop inappropriate drug use before implantation.
6.	No indication that secondary gain is directly influencing pain or disability complaints.
7.	Ability to give informed consent for the procedure.
8.	Successful results of at least 50% pain reduction from a trial of a temporary external stimulator of approximately 2-3 days and reduction of use of opioid medication or other medication with significant

adverse effects or functional improvement such as return to work that may be evaluated by an occupational or physical therapist prior to and before discontinuation of the trial.

*Adapted from Kumar K, Hunter G, Demeria D. Spinal cord stimulation in treatment of chronic benign pain: challenges in treatment planning and present status, a 22-year experience. *Neurosurgery*. 2006;58(3):481-96(; Lee AW, Pilitsis JG. Spinal cord stimulation: indications and outcomes. *Neurosurg Focus*. 2006;21(6):E3[38]; Segal R, Stacey BR, Rudy TE, et al. Spinal cord stimulation revisited. *Neurol Res*. 1998;20(5):391-6.(873)
**Some authors advocate earlier intervention,(37, 859); however, quality evidence is lacking.
***Presence of depression is common in patients with chronic pain, requires evaluation and may require treatment. Depression that is particularly severe may require treatment prior to assessing appropriateness of SCS, however, the presence of depression does not preclude SCS.

L.2 Amputation for CRPS

Not Recommended – for the treatment of CRPS.

M. Rehabilitation

There are manydifferent types of rehabilitation programs. To help organize and present a hierarchical construct, rehabilitation is classified in this guideline as primary, secondary, or tertiary.

Primary rehabilitation includes the most widely encountered therapy and consists of a relatively minimal quantity(ies) of medical care coupled with physical therapy, occupational therapy or healthcare provider directed exercises (i.e., a home exercise program). While there is much diversity, typical strategies commonly include teaching specific stretches, graded exercises, addressing fear avoidant beliefs (“kinesiophobia”), and advancing activity levels, generally in the acute to subacute phases, until recovery is complete.

Secondary rehabilitation usually occurs after either failure of primary rehabilitation and/or a determination that the healing course will not result in bridging a gap between current abilities and job physical demands. Secondary rehabilitation includes more advanced and contact time-intensive rehabilitative treatments and are most commonly termed Work Conditioning and Work Hardening. Work Conditioning usually emphasizes exercises and includes tasks to simulate work activities. Work Hardening typically includes progressive exercise but adds some limited psychological counseling and education.

Tertiary rehabilitation involves interdisciplinary rehabilitation. There are many different terms and emphases of tertiary rehabilitation programs; however, they can generally be classified into pain programs and functional restoration programs. These programs generally employ multiple disciplines using biopsychosocial approaches to address pain, function, work, and psychological distress. There are some quality trials of tertiary rehabilitation programs and guidance is included in this section.

Initiation of these programs may be considered in the subacute stage if disability is not adequately explained by physical findings and primary rehabilitation treatments have failed to significantly improve the functional status. Chronicity by itself is a major predictor of poor outcome. The longer it takes to resolve the disability (delayed recovery), the more likely patients are to never return to normal or near-normal function or to work.

Functional restoration is both a type of interdisciplinary pain management and rehabilitation program, as well as a general approach to medical care. Fundamental elements of a functional restoration approach include assessment of the patient’s dynamic physical and functional status including traditional tests for strength, sensation, and range of motion. Psychosocial strengths and stressors must also be assessed (including a history of childhood abuse, anger,

fear of reinjury, and a history of substance misuse), and the patient's support system, evidence of mood disorders, assessment of education and skills, medication use, presence of litigation, and work incapacity analyzed. Following this evaluation, the emphasis is on expectation management, directed conditioning and exercise, CBT, functional goal setting and decrease in medication use. An ongoing assessment of patient participation and compliance (with documentation of complicating problems and progress toward specific goals, including reduction in disability and medical utilization) is needed.

In functional restoration, the treatment team functions more as educators and coaches, not "treaters". Passive therapies and invasive interventions are de-emphasized in favor of home exercise/self-management techniques. There should be a shift of health, function, and well-being responsibility (locus of control) from physicians and therapists to the individual. A functional restoration approach may include the limited/adjunctive use of medications and interventional measures (where specifically indicated); however, these should not be viewed as ongoing solutions, and used to support the patient's active participation in rehabilitation. Rehabilitation should include instruction in preventive measures, education for relapse prevention, proper activity and work pacing, ergonomic accommodation, and when appropriate, recommend transitional return to employment.

The goal is a mitigation of a patient's suffering and his or her return to a productive life despite having a chronic pain problem. If an individual has risk factors for delayed recovery or fails to recover within the appropriate biological healing time frame, the acute care paradigms of specific diagnosis and treatment change to biopsychosocial approaches that address pain, function, work, and psychological factors impeding progress. Treatment programs focus on restoration of work-related function. These programs include work conditioning and work hardening, interdisciplinary pain rehabilitation programs and functional rehabilitation. Because functional restoration is an approach, not just a specific program, the approaches taken both overlap and are on a continuum.

There is no unified agreement on definitions for work conditioning and work hardening, and sometimes the terms are used interchangeably.

Work conditioning has been defined by the American Physical Therapy Association (APTA) as "an intensive, work-related, goal-oriented conditioning program designed specifically to restore systemic neuromusculoskeletal functions (e.g., joint integrity and mobility, muscle performance (including strength, power, and endurance), motor function (motor control and motor learning), range of motion (including muscle length), and cardiovascular/pulmonary functions (e.g., aerobic capacity/endurance, circulation, and ventilation and respiration/gas exchange).

Work hardening has been defined by APTA as a "highly structured, goal-oriented, individualized intervention program designed to return the patient/client to work. Work Hardening programs, which are multidisciplinary in nature, use real or simulated work activities designed to restore physical, behavioral, and vocational functions. Work Hardening addresses the issues of productivity, safety, physical tolerances, and worker behaviors." Thus, work conditioning is classified as a single-discipline program and work hardening program as interdisciplinary.

The Commission on Accreditation of Rehabilitation Facilities (CARF) defines occupational rehabilitation as work conditioning, and comprehensive occupational rehabilitation as work hardening. Although not universally accepted, some physicians consider work conditioning as

a generalized endurance and strengthening program that includes work simulation activities, whereas work hardening is a program where a specific job has been identified and stresses involvement in sets of occupationally-related tasks and functional activities that are directly related to a patient's work. Work conditioning programs in the U.S. are most often provided by a single-therapy discipline, either physical or occupational therapy.

Early identification and appropriate management of patients exhibiting signs of delayed recovery is believed to decrease the likelihood that symptoms will become chronic. Patients who are identified at risk for delayed recovery may benefit from a limited but intense program of physical restoration and education, including management of barriers to recovery and return to work. These patients may require an abbreviated early intervention interdisciplinary rehabilitation program (IPRP based on functional restoration principles, rather than a longer program utilized for more complex cases. Early intervention programs are an alternative to work conditioning and work hardening programs for subacute or early patients with chronic pain who have evidence for delayed recovery with an increased need for education and psychological assessment and intervention. These programs are usually begun when a significant gap is identified between functional abilities and job demands, ideally in the early subacute time (e.g., 30-60 days). An IPRP may also be justified earlier if risk factors for delayed recovery are identified. The interdisciplinary functional restoration program used for early intervention contains the features of a functional restoration program, but involves lower intensity and duration of services than a program used for patients with greater chronicity or intensity of disability. The type, intensity, and duration of services should be dictated by the patient's unique rehabilitation needs. These services may be used for patients who fail work conditioning and work hardening programs, usually within six months of onset of disability post-injury. The time frame of three to six months post-injury (or earlier if risk factors for delayed recovery are identified) is vital for intervening with the most effective treatment possible in order to avoid the negative sequelae that come with increasing duration of disability. During this time frame, normal musculoskeletal healing will generally have occurred, eliminating any remaining physical barriers to intensive rehabilitation. Such programs are appropriate for prevention, before the patient is entrenched in a chronic pain syndrome or before severe pain and illness behavior evolves.

M.1 Work Conditioning, Work Hardening, Early Intervention Programs for CRPS

Recommended - for treatment of CRPSpatients.

Indications: Patients who: 1) remain completely off work or are on modified duty for 6 to 12 weeks, most commonly due to manual materials handling tasks; 2) have not responded to less costly interventions including a four to six week physical therapy program or a graded therapy program of at least six to eight weeks that includes aerobic and strengthening exercise components; 3) have a stated strong interest and expectation to return to work; 4) involve cooperation of the employer; 5) are supervised by a qualified physical or occupational therapist; 6) have had a careful assessment of their occupational demands; 7) have had either inability to return to work or a FCE that indicated appropriate performance effort and consistency at a level of work lower than that to which they need or wish to return; and 8) are in a program that includes a cognitive-behavioral approach with a focus on function rather than pain, a conditioning or aerobic exercise component and simulated graded work tasks, and is tailored to

their needs and identifies gaps between current capabilities and job demands. Incorporation of FABT is often helpful.

Frequency/Dose/Duration: Work conditioning and early intervention programs three to five times a week; work hardening daily. Weekly evaluations demonstrating compliance and functionally significant progress towards the return-to-work goal must be documented to justify continuation. Program length and intensity should be dictated by each patient's unique rehabilitation needs.

Evidence for Work Conditioning, Work Hardening, and Early Intervention Programs

M.2 Tertiary Pain Programs: Interdisciplinary Pain Rehabilitation Programs, Multidisciplinary Rehabilitation Programs, Chronic Pain Management Programs, and Functional Restoration Programs

Recommended - selectively for patients with CRPS who have failed conventional treatments and remain significantly incapacitated.

Indications: The decision to admit the patient to a tertiary pain program should be based on all of the following criteria:

1. Patients are either completely off work or on modified duty for at least three months and trending towards unusually slow and delayed functional recovery
2. There is a known etiology to the chronic pain syndrome or specific clinical condition which includes physical injury or disease.
3. Other appropriate medical and/or invasive care has been attempted and proved to be inadequate to restore functional status.
4. The patient has appropriate rehabilitation potential (i.e., he or she is judged to be able to substantially benefit from the program).
5. The patient is not responding to other interventions including quality physical therapy programs;
6. The patient has at least some behavioral or psychosocial issues affecting their recovery. **For workers without behaviorally related issues and merely a physical gap between the current capabilities and future job requirements, work conditioning/work hardening programs are usually both more appropriate and cost effective.**
7. The patient has substantial gaps between current physical capabilities and actual or projected occupational demands
8. There are no known contraindications to the treatment program, e.g., certain unstable medical conditions, primary substance abuse disorder or cognitive limitation which would prevent appropriate learning.
9. The patient is committed to recovery.

Frequency/Dose/Duration: Progressive physical activity, which incorporates exercise intended to move the patient toward a home fitness maintenance program and a gradual increase in personal and occupational functional tasks. Tertiary pain program treatment is generally five full days a week. Treatment program length is determined by the severity of deficits, speed of progress, cessation of healing (or reaching a

"plateau"), and thus are somewhat individualized. Typical lengths are four to five weeks. Complicating problems such as coordinating with part-time work, transportation, child care, extreme physical deficits, high-dose opioids, or limitations imposed by comorbid medical conditions are considerations that may necessitate a slower approach to program participation and longer treatment duration.

Treatment Objectives. Appropriate treatment objectives must include the following which have to be regularly assessed and documented:

1. *Functional improvement.* This should emphasize those physical parameters which have been assessed as "pain limited." While general or aerobic conditioning is appropriate for most patients, there should be evidence of progress in the specific areas where dysfunction or deficits have been present.
2. *Improvement in activities of daily living.* These are unique to each patient and goals should also be relevant to "pain limited" activities.
3. *Relevant psychosocial improvements.* Objective improvement in patient's psychosocial functioning should be evident.
4. *Withdrawal from opioid, sedative-hypnotic, and muscle relaxant medications.* This is a requirement, absent specific indications. A history of adequate functional improvement associated with opioid medications would not by itself result in referral to a tertiary pain program unless excessively high doses of medications are being used with associated physical and psychological dysfunction.
5. *Medical management.* All other medications should be continually reviewed and adjusted as necessary.
6. *Return to work or other productive activity.* Appropriate assessment, counseling, planning, and skill development should begin early in the program with efforts directed at identifying if it is reasonable for the patient to return to work.

Inpatient Care. Nearly all patients can be treated on an ambulatory basis. In the rare circumstances where hospitalization is required, this should be under the control of or closely coordinated with a tertiary pain program physician. Indications for inpatient care include any of the following:

1. detoxification on an outpatient basis may present unacceptable medical risk;
2. medical instability;
3. the evaluation suggests that treatment may exacerbate pain/illness behavior to the extent that there is a risk of injury or render florid manifestation of a major psychiatric disorder;
4. 24-hour nursing care is required;
5. extreme pain behavior and dysfunction that makes outpatient care not feasible and there is reasonable evidence presented by the evaluating pain team that a brief inpatient stay will enable transfer to an outpatient tertiary pain program.

Other Functional Restoration. At times, patients may require functional restoration, but find that either a formal program does not exist or it is not appropriate due to medical or social issues. In such cases, functional restoration can sometimes be accomplished, provided the patient requires treatment for specific clinical indications with the services which are to be provided. At a minimum, there should be appropriate indications for behavioral/psychological treatment, physical or occupational therapy, and at least one other rehabilitation oriented discipline. Care must be coordinated by a

physician appropriately qualified and experienced to provide and supervise rehabilitation services or functional restoration. Criteria for the provision of such services should include:

1. Satisfaction of the criteria for coordinated functional restoration care as appropriate to the case;
2. A level of disability or dysfunction which does not *require* treatment in a formal program;
3. No drug dependence or problematic or significant opioid usage; and
4. A clinical problem for which return to work can be anticipated upon completion of the services.

Follow-up. Regular or intensive formal treatment is not usually necessary after successful discharge from a tertiary pain program. However, it is important that patients continue a self-directed home program of physical restorative and psychological pain management approaches learned during the tertiary pain program. Routine follow-up should be provided to assess the durability of the functional restoration achieved, with a long-term-care plan established to facilitate management by the treating physician.

Evidence for Interdisciplinary Work Rehabilitation Programs

Evidence for Interdisciplinary Pain Rehabilitation Programs

Evidence for Multidisciplinary Rehabilitation Programs

Evidence for Chronic Pain Management Programs

Evidence for Other Functional Restoration Programs

N. Behavorial Interventions

Pain is a psychological phenomenon that is influenced by a myriad of biomedical and psychosocial factors. An approach to pain assessment that has shown considerable promise has been the assessment of cognitions related to pain, particularly the assessment of pain catastrophizing and fear avoidance (i.e. kinesiophobia). This approach naturally leads to behavioral interventions.

The traditional approach to assessing and treating pain uses an ordinal pain scale (0 to 10). Unfortunately, a patient's pain report may be confounded by a variety of variables including: 1) the perception of pain, and especially chronic pain has a low correlation with pathophysiology, 2) the perception of pain is influenced by psychological variables such as mood, arousal, attention and cognition, and 3) the patient may be incentivized to alter reports of pain. Thus, there is increasing use of function-centered questionnaires to determine the degree to which pain impacts function, although these too are usually subjective.

When patients are assessed psychologically, pain problems are generally evaluated with various psychological instruments that provide qualitative and quantitative inferences about the patient's perceptions and related behaviors. Addressing pain-related dysfunction, psychological comorbidities (e.g., anxiety, fear, depression, anger, hopelessness, stress) and engaging in problem solving to address social roadblocks to recovery is usually more helpful

than focusing on analgesia. One treatment approach with considerable evidence of success is cognitive behavioral therapy (CBT). CBT recognizes the pain, but works to change the patient's negative thoughts about the pain and its impacts, including the development of constructive skills, coping and behaviors related to the pain.

The way in which the provider manages the patient with delayed recovery may affect the degree to which chronic pain behaviors develop. As pain is a biopsychosocial phenomenon, a formal psychological evaluation (which may include appropriate diagnostic psychological testing) may be helpful (see below). In addition to identifying psychological risk factors, the identification of any social risk factors is also important. Social risk factors may include work-related issues such as job satisfaction or co-worker support, family reinforcement of pain behaviors or lack of support, and legal/financial incentives for poor recovery. Additionally, cultural beliefs regarding origins of disease and health care patterns may also influence presentation and recovery. These should be addressed in a positive, cooperative and sensitive manner to facilitate recovery and minimize the chance of physical debilitation and chronic or long-term disability.

Treating CRPS requires specialized knowledge, substantial time, and access to multiple disciplines if not multidisciplinary care. Judicious involvement of other health care professionals (e.g., psychologists, occupational and physical therapists, etc.) who can offer diagnostic assessments and additional therapies where indicated, while the provider continues to direct the therapeutic process to maximize functional restoration. Close communication between all treating professionals is essential.

Psychological evaluation and treatment should be strongly considered for patients with CRPS. Since such patients often present difficulties in diagnosis, rehabilitation, appropriateness for invasive procedures, and return to work planning, consultation can be helpful in these areas. Additionally, through behavioral medicine even those with relatively low levels of formal psychopathology may learn better ways of self-managing symptoms and therefore optimize their pain outcomes. As well, those with subacute pain who are not improving as expected are also candidates for psychological evaluation to improve function and to develop a plan to avoid chronic pain behaviors.

Psychological or behavioral treatments are commonly provided to patients with CRPS. Patients who should be more strongly considered for these services include those with one or more of the following: delayed recovery, ineffective pain coping skills, psychological disorder(s), insomnia, stress-related psychophysiological responses such as muscular bracing, problematic medication use, excessive fear avoidant beliefs, and/or non-adherence with prior physical activity or other prescriptions. Where indicated, this has been typically provided with cognitive-behavior therapy (CBT). This is a type of psychotherapy which emphasizes the relationship of cognitions, behaviors, and mood to physical symptoms in an attempt to promote specific therapeutic goals. CBT techniques generally employ "homework" assignments in addition to direct psychotherapeutic treatment, and because of that CBT protocols have varying requirements for literacy. The provision of therapy does not generally require an ICD-10 diagnosis, though this is often obtained in patients with CRPS, and many such patients *may* meet criteria for various diagnoses. Other diagnoses frequently include insomnia, post traumatic stress disorder, somatoform disorders, depression and/or anxiety disorders. Note that CBT treatments for chronic pain, depression, insomnia etc. are distinct therapies with unique protocols.

N.1 Psychological Evaluation for CRPS Patients

Recommended - as part of the evaluation and management of patients with chronic pain in order to identify psychosocial barriers that are contributing to disability and inhibiting function and to assess whether psychological factors will need to be considered and treated as part of the overall treatment plan.

Indications: Moderate to severe CRPS in which:

1. Cases in which significant psychosocial dysfunction is observed or suspected.
2. The provider has need to understand psychosocial factors contributing to the patient's pain reports and disability behaviors
3. *Inadequate recovery:* This includes continued dysfunctional status despite a duration which exceeds the typical course of recovery; failure to benefit from indicated therapies or to return to work when medically indicated; or a persistent pain problem which is inadequately explained by the patient's physical findings.
4. *Medication issues and/or drug problems:* This includes any suspicion of drug overuse or misuse, aberrant drug behavior, substance abuse, addiction, or use of illicit substance, or for consideration of chronic use of opioids.
5. Current or premorbid history of major psychiatric symptoms or disorder.
6. *Problems with compliance/adherence with prescribed medical treatment or rehabilitation program:* For evaluation of candidly for or potential benefit from a proposed functional restoration program, e.g., comprehensive occupational rehabilitation or interdisciplinary pain rehabilitation (see Functional Restoration).
7. *Evidence of possible cognitive impairment which is associated with related significant ADL dysfunction:* This may be secondary to injury and/or possible adverse effects of medical therapies initiated for the chronic pain.
8. Catastrophic injuries with significant pain related or other dysfunction, e.g., spinal cord injury.
9. Cases for which certain procedures are contemplated, e.g., back surgery or spinal cord stimulation.

   Frequency/Dose/Duration: One comprehensive psychological evaluation should be performed by an independently licensed psychologist. Ongoing treatment as indicated by the results of the initial evaluation. Content should include:

   a. *Appropriate review of records:* The referring provider should assist in providing medical record documentation. Other information is sometimes reviewed, as necessary, e.g., from a family assessment, job description, etc.
   b. *Clinical interview with patient:* The following parameters should be described from this interaction and other data obtained: History (including mental health, physical health, work, educational, legal, and substance use history), description of the pain, disability and/or other clinical problem, analysis of medication usage, social history, mental status, and behavioral assessment (including, as necessary, ADL, functional issues, and operant parameters, e.g., pain/illness behavior and environmental influences).
   c. *Psychological testing:* A battery of appropriate diagnostic psychological tests should be administered and interpreted, as necessary. This should include instruments with evidence of validity and/or appropriate normative

data for the condition or problems being assessed and have known value in differential diagnosis or treatment planning.(886) In selecting test instruments, the clinician should consider: 1) the appropriateness of the test(s) for the patient's presenting complaints and condition; 2) the appropriateness of a test(s) given the degree to which the patient's medical, gender, race/ethnicity, age, educational and other group status was represented during the test(s) development; 3) how a patient's performance in comparison to normative data will be useful in diagnosis or treatment planning; 4) the prognostic value of interpreted test data for certain treatments; and/or 5) whether the sensitivity and specificity will enhance the accuracy of a diagnosis. Indications for psychological tests may include circumstances when:

i. understanding factors contributing to the patient's pain reports and disability behaviors;
ii. a mental disorder is suspected;
iii. evaluating for a functional restoration program;
iv. the evaluation is part of a pre-surgical assessment;
v. there is suspicion of cognitive impairment;
vi. the veracity of the complaint is at issue.
vii. Standardized psychological testing should be done as a part of a comprehensive mental health evaluation, as properly performed psychological testing enhances the reliability and value of a psychological evaluation. Psychological testing is usually performed by a psychologist, but psychiatrists or other physicians also perform such assessments if it is within the scope of their training and experience. Standards for the psychological assessment of patients with chronic pain have been reviewed elsewhere. Additionally, both evidence and expert consensus regarding what variables should be assessed in these evaluations has also been reviewed. The test battery for evaluation of patients with chronic nonmalignant pain includes, but is not limited to:
    a) test(s) for assessment of the presenting pain, and/or other related health complaints or dysfunction;
    b) test(s) of personality and psychopathology;
    c) brief cognitive testing, when there is suspicion of CNS impairment;
    d) *diagnostic impressions:* These should be inferred according to the ICD-10;
    e) *summary:* The psychological evaluation should provide both cogent explanations for the identified complaints and dysfunction, and recommendations for management.

N.2 Cognitive Behavioral Therapy for Patients with CRPS

Recommended - for treatment of subacute and chronic CRPS.

Indications: Indications for the use of CBT in CRPS conditions include:

1. Inadequate results from traditional physical therapy and exercise program;

2. clinically significant problems of noncompliance or non-adherence to prescribed medical or physical regimens;
3. Mood disorders that complicate the management of the pain condition
4. vocational counseling for resolution of psychosocial barriers in return to work (requires a current or imminent medical release to return to work);
5. resolution of interpersonal, behavioral, or occupational self-management problems in the workplace, during/after return to work, where such problems are risk factors for loss of work or are impeding resumption of full duty or work consistent with permanent restrictions; and
6. Management of clinically significant behavioral aberrations and/or anxiety during opiate weaning or detoxification.
7. Sleep disturbance due to pain (Currie 00)

Frequency/Dose/Duration: CBT psychotherapy provided either independently or as a component therapy integrated into a program that includes physical therapy, such as an interdisciplinary or other functional restoration program. Established protocols for CBT require from 16 hours to up to 24 hours to accomplish. For select patients (e.g., ongoing medical procedures, serious complications, medication dependence, injuries associated with psychological trauma), longer supervised psychological/psychiatric treatment may be indicated. Adjunctive treatment generally includes medication for another condition (e.g., depression) as indicated. CBT should normally be limited to six sessions or less initially. Additional appointments are generally needed, especially for those with multiple complex problems to address. Provision of additional appointments should be contingent on compliance with the requirements from the initial set of appointments. When therapy is provided as a component of an interdisciplinary or functional restoration program, the number of sessions is based on the needs of the program to provide relevant treatment objectives.

Evidence for the Use of Cognitive Therapy

N.3 Fear Avoidance Belief Training

Recommended - for treatment of patients with acute, subacute and chronic CRPS.

Indications: All stages and phases of CRPS FABT is particularly indicated at the time a patient is voicing a belief. It is also indicated at any point when there is a FAB that is uncovered in routine discussions. Preemptive training is also indicated in the event the worker does not voice the FAB. FABT is generally combined with, and/or addressed in the course of other treatment.

Frequency/Dose/Duration: Intervention is provided at the time a FAB is voiced or uncovered. Should particularly address a de-emphasis on anatomical abnormalities, encouraging active management by the patient and education. When a FAB is identified, subsequent vigilance on the part of the provider may help to reinforce proper beliefs and then would usually consist of two to three appointments and could range up to a total of approximately six appointments. Patients with particularly strong FABs may require up to 12 appointments.

Fear Avoidance Belief Training (FABT)

N.4 Biofeedback

Recommended – for select treatment CRPS.

Indications: CRPS patients who have been treated and compliant with aerobic and strengthening exercises, NSAIDs, etc., with ongoing significant impairment needing multidisciplinary rehabilitation. Biofeedback also is a reasonable as an intervention for patients who also have significant stress-related issues combined with chronic pain. Biofeedback requires motivated and compliant patients and is often performed in conjuction with other self-regulation strategies (e.g., relaxation training, mindfulness meditation, self-hypnosis).

Frequency/Dose/Duration: Requires a series of appointments to teach techniques and verify appropriate use, generally starting with five to six appointments. Appointments also needed to reinforce home use. Should generally be used to subsequently enhance functional gains, (e.g., increasing activity or exercise levels). May require up to 12 appointments.

Evidence for the Use of Biofeedback

Appendix 1: Basic Definitions of Terms Often Used in the Context of CRPS

Acute Pain: Pain of one month or less duration. Pain lasting >1 month but <3 months is termed “subacute.”

Central Pain: Pain that is due to a lesion or other abnormality that is located in the central nervous system. Examples of disorders in this category include tumors, strokes, and traumatic brain injury (TBI) sequelae.

Central Sensitization and Central Sensitivity Syndromes: Central sensitization is considered a condition of the central nervous system that produces and maintains a chronic pain state. While the exact mechanism(s) is(are) not known, the entity is believed to involve an up-regulation from a normal state of perceptions of pain. Patients may have increased sensitivity to pain, thus experiencing as painful something that normal individuals would not generally consider painful (e.g., touch, pressure), also known as allodynia. They also usually experience more pain than usual to a mildly painful stimulus (hyperalgesia). The prototypical diseases for central sensitization have been generally considered to be post-stroke and spinal cord injury. Other diseases commonly associated with central sensitivity include fibromyalgia, traumatic brain injury, and multiple sclerosis.

Chronic or Non-Acute Pain: Pain categorized purely based on duration is defined as chronic when lasting at least 3 months. This may be divided into chronic malignant pain and chronic non-malignant pain, although evidence of meaningful differences between those 2 categories is negligible. Yet, chronic pain is much more complex.

As a patient’s condition transitions through the acute, subacute and chronic phases, the central nervous system is reorganized. As pain continues over time, the CNS remodels itself so that pain becomes less closely associated with sensation, and more closely associated with arousal, emotion, memory and beliefs [7,12]. Because of these CNS processes, the physician should be aware that as the patient enters the subacute phase, it becomes increasingly important to consider the psychosocial context of the disorder being treated, including the patient’s social circumstances, arousal level, emotional state, and beliefs about the disorder. However, behavioral complications and physiological changes associated with chronicity and central sensitization may also be present in the acute phase, and within hours of the initial injury.[13]

Chronic Non-malignant Pain (CNMP): Pain lasting over 3 months that is not due to neoplasms, cancers, or tumors. It is also referred to as chronic non-cancer pain (CNCP). It is a subcategory of all chronic pain which may be further subdivided into the subcategories of chronic persistent pain and chronic pain syndrome. The former predominantly refers to pain duration with the latter indicating that additional features such as limited functional status, vocational status, and/or significant psychological features are present. See also the “The New York Non-Acute Pain Medical Treatment Guidelines” of the New York State Workers’ Compensation Board.

Chronic Pain Syndrome: Pain over 3 months duration with additional features such as limited functional status, vocational status, and/or significant psychological features are present.

Delayed Recovery: An increase in the period of time prior to returning to work or usual activities compared with the length of time expected based on reasonable expectations, severity of disorder, age, and treatments provided.

Factitious Illness: A mental disorder wherein the patient either falsifies or self-induces symptoms of illness. It is thought to involve both conscious and non-conscious factors. The primary drive is thought to be assuming the role of being a patient or being sick. By definition it is not occupational.

Functional Improvement (especially Objective Evidence): Evaluation of the patient prior to the initiation of treatment should include documentation regarding objective physical findings and current functional abilities both at home and at work. This should include a clear statement regarding what objective or functional goals are to be achieved through the use of treatment. These measures should be tracked during treatment and evidence of progress towards meeting these functional goals should be sought. Examples of documentation supporting improved function would be increased physical capabilities including job specific activities, return to work, return from off-duty-status to modified duty, performance of exercise goals, participation in progressive physical therapy, and other activities of daily living. Validated tool(s), such as the Modified Oswestry Questionnaire and Roland-Morris Disability Questionnaire may also help track progress, although they are subjective. Objective improvements in strength or aerobic capacity may be physical examination correlates of improved function.

Hyperalgesia: Increased or markedly painful response to a stimulus which is normally painful (e.g., light pinprick leads to extreme and prolonged pain). This is in contrast to **allodynia**, pain due to a stimulus which does not normally provoke pain (e.g., light touch causes pain).

Malignant Pain: Pain associated with cancer, or treatment effects of cancer is commonly termed malignant pain. This pain should be distinguished from non-malignant pain or chronic non-malignant pain.

Neuralgia: Pain that is thought to be nerve related and is present in the distribution of a nerve or nerve root.

Neuritis: Neuritis technically describes an inflammation of a nerve(s). In practice it is often inaccurately used to label any pain thought to be nerve-related, regardless of whether or not there is an inflammatory process.

Neurogenic Pain: Pain initiated or caused by a primary lesion, dysfunction, or transitory perturbation in the peripheral or central nervous system.

Neuropathic Pain: Pain caused by abnormal function of the nervous system due to injury or disease. There is generally no relationship between end-organ damage and pain perception as is thought to be present in nociceptive pain. Although an affected individual perceives pain as emanating from some bodily structure (e.g., the distal lower extremity in sciatica), the pathophysiologic basis for the pain is believed to be an abnormality in the functioning of the central or peripheral nervous system, rather than an abnormality in the location where the pain is perceived. Neuropathic pain can be due to a lesion in the central nervous system, as is seen in post-stroke pain or thalamic pain, (central neuropathic pain) or due to lesions in the peripheral nervous system. Postherpetic neuralgia, painful neuropathies (e.g., diabetes

mellitus), and what was previously referred to as causalgia (CRPS II) are all examples of conditions characterized by peripheral neuropathic pain.

Neuropathy: A disturbance of function or pathological change in a nerve. This is called a mononeuropathy if involving one nerve. If diffuse and bilateral, it is called a peripheral or polyneuropathy.

Nociceptive Pain: Pain that arises through the normal activation of pain pathways. In the acute stage, it serves as a protective mechanism to alerting the individual to the presence of potentially damaging stimuli. Once the inciting stimulus is removed and healing has occurred, nociceptive pain typically resolves. While nociceptive pain can be somatic (carried along the sensory fibers) or visceral (transmitted through the autonomic nervous system), most injuries lead to somatic pain.

Nocebo Effect: The opposite of placebo effect, occurring when the patient believes that exposure to treatment, activity, or event may be harmful and leads to adverse effects or results in less benefit than expected.

Pain Behavior: Verbal and non-verbal actions (e.g., grimacing, groaning, limping, using pain relieving or support devices, requesting pain medications, etc.) which communicate the concept of pain to others.

Pain Documentation: Pain is most commonly assessed via patient report using numeric or visual analog scales. It cannot yet be measured objectively.

Peripheral Pain: Pain that is due to pathology in a location other than in the central nervous system. This includes some examples of neuropathic pain (e.g., pain from an entrapment neuropathy) and all types of nociceptive pain (e.g., pain from muscle-tendon unit abnormalities).

Placebo Effect: A placebo effect is a beneficial effect that is not attributable to the "intervention" itself. This effect may be based on patient and provider belief(s) and/or expectation(s).

Psychological tests. Psychological tests are part of the standard for assessing chronic pain, and are generally indicated by a positive psychological screening test or by other indications. They are usually multidimensional. These tests are typically standardized with test results compared to norms. These are interpreted by a psychologist and/or physician with appropriate training.

Screening tool. A screening tool is generally succinct, and may be as short as one or two questions. The frequency is usually at least in the initial exam and/or once a year.

Subacute Pain: Pain lasting 1 to 3 months.

Tender Points: Unusual tenderness on palpation at a tendon insertion or origin, muscle belly or over bone. Some examiners require palpation of a taut muscle band or knot to qualify as a tender point. The most widely used criteria are palpation of the area(s) involved with the thumb or forefinger, applying pressure (palpation) approximately equal to a force of 4 kilograms (blanching of the entire nail bed) with a requirement for the patient to acknowledge that the palpation is not merely a discomfort, but would be described as pain.

Trigger Points: Frequently used as a synonym for tender points, but is technically reserved for a subset of tender points in which there is elicitation of distal symptoms, usually accompanied with local symptoms, on palpation of the tender point. Trigger points are traditionally associated with myofascial pain.

Visual Analog Scale (VAS): Measures a patient's reported level of pain, ranging from "no pain" to "worst pain" by indicating a mark on a line, frequently 10 cm long. The distance from the low end of the line to the patient's "x" is the pain score.

Appendix 2: Areas of Inquiry for Initial CRPS History

Medical History Questionnaire

Asking the patient open-ended questions such as those below allows the provider to gauge the need for further discussion or specific inquiries to obtain more detailed information (see Appendix 3 for additional questions).

1. Functions on the Job:

- What is your job?
- What are your specific regular/modified duty job duties?
- How well do you function at work?
- Do you have assistance of other people or lifting devices?

Functions for Off-work Activities:

- What other activities (hobbies, workouts, sports) do you engage in? At home or elsewhere?
- How well do you function at home?
- Describe your current daily activities from awakening to bedtime. Do you go grocery shopping, prepare your own meals, and do yard work or laundry?
- Any heavy lifting? How? How often?

2. What are your symptoms?

- When did your symptoms begin? Gradual vs. acute onset? If acute, what was the specific event?
- Where are the symptoms located?
- What activities make you worse or better?
- Do you have pain or stiffness?
- Do you have numbness or tingling?
- Do you have pain or other symptoms elsewhere?
- Have you lost control of your bowel or bladder?
- Do you have fever, night sweats, or weight loss?
- Are your symptoms constant or intermittent? What makes the problem worse or better?
- What is the day pattern to your pain? Better first getting out of bed in the morning, during the morning, mid-day, evening or while asleep? When is it worst? Do you have a problem sleeping? What position is most comfortable? Is there any pain with coughing, sneezing, deep breathing, or laughing?
- Have your symptoms changed since the time they began? How?
- How does having this pain affect your life?

3. How did the condition develop?

Past:

- Have you had similar episodes?
- Have you had previous testing or treatment? What treatment? What were the results? With whom? How long did it take to get back to work? To light duty?
- Was recovery complete?

Cause:

- What do you think caused the problem?
- How do you think it is related to work?
- Were you doing anything at that time when your symptoms began?
- Did your symptoms begin gradually or suddenly?
- Did you have a slip, trip, fall, strike, twist, or jerk?
- For traumatic injuries: Was the area deformed? Did you lose any blood or have an open wound?

4. Discuss symptom limitations.

- How do these symptoms limit you?
- How long have your activities been limited?
- How long can you sit, stand, walk, and bend?
- Can you lift? How much weight (use items such as gallons of milk, groceries, etc. as examples)? How much can you push or pull?
- Are you working on your regular job? Modified duty?
- What activities do you perform in a typical day? Begin with waking in the morning and proceed to bedtime. What activities are you now unable to do? Why?
- Do you need to lie down or rest during the day?
- What activities at home do you need help with?

5. Assess treatments and how the responses may or may not have differed from expected outcomes.

- What treatments have you had?
- Did anything help decrease your symptoms? What and for how long?
- Exactly what treatment did you receive in physical therapy (detailed descriptions of all modalities and specific exercises used)? Did it help?

- Are you doing physical therapy exercises at home? How often do you perform them? When? Do you feel that they help? Please show me how you do them.

6. Are there other medical problems? For example:

- Osteoarthrosis, rheumatoid arthritis, or other arthritides
- Cardiovascular disease
- Pulmonary disease
- Gastrointestinal problems
- Diabetes mellitus
- Neurological disorders (including headaches)
- Psychophysiologic disorders (e.g., irritable bowel syndrome, chronic fatigue syndrome, sick building syndrome, muscle tension syndrome, and multiple chemical sensitivity)

7. Are there psychosocial “yellow flag” risk factors that are present? If so, how many?

a. Have you ever had anxiety?[i] Depression?[ii]
b. Have you ever had psychological, psychiatric or mental health evaluation, treatment or counseling? When? Concerning what issue(s)? For how long were you treated?
c. Do you have any memory or concentration problems?
d. Have you ever had a substance use problem? DUI? Blackouts? Detoxification?
e. Have you ever used or are you now using marijuana?
f. How much alcohol do you consume in an average day? Week?
g. How many cups of coffee do you have a day? How many cups of tea? How many sodas? Caffeinated or decaf? What size is the beverage? How much chocolate do you eat each day?
h. Tobacco use? Prior use? (packs a day for how many years)
i. Do you take any other drugs? (current and prior use)
j. How well do you sleep? How many hours of sleep do you get each night? Do you have any problems falling asleep? Do you have any problems staying asleep? Do you wake up early?

8. What is the occupational psychosocial context?

a. If you had to take a job again, would you go back to your current job?
b. Do you like your job?
c. What is your relationship with your co-workers and supervisor?
d. Do your coworkers help you if you need it?
e. How does your supervisor help you if you need help?
f. Is your employer concerned about you?
g. What kinds of successes and difficulties were you having on the job before you got hurt?
h. Are you facing any disciplinary or performance action?

9. Is the worker encountering perceived problems with the ergonomics of the job or workstation?

- What do you do for work/modified duty?
- What are your work hours and breaks?
- Do you rotate jobs?
- What is the hardest part of the job for you to do with your injury? Why?
- How much do you lift at work as a maximum? Usual lift?
- How often do you do those tasks?
- Describe work times, movement and breaks for sedentary jobs.

[i] Clinical presentations of anxiety vary widely. Common symptoms of anxiety include feeling nervous, tense, restless; trouble sleeping; early awakening and worrying about things; avoiding things that trigger nervous feelings; sensing impending danger, panic, or doom; fatigue; trouble concentrating; inexplicable gastrointestinal problems including nausea, constipation, diarrhea, abdominal pain, and irritable bowel syndrome. Physical manifestations may also occur and include palpitations, hyperventilation, sweating, trembling.

[ii] Clinical presentations of depression vary. Common symptoms of depression include feeling down, sad, blue, hopeless, tearful; loss of interest in normally pleasurable activities; social withdrawal; sleep disturbance; fatigue; lack of energy; irritability; frustration; difficulty thinking and concentrating; memory problems; appetite changes, with weight gain or loss. Particularly with more severe presentations, other symptoms commonly occur, including feeling worthless; focusing on past problems and failures; suicidal thoughts; slowed thinking, speaking and body movements. Some patients experience symptoms of anxiety as well as depression.

10. Assess whether there are problems at home/social life. Does the patient feel in control of most situations? Is there support?

- How do your family members get along with each other?
- How do they help and support you?
- Does your family treat you differently now that you are in pain? Have your roles at home changed because of your injury?
- Do your friends treat you differently?
- Do you get increased symptoms when you are dealing with problems with your family and friends? How often? When? Why? Does stress change your symptoms?

12. What are your expectations regarding your return to work and disability from this health problem?

13. What are your concerns about the potential for further injury as you recover?

14. What do you hope to accomplish during this visit?

As noted previously, many of these factors are operant during the acute and sub-acute phases of injury.

The **Stanford Five** (created by Dr. Sean Mackey of Stanford University) is an augmented set of medical history obtained by the clinician during the medical interview for patients with pain. The Stanford Five is designed to assess and present the pain experience as viewed from the patient's primary belief system. The following are the components of the Stanford Five:

- **Cause**: What tissue abnormalities the patient believes to be the cause of the current problem
- **Meaning**: The presence of any sinister beliefs related to the pain, in terms of tissue damages, that precludes activities
- **Impact**: What impact the primary problem has on the patient's life, including interference on vocational, social, recreational activities, and in general the patient's quality of life
- **Goals**: What the patient expects to achieve with further treatment
- **Treatment**: What the patient believes needs to be done now and in the future to help resolve the problem

Appendix 3: Components of Interval Pain History to be Considered by Provider

What do you hope to accomplish during this visit?

What are your concerns about the potential for further injury as you recover?

What are your expectations regarding your return to work and disability from this health problem?

What are your symptoms since we last talked?

- Where are the symptoms located?
- How bad is the pain, (e.g., on a 0 to 10 scale)?
- Do you have pain or stiffness?
- Do you have numbness or tingling?
- Do you have pain or other symptoms elsewhere?
- Have you lost control of your bowel or bladder?
- Do you have fever, night sweats, or weight loss?
- Are your symptoms constant or intermittent?
- What makes the problem worse or better?
- What is the day pattern to your pain?
- Better first getting out of bed in the morning, during the morning, mid-day, evening or while asleep?
- When is it worst?
- Do you have a problem sleeping?
- What position is most comfortable?
- Is there any pain with cough, sneezing, deep breathing, or laughing?
- Since these symptoms began, have your symptoms changed? How?
- How does having this pain affect your life?

Job

- Are you working at your regular job?
- How long do you spend performing each duty on a daily basis?
- What tasks are you doing on your modified or light job?
- Do you have assistance from other people or lifting devices?
- Are you on modified or light duty?
- What are your work hours and breaks?
- Do you rotate jobs?
- What is the hardest part of the job for you to do with your injury? Why?
- How much do you lift at work as a maximum? Usual lift?
- How often do you do those tasks?
- Describe work times, movement and breaks for sedentary jobs

Off-work Activities:

- What other activities (hobbies, workouts, sports) do you engage in, at home or elsewhere?

- Describe your current daily activities starting with waking up to bedtime.
- Do you go grocery shopping, prepare your own meals, do yard work and laundry?
- Family, sexual function
- How heavy?
- Lifting from what height?
- How large is(are) the objects?
- How often?
- Do you carry objects long distances?
- Do you sit for long periods of time?
- Any heavy or difficult lifting?

Interval Treatments and Activities

- What treatments and medications have you received (include complete medication review)?
- Did treatment help decrease your symptoms?
- What and for how long?
- Did it help?
- How?
- How often do you perform them? When?
- Do you feel that they help?
- Show me how you do them.
- Exactly what treatment did you receive or participate in physical therapy (detailed descriptions of all modalities and specific exercises used)?
- Are you doing physical therapy exercises at home?

Symptom Limitations

- How do these symptoms limit you?
- How long can you sit, stand, walk, and bend?
- Can you lift?
- How much weight (use items such as gallons of milk, groceries, etc. as examples)?
- How much can you push or pull?
- Do you need to lie down or rest during the day?
- What activities at home do you need help with?
- What activities do you perform in a typical day? Begin with waking in the morning and proceed to bedtime.
- What activities are you now unable to do? Why?

Is there any change in medical conditions, psychological, psychiatric, mental health, substance use, alcohol or tobacco disorder history?

What is the occupational psychosocial context?

- If you had to take a job again, would you go back to your current job?
- Do you like your job at this point?
- What is your relationship with your co-workers and supervisor and how do they treat you now?
- How do you get along with your supervisor now?

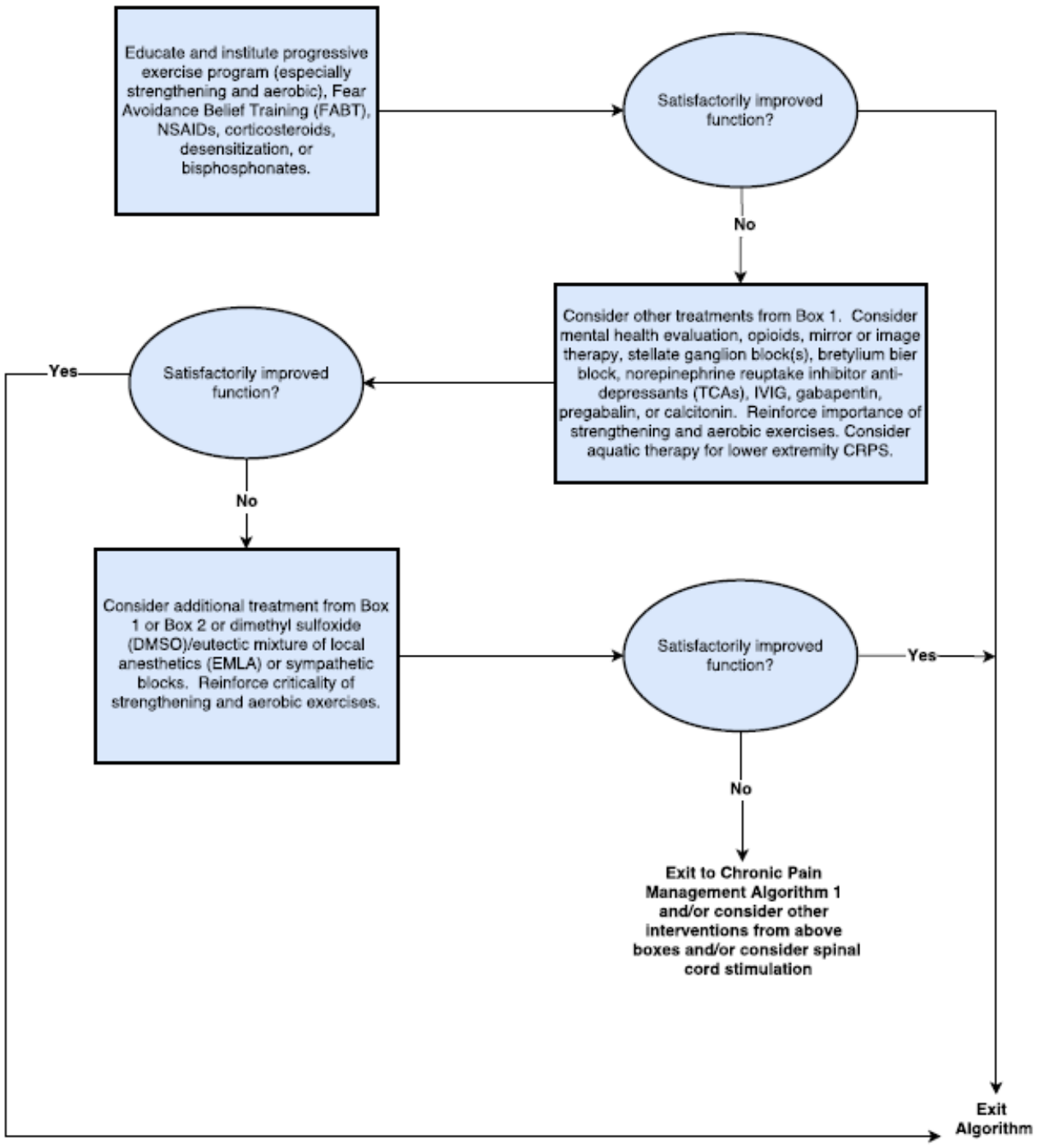
- How do you get along with your coworkers now?
- How do your coworkers help you if you need it at this point?
- How does your supervisor help you if you need help now?
- Is your employer concerned about you now?
- Are you facing any disciplinary or performance action now?

Assess whether there are problems at home/social life. Does the patient feel in control of most situations? Is there support?

- How do your family members get along with each other now?
- How do they help and support you now?
- Does your family treat you differently now?
- Have your roles at home changed because of your injury?
- How do your friends treat you differently?
- Do you get increased symptoms when you are dealing with problems with your family and friends? How often? When? Why?

Appendix 4: CRPS Management Algorithm

Algorithm. Management of Chronic Regional Pain Syndrome



Appendix 5: Evidence Tables

Evidence for Bone Scanning

Author Year (Score)	Category:	Study type:	Conflict of Interest	Sample size:	Age/Sex:	Diagnoses	Comparison	Results:	Conclusion:	Comments:
Kozin, 1981 (score=6.5)	Scintigraphy	Diagnostic	No mention of sponsorship or COI.	N=64 patients	Mean age: 48.3±15.2 years. 28 males, 36 females.	Reflex sympathetic dystrophy syndrome	Stellate ganglion blockade vs Systemic oral corticosteroid therapy	The grip strength was reduced 136.2±16.8 mmHg in the affected hand compared with contralateral hand. Tenderness scores were greater in affected hand (95.5±8.5 U. Osteopenia was found in 81% of patients with definite RSDS, 45% with probably RSDS, and 57% with possible RSDS. Of the patients where scintigraphs were taken, 44% were positive. Half of patients in groups I-IV showed asymmetrical radionuclide activity. Forty-nine percent of patients had both positive roentgenograms and scintigraphs, whereas 33% were negative. None of 20 patients receiving stellate ganglion blockade had a good response. Sixty-three percent of patients had a good to excellent response to systemic corticosteroid therapy.	"Scintigraphy was found to be a useful diagnostic study that may also provide a method of predicting therapeutic response. Systemic corticosteroid therapy proved to be a highly effective mode of treatment for up to 90% of the patients with RSDS."	Data suggest bone scans are superior (far more specific) to x-ray without loss of sensitivity (86% vs 71%). Also, positive bone scans are helpful in guiding therapy as 90% of patient with positive bone scans responded well to corticosteroid therapy which was determined to be highly effective for treating RSDS.
Schürmann, 2007 (score=6.5)	Scintigraphy	Diagnostic	Sponsored by Friedrich Baur Stiftung München. No mention of COI.	N=148 patients with distal radial fracture	Mean age: 59.9 years; 47 males, 111 females.	Complex Regional Pain Syndrome Type I	Three-phase bone scans vs bilateral thermography vs plain radiographs, and contrast	Combined diagnostic procedures showed an increased sensitivity of 55%, specificity of 87%. Combination of positive results in TPBS or MRI showed low sensitivity of 18% and specificity of 98%.	"Clinical findings remain the gold standard for the diagnosis of CRPS I and the procedures described above may serve as additional tools to establish the diagnosis in doubtful cases."	Data suggest use of imaging studies to screen for CRPS I are unreliable and clinical findings should be considered the gold standard for accurate diagnosis.

							enhance MRI			
Wüppenhorst, 2009 (score=6.5)	Scintigraphy	Diagnostic	Sponsored by BMBF grants (German Research Network on Neuropathic pain, DFNS). No mention of COI.	N=78 patients	Mean age: 49.94 years; 40 males, 38 females.	Complex Regional Pain Syndrome	3 phases of Bone Scintigraphy	Investigators show sensitivity of 31% and 51% due to high false-negative CRPS diagnoses. Bone scans showed high specificity between 83% and 100%. In all 3 phases of scintigraphy, mean ROI scores of CRPS patients were higher than that of control group. Phase 2-3 differed significantly. Sensitivity decreased to 50% for ascending ROI scores whereas specificity increase to 94-100%. Length of CRPS until TPBS was only variable with significant impact on ROI scores of phase 3 (F=23.7; p=0.000; R^2=.42). ROI scores decreased with increasing time of CRPS.	"In conclusion, TPBS is a highly specific tool for diagnosing CRPS of the upper limb. ROI evaluative of phase 3 within first 5 months after onset of CRPS is an appropriate additional diagnostic tool to confirm or exclude CRPS of the upper extremity.	Data suggest TPBS is highly specific for a diagnosis of CRPS in the upper extremity.
Schweitzer, M 1995 (score=5.5)	Scintigraphy	Diagnostic	No reported COI from all authors. No Mention of sponsorship	51 patients with Reflex Sympathetic Dystrophy (SDR)	22 males, 29 females; mean age 42.	Reflex Sympathetic Dystrophy syndrome.	T1- and t2-weighted sequence vs T1-weighted sequences with fat suppression before and after the intravenous administration of contrast material	RSD confirmed in 45 patients at clinical examination. 35 patients had confirmed RSD by 6 month follow-up. MR images were positive in 39 patients (sensitivity, 87%; specificity, 100%. Positive predictive value of MR imaging was 100%, negative predictive value 45%. At MR imaging, 35 had stage 1, 5 stage 2, 5, stage 3. MR imaging of stage 1 most accurately demonstrated (31 of 35) contrast enhancement (31 of 35 patients), infrequently sof-tissue edema (6 of 35 patients). Stage 2 RSD most difficult to accurately stage. (2 of 5) had skin thinning, (2 of 5) skin thickening; enhancement was unusual and was seen in only (1 of 5). No patients with soft tissue or muscle edema. Stage 3 RSD no enhancement seen, (4 of 5) showed muscle atrophy. Inconsistent skin changes were seen; skin thicking (1 of 5) skin thinning (3 of 5).	"MR imaging was beneficial in the demonstration of soft-tissue abnormalities in patients with RSD. MR imaging may also help stage RSD, particularly stages 1 and 3."	Data suggest MRI is useful for diagnosing RSD, specifically in those patients with soft tissue abnormalities.

								All MR imaging signs were highly reproducible.		
Todorović-Tirnanić, M 1995 (score 5.5)	Scintigraphy	Diagnostic	No mention of COI or sponsorship.	N =44. 44 patients with limb fracture, (37 with RSD and Seven without RSD)	Mean age of 44 patients: 51 years, Female = 22, Male = 22.	RSD.	bone scintigraphy and radiography in the early diagnosis of post-fracture reflex sympathetic dystrophy	Delayed scintigrams of RSD showed typical appearance of diffusely particularly peri-articularly increased radioactivity in bones of the distal portions of the limbs. Scintigrams of control were characterized by symmetrical distribution of 99mTc-DPD in the distal portion of the injured and contralateral extremities. Increase in 99mTc-DPD noted only at the site of fracture in its immediate vicinity. Scintigraphy was positive in (36 of 37) RSD. Presence of "patchy" atrophy in the bones of the distal part of the affect limb was noted in (27 out of 37) RSD patients. In 10 RSD patients the findings were negative. The significance of the difference between scintigraphic and radiographic, as well as between the interpreters of the results ($p < 0.01$). In second clinical stage of RSD ($p > 0.05$) Between the interpreters of scintigraphic and radiographic findings in both RSD and control ($p > 0.05$). X2 test ($x2=2.17$; $df = 1$; $p > 0.050$) in difference in the occurrence of fracture with fragment dislocation between the RSD patients and control group. ($X2 = 3.94$; $df = 1$; $0.01 < p < 0.05$) in RSD occurrence between patients with and without fragment dislocation after fracture. ($X2 = 0.17$; $df = 1$; $p > 0.05$) in occurrence of RSD after fracture according to the sex of the patient. X2 test showed ($0.01 < p < 0.05$) between the results of RNS, blood pool scintigraphy and delay scintigraphy. RNA was falsely negative in (4 of 20) patients with RSD, blood pool	"Bone scintigraphy has a very high sensitivity (97%), positive predictive value (97%) and accuracy (95%), as well as a high specificity and negative predictive value, in the diagnosis of RSD after fracture. In comparison with radiography, bone scintigraphy proved to be the more sensitive, more specific and more accurate method. It has a higher positive and a markedly higher negative predictive value. It also provides insight into the condition of the complete skeletal system of the patient. The superiority of scintigraphy is most evident in the first clinical stage of RSD after fracture."	Data suggests bone scan is the preferred early diagnostic method for post fracture RSD compared to radipgraphy.

								scintigraphy was falsely negative in (1 of 20) while delayed scintigrams did not produce any false negative results. RNA, blood pool and delayed scintigrams were negative in all control subjects.		
Kock, E 1991 (Score 5.0)	Scintigraphy	Diagnostic	No mention of COI or sponsorship	17 patients with reflex sympathetic dystrophy syndrome.	12 females, 5 males; No mention of mean age.	Reflex sympathetic dystrophy.	Ti- and T2-weighted MR Imaging of the affected body region.	10 patient's completely normal findings. Bone marrow was abnormal in 3. Low signal intensity was noted on T1 and T2 weighted images. Third case showed diffuse decrease in signal intensity f the talus on T1 weighted and an increase on t2 weighted images. 3 patients showed soft tissue changes. One had edema, 2 had muscular atrophy. 2 showed join effusions in effected region. 8 patients who did not have RSD. 16 false-negative, 6 true negative, one true positive, two faulse positive cases, the sensitivity, specificity and diagnostic accuracy are 6%, 75% and 28% respectively.	appears to be of little value in establishing the diagnosis of sympathetic dystrophy, but may improve diagnostic specificity when used in conjunction with Scintigraphy.	Data suggest MRI is not particularly useful for diagnosing RSD.
Werner, 1988 (score=4.0)	Scintigraphy	Diagnostic	No COI. Sponsored by Clinical Investigator Development Award [160] from the National Institute of Neurological and Communicative	N=63 patients with nonspecific upper extremity pain.	Mean age:38±15 years. No mention of sex.	Reflex sympathetic dystrophy syndrome	RSDS with abnormal bone scan vs RSDS with normal bone scan	Patients with RSDS were on average 6 years older than others. Sensitivity, specifity, positive and negative predictive values were 50% in uptake phase to 38% in blood pool phase, 92% for both phases, 60% to 67%, and 81% to 84% respectively. Prevalence rate increased to 27%, but sensitivity, specificity, and predictive value did not change significantly. RSDS was diagnosed in 16 patients and abnormal TPBS in 8 patients. RSDS with abnormal TPBS had average symptoms for 2.4 months and average age of 50 years. RSDS and normal TPBS had symptoms on average for 18.9 months and average age of 31 years. (p=.07, .01 respectively) After restriction of dataset	"The predictive value of the three-phase technetium bone scan was affected by the duration of symptoms and the age of the patient. Duration of symptoms less than 6 months, or ages more than 50 years substantially increased the sensitivity and positive predictive value of the three-phase technetium bone scan."	Data suggest the sensitivity and specifity of the three-phase technetium bone scan is dependent upon the duration of symptoms and patient age.

			Disorders and Stroke (NS 01120-20).					to patients with symptoms for less than 6 months sensitivity was 65%, specificity was 94%, positive predictive value of 88%, and negative predictive value of 79%. Patients include only above age 50 sensitivity increase to 100%, positive predictive value to 75%, and negative predictive value to 100%.		
Davidoff, 1989 (score=4.5)	Scintigraphy	Diagnostic	Sponsored by Clinical Investigator Development Award (NS 01120-20) to Dr. Davidoff from the National Institute of Neurological and Communicative Disorders and Stroke. No COI.	N=119 patients with nonspecific limb pain.	Mean age: 35.1 years. 54 males, 65 females.	Reflex Sympathetic Dystrophy Syndrome	RSDS in upper extremity vs RSDS in lower extremity.	RSDS patients had shorter duration of symptoms between onset and date of TPBS (11.1 months vs 77.9 months; p<.05) and was an average of 10 years older. Of the 119 patients, 7 had diffusely asymmetric and abnormal blood-flow scan, 6 had diffusely asymmetric and abnormal delayed images, and 12 with abnormalities in all three phases. Sensitivity of blood-flow was 40%, specificity was 90%, positive predictive value was 53%, negative predictive value was 85%. When limb involvement was stratified decreased sensitivity and positive predictive value was observed for lower extremity RSDS.	"The results of this study suggest that for patients presenting with upper-extremity involvement, the three-hour delayed image may be an acceptable alternative to the more costly TPBS as an adjunct to the diagnosis of RSDS. In the case of patients with lower-extremity involvement, it would appear that the TPBS is indicated because of the improved sensitivity and specificity in diagnosing RSDS."	Data suggest comparable efficacy between tests and the uptake scan may be used for upper-extremity RSDS vs TPBS.
Wang, 1998 (score=4.5)	Scintigraphy	Diagnostic	No mention of sponsorship or COI.	N=30 patients with associated limb discomfort within	Mean age: 63 years; 21 males, 9 females.	Reflex sympathetic dystrophy syndrome	RSDS in Right hemiplegia vs RSDS in Left hemiplegia	Positive delayed image of TPB demonstrated a sensitivity 92%, specificity of 56%, positive predictive value of 58%, and negative predictive value of 91%. Kappa statistic for positive bone scans and RSDS development was 70% (kappa=.43, p<.05). Male patients, patients with left	"In conclusion, TPBS is a useful screening tool for development of RSD in hemiplegic patients. However, the diagnosis of RSDS depends on the clinical evaluative and the TPBS as an adjunct	Data suggest both clinical symptoms as well as bone scans are useful for screening RSDS in hemiplegic patients.

				3 months onset of stroke.				hemiplegia or hemorragic stroke had higher incidence of RSDS.	assessment of RSDS must be interpreted with caution.	
Kline 1993 (5.5)	Scintigraphy	Diagnostic	No reported COI from all authors. No Mention of sponsorship	8 patients with Segmental Reflex Sympathetic Dystrophy And consecutive bone scans (n=127) performed during 6 month period for upper extremity problems	mean age of 59.3 years; (4 males, 4 females)	Clinical diagnosis of Segmental reflex Sympathetic dystrophy and Segmentally diffuse pattern of tracer uptake in bone scans was found to be highly specific (98%) for segmental reflex sympathetic dystrophy.	Clinical criteria vs scintigraphic criteria	The 8 patients in group 1 who met the strict criteria for segmental RSD were found to have a recognizable scan pattern. Of the 127 sequential TPBSs evaluated to obtain specificity and predictive value data, 5 patients had a scintigraphic pattern consistent with segmental RSD. Two of these patients also had clinical findings and were included in group 1. One patient demonstrated segmental scintigraphic abnormalities of his thumb and carpal region. He was felt to have de-Quervain's disease. The bone scan was obtained to rule out scaphoid For statistical purposes he was considered to have a false positive result for segmental RSD. The other two patients, also classified as false positive for segmental RSD, were clinically felt to have regional RSD. They had more intense segmental tracer uptake superimposed on the diffuse pattern of regional RSD. One of these patients had rheumatoid arthritis. She had severe middle finger pain and swelling superimposed on more diffuse changes compatible with regional RSD. The other patient demonstrated "radial-to-ulnar fade," a pattern of regional RSD with slight radial accentuation of tracer uptake. We incidentally had noted this pattern in other patients evaluated for regional RSD.	"The vast majority of individuals with painful hand and finger injuries do not demonstrate the clinical or scintigraphic abnormalities demonstrated by the small group of patients in this series. However, when recovery is abnormally prolonged and symptoms are out of proportion to the clinical injury, the contribution of sympathetic dysfunction should be considered. Management of patients with sympathetically mediated pain syndromes requires accurate diagnosis of the sympathetic component of their disorder in addition to an exhaustive search for	Small sample. Data suggest earlier recognition of RSD via both clinical and scintigraphic data is beneficial for managing pain.

									anatomic sources serving as a triggering mechanism"	
Genant, 1975 (score=4.0)	Scintigraphy	Diagnostic	No mention of sponsorship or COI.	N=9 patietns	Mean age: 57 years. 3 males, 6 females.	Reflex sympathetic dystrophy syndrome	Scintigraphy vs radiography, and Histopathology	Bone mineral analysis showed metacarpal thickness for 7 of 9 patients at 3.5mm compared to 4.59 for uninvolved hands and 5.17 mm for controls. Both quantitative techniques indicate clinical less involved extremity demineralization. Joint and bone scintigraphic findings showed an increased sensitivity. Histopathological exams showed edema, fibrosis, capillary proliferation in some of the findings.	"Aggressive patterns in bone resorption in reflex sympathetic dystrophy have been defined and characterized by fine-detail radiography. The arthropathy of this disorder has been documented by a composite of radiographic, scintigraphic, and histological manifestations."	Small sample size. Data suggest RSDS is a symptom complex of radiographic, scintigraphic, and histologic findings.
Handa R 2006 (4.0)	Scintigraphy	Diagnostic	No mention of COI or sponsorship	Fourteen patients with reflex sympathetic dystrophy syndrome.	Mean age of 49.1, (8 male, 6 female)	Clinical features included extremity pain (100%), vasomotor symptoms (79%), hyperalgesia (72%), allodynia (36%), sudomotor symptoms (14%) and motor dysfunction (14%). Radiologic features included osteopenia	Clinical criteria to diagnose CRPS vs. radiography (Bone scintigraphy)	As many as 43% of patients exhibited normal radiographs. Technetium 99 m 3-phase bone scintigraphy was abnormal in all patients in our series. Eleven of the 14 patients exhibited symptomatic response to nonsteroidal anti-inflammatory drugs and corticosteroids	"Reflex sympathetic dystrophy syndrome is a pain syndrome occasionally encountered by rheumatologists. Extremity pain is the most common presenting feature. Bone scintigraphy is very useful in corroborating the diagnosis even when radiographs are normal."	Small sample. Data suggests bone scintigraphy is useful for confirming a diagnosis of RSD in lien of negative radiography

						(50%) and soft tissue swelling (7%).				
Mackinnon S 1983 (score=5.5)	Scintigraphy	Diagnostic	No mention of COI or sponsorship.	N = 145 bone scans 102 of these were performed to evaluate pain in the hand, of these 23 patients clinically had reflex sympathetic dystrophy	Mean age of 23 patients: 43 years, Female = 12, Male = 11.	postsurgical or posttraumatic patients with pain who had definite RSD.	Three phase radionuclide bone scanning vs. clinically diagnosed RSD	Detailed analysis of the 145 three-phase radionuclide bone scans of the hand demonstrated that the diffuse increased tracer uptake in the delayed image (phase III) is diagnostic for RSD, with a sensitivity of 96% and a specificity of 98%. The two early phases (radionuclide angiogram and blood pool) were positive in only 45% and 52% of the RSD patients, respectively.	"Although a clear understanding of the pathogenesis of RSD and of the mechanisms of tracer uptake is still lacking, the TPBS remains useful as a diagnostic indicator for patients suspected of having RSD and thus may help facilitate both the early diagnosis and the treatment of this significant problem."	Data suggest use of delayed bone scans is sensitive to early diagnosis and then treatment of RSD.
Kwon 2010 (5.0)	Scintigraphy	Diagnostic	No COI. No mention of sponsorship	Total 140 patients with/without CRPS1	mean age of 39±15 years, Female = 60, Male =80.	CRPS-1 (n=79), non CRPS (n=61)	Three-phase bone scan (TBPS)	Both increased and decreased periarticular delayed uptake image patterns (DU) were significant image findings for CRPS-1 (CRPS-1 positive-rate=73% in the increased DU group, 75% in the decreased DU group). The TIevent-scan did not differ	"Optimally modified TPBS image criteria for CRPS-1 were suggested using image pattern and quantitative analysis. With the criteria, TPBS is an effective	Data suggest TPBS is an effective imaging study for CRPS 1

								significantly between the different image pattern groups. Quantitative analysis revealed an LCR of 1.43 was the optimal cutoff value for CRPS-1 and diagnostic performance was significantly improved in the increased DU group (area under the curve=0.732). Given the modified image criteria, the sensitivity and specificity of TPBS for diagnosing CRPS-1 were 80% and 72%, respectively.	imaging study for CRPS-1 even with the most recent consensus clinical diagnostic criteria"	
Holder L 1984 (5.0)	Scintigraphy	Diagnostic	No mention of COI or sponsorship	Twenty-two of 23 patients with clinical criteria for RSD	Mean age and gender not specified.	Twenty-three patients with reflux sympathetic dystrophy were characterized as having complaints of diffuse hand pain. diminished hand function, joint stiffness, and skin and soft tissue trophic changes with or without vasomotor instability.	Three phase bone scanning (TPBS)	145 consecutive patients, 23 of whom had clinical RSD, underwent three phase radionuclide bone scanning (TPBS). Specific patterns for positive radionuclide angiogram, blood pool, and delayed images	"We concluded that TPBS could provide an objective marker for RSD, and it could also be used to exclude RSD in patients who had less specific signs and symptoms."	Data suggest TPBS may provide an objective marker for RSD to better determine the diagnosis of RSD in those patient with less specific symptoms.
Park 2007 (4.5)	Scintigraphy	Diagnostic	Sponsored by a research fund and Dankook University in	N=38, 26 patients who were post	25 males, 13 females; mean age in CRPS patients: 57.5±11.6.	CRPS was diagnosed clinically using the criteria from International Association	Three Phase Bone Scintigraphy (TPBS) readings	Sensitivity of Vascular phase 42.3%, blood pool phase 50%, delayed phase 65.4%. Combination of positive findings revealed a 80.8% sensitivity, and 100% specificity.	"In summary these findings suggest that a combined quantitative evaluation of each TPBS phase can improve the diagnostic strength of the very	Population is stroke patients. Data suggest a combination of TPBS phases may improve he diagnostic strength of the acute stage of CRPS post stroke.

			2005. No mention of COI.	stroke with acute CRPS and 12 healthy controls.	Control patients: 46.8±18.8.	for the Study of Pain [10] in 1994.	including vascular, blood pool, and delayed phase between healthy controls (N=12) vs. CRPS patients (N=26).		acute stage of CRPS after stroke."	
Zyluk 1999 (4.5)	Scintigraphy	Diagnostic	No mention of sponsorship or COI.	N=100 patients with RSD and healthy controls.	28 males, 72 females; Mean age for RSD patients: 57 & Control patients: 58.	RSD diagnosis was made using 4/5 positive clinical indicators (diffuse pain, swelling, discoloration of the hand, abnormal skin temperature, limited range of motion (ROM).	Comparison on TPBs in phase 1 (P1) which included metacarpal/carpal bones. In phase 2 metacarpal area (P2-hand), wrist area (P2-Wrist), and Phase 3 metacarpophalangeal joints of all four fingers (P3-MPJ), metacarpal bones in all four	Uptake ratios control vs RSD patients phase 2 P2-hand RSD vs control patients, sensitivity & specificity: 40% & 60% vs 73% & 27% ($p<0.005$). P3-MPJ RSD vs control, sensitivity & specificity: 36% & 64% vs 80% & 20% ($p<0.0001$). P3-MB RSD vs control sensitivity & specificity: 20% & 80% vs 67% & 33% ($p<0.0001$). Uptake ratios varied significantly in duration of RSD as well as type of injury all phases ($p<0.005$).	"The results of our study, based on quantitative evaluation of TPBS, showed that this technique may be used only as an additional test in the diagnosis of RSD, with a sensitivity and specificity of 80%."	Data suggests that the diagnostic strength of TPBS to detect RSD is significantly associated with disease duration and type of RSD.

							fingers (P3-MB), carpal bones (P3-CB) in RSD patients (N=70) vs Healthy Controls (N=30)			
Intenzo 1988 (4.0)	Scintigraphy	Retrospective Diagnostic	No mention of sponsorship or COI.	N=32 patients with clinically confirmed RSDS.	8 males, 24 females; Age range 14-57.	Diagnosed with RSDS using clinical items (physical exam, history, signs and symptoms etc.)	Comparison between patients within stages I (N=8), II (N=21), and III (N=3) RSDS. Periarticular activity between symptomatic and asymptomatic contralateral extremities.	Periarticular increased activity, Stage 1, 2,and 3 ((N) (%)): Stage 1 patients: 2 had increased activity (25%), 6 normal (75%). Stage 2: 14 increased activity (66%), 4 decreased (20%), and 3 normal (14%). Stage 3: 3 had increased activity (100%). In summary, 72% Sensitivity.	"The authors conclude that bone scintigraphy is more likely to be positive in the later clinical stages of reflex sympathetic dystrophy of the lower extremity"	Data suggest bone scans are likely to yield positive findings for confirming RSDS in the lower extremities in later stages of the disease process.

Evidence for Surface EMG

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Taaffe 2005 (score = 8.0)	Surface EMG	Prospective Cohort Study	No mention of Sponsorship or COI.	N = 880 age 70-79 participants in MacArthur Study of Successful Aging	Mean Age: 74.3 ± 2.7 years Sex (M:F) 412:458	Plasma IL-6, CRP levels determined by enzyme-linked immunosorbent assay and log transformed to normalize distributions. Physical function measures: handgrip strength, signature time, chair stands, 6-m walk time.	7 years	Women had lower ($p < 0.05$) IL-6 levels. Hours per year undertaking moderate and strenuous physical activity also related to inflammatory markers with higher ($p < 0.001$) IL-6 and CRP levels in less active individuals.	"Although IL-6 has been shown to predict onset of disability in older persons and both IL-6 and CRP are associated with mortality risk, these markers of inflammation have limited associations with physical performance, except for walking measures and grip strength at baseline, and do not predict change in performance 7 years later in a high-functioning subset of older adults."	Baseline IL-6 and CRP not associated with change in performance.

Evidence for the Use of Thermography

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Niehof, 2006 (score=4.5)	CRPS	Diagnostic	The project is supported by a grant from the Dutch government (BSIK03016) and the Algesiological Research Foundation, Erasmus MC Rotterdam.No COI.	12 patients with CRPS I.	12 patients, (11 women and 1 man) with a mean age of 51.5 years	Complex Regional Pain Syndrome type 1	Thermography imaging during high and low whole body cooling and warming	The temperature difference between the hands in the CRPS patients increases significantly when the sympathetic system is provoked. At both the maximum and minimum vasoconstriction no significant differences were found in fingertip temperatures between both hands.	"The majority of CRPS1 patients do not show maximal obtainable temperature differences between the involved and contralateral extremity at room temperature (static measurement). During cold and warm temperature challenges this temperature difference increases significantly. As a result a higher sensitivity and specificity could be achieved in the diagnosis of CRPS1. These findings suggest that the sympathetic efferent system is involved in CRPS1."	Small sample. Data suggest baseline fingertip temperature measurements should not be used exclusively for diagnosing CRPS I.

Krumova 2008 (score=6.0)	CRPS	Diagnostic	Supported by Bundesministerium fur Bildung und Forschung (BMBF) Grants 01EM0107 and 01EM0502 (German Research Network on Neuropathic Pain, DFNS). No COI.	N = 22	Mean age is 53 years; 6 males, 16 females.	CRPS	Skin temperature, oscillation number, assessed time.	Specificity of 67% for patients with pain 79% for healthy controls/ Sensitivity of 73% and 94% respectively.	"The applied skin temperature analysis can be easily applied in the clinical settings and serves as a further facet in the difficult diagnosis of CRPS."	Data suggest skin temperature measurement can be a useful diagnostic tool in management as well as diagnosis of CRPS.
Niehof 2008 (score=6.5)	CRPS	Diagnostic	Supported by Dutch Government grant (BSIK03016). No mention of COI.	N = 24	Mean age is 56 years; 7 males, 17 females.	CRPS	Hand or foot temperature, finger and to temperature, wrist and ankle temperature.	Sensitivities: Hand/feet 48%, finger/toe 67%, wrist/ankle 63%. Specificities: hand/feet 64%, finger/toe 57%, wrist/ankle 78%.	"The validity of skin surface temperature recordings under resting conditions to discriminate between acute CRPS1 fracture patients and control fracture patients with/without complaints is limited, and only useful as a supplementary diagnostic tool."	Data suggest limited validity with use of skin surface temperature in discriminating acute CRPS I patients from controls and should be used in combination with other CRPS diagnostic tools.

Evidence for the Use of Exercise

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Length of Follow-up:	Results:	Conclusion:	Comments:
Lee 2002 (score = 7.5)		RCT	Supported by a grant from the National Institutes of Health/National Institute of Child Health and Human Development. No mention of COI.	N = 28 with CRPS recruited from a children's hospital in Boston	Mean age: Group A: 12.5 ± 2.2 Group B: 13.3 ± 2.8 Sex(M:F) 2:26	Low frequency(n = 15, once a week, 6 weeks) PT vs. high frequency (n = 13, 3 times week for 6 weeks). Both interventions received cognitive behavioral therapy.	Follow up at 6 weeks to 3months and 6-12months.	At end of study, pain scores were median 0, CRPS recurrences 38% low frequency vs. 64% high frequency and 67% (low frequency) vs. 70% (high frequency) participated in sports.	"Compliance with attendance of PT sessions was good in both groups, and there was no apparent difference between a group of individuals receiving 6 PT sessions and those receiving 18 sessions."	Pediatric population, may not apply to adults with CRPS. No between-group differences at baseline or follow-up. Improvements maintained.
Oerlemans 1999, 2000 (score = 7.0)		RCT	Supported by by a grant from National Health Insurance Board. No mention of COI.	N = 135 with upper extremity CRPS-I of 1 upper extremity (<1 year duration) in Netherlands	Mean Age: 52.7 Sex(M:F) 30:70	PT (n = 44) vs. OT (n = 44) vs. social work (SW) control (n = 47). Pre-established protocol of free-radical scavengers, peripheral vasodilators in case of primarily cold RSD, treatment of trigger points.	*6 weeks, 3months, 6months, 12months.*	PT/OT/SW/PT-OT/PT-SW/OT-SW mean(SE) impairment-level subscores and components (per protocol analysis) for ISS, temperature, VAS, MPQ-DLV, volume, and AROM.	"[A]djuvant PT, and to a lesser extent OT, makes a variable contribution to the relief and cure of signs and symptoms of RSD."	Data suggest minimal differences. Authors attribute to lack of active rehab program.

De Jong 2005 (score = 5.0)		RCT	No mention of sponsorship or COI.	N = 8 who had CRPS Type I and reported substantial pain-related fear	Mean age: 40±10.2 Sex(M:F) 0:8	Single-case experimental ABC-design: a) BAS no treatment; b) EDU post-BAS then no treatment; Cc GEXP. Education intervention on Day 8 vs. 15; duration 7 vs. 14 days. No-treatment baseline then education then no-treatment. GEXP engaged in activities patients identified as fearful on graded basis. Education group received information on fear-avoidance behaviors.	*6 months*	Self reported signs/symptom differences across study periods for BAS vs. GEXP (p = 0.042), and BAS vs. follow-up (p = 0.039). Self reported signs and symptoms of CRPS (% positive) by group: hyperesthesia (BAS 100.0 vs. GEXP 0.0 vs. follow-up 0.0), edema (BAS 87.5 vs. GEXP 0.0 vs. follow-up 0.0).	"The GEXP was successful in decreasing levels of self-reported pain-related fear, pain intensity, disability and physiological signs and symptoms. These results support the hypothesis that the meaning people attach to a noxious stimulus influences its experienced painfulness and the GEXP activates cortical networks and reconciles motor output and sensory feedback."	Small sample size. ata suggest efficacy.

Gobelet 1986 (score = 4.0)		RCT	No mention of sponsorship or COI.	N = 24 with Stage I RSDS affecting extremities after trauma; severe pain, edema and hyperhidrosis	Mean Age: Group 1: 54 Group 2: 54.7 Sex(M:F) 11:13	PT (n = 12) vs. PT plus salmon calcitonin 100 MRC SQ units daily for 3 weeks (n = 12). PT 5 times a week for 3 weeks, then 3 times a week up to 5 more weeks. Controls received same PT.	*2 weeks, 8 weeks, 24 weeks*	Four of 12 (33%) from PT alone group vs. 6 of 12 (50%) from PT with calcitonin group fit for work at 8 weeks. Nineteen of 24 fit for work at 24 weeks.	"[T]he authors advocate the use of calcitonin in addition to physical therapy in reflex sympathetic dystrophy syndrome – and even of calcitonin alone where physical therapy is not possible."	Small sample sizes (12 each). Multiple co-interventions. Many details sparse. Data suggest calcitonin modestly effective as an adjunct to PT.
Barnhoorn 2015 (4.5)	Treatment	RCT	Funded by the Netherlands organization for health research and development (ZonMw) (grant number 170991004).	N = 56 with CRPS I. All had had stroke.	(11 males, 45 females); mean age is 44.3 years.	(N = 28) Pain Exposure Physical Therapy (PEPT) vs (N = 28) Conventional Treatment	*3,6, and 9 month follow-up.*	63 percent of the PEPT group achieved MCID compared to 56 percent in the conventional treatment (CONV) group (95% CI .72 to 1.77). The PEPT group had a decrease in ISS-RV of 6.7 points and 6.2 points for CONV (95% CI 1.56 to 3.48 p = 0.45). There was a significant difference for the AROM with a decrease in PEPT and CONV group (95% CI .07 to .94 p = 0.02). Greater improvement between treatment groups in favor of PEPT (95% CI .1 to 5.7; p = .04).	"We cannot state that PEPT is superior to CONV for patients with CRPS-1. However, patients allocated to PEPT did experience a greater improvement in AROM compared to those allocated to CONV."	Intervention is poorly defined and described. Intention to treat analysis yields only one statistically significant difference between treatment groups; range of motion.

Evidence for the Use of Motor Imagery Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Moseley 2004 (score = 7.0)	Motor imagery programs	RCT/Crossover Trial	This study was sponsored by a Clinical Research Fellowship from the National Health and Medical Research Council of Australia ID 210348. No mention of COI	N = 13 with CRPS Type I diagnosed by Bruehl criteria after complicated wrist fracture (>6 months duration)	Mean age: 36..5 years (9 females, 4 males)	Motor imagery program (MIP) consisting of hand laterality recognition task, imagined hand movements and mirror therapy vs. ongoing management. CRPS subjects chosen due to prior evidence that technique worked in acute CRPS I; medications remain unchanged. MIP group asked to perform their treatment for 10 minutes of each waking hour. Control group or waiting-list control asked not to change medication or dosage and to record any new treatments received. Treatment 12 weeks before crossover.	Assessments were repeated 2, 4, 6 and 12 weeks after the commencement of treatment of the 6-week program	After 6 weeks, 2 MIP-treated patients no longer met CRPS diagnostic criteria. After 12 weeks, control group crossed-over to MIP. Main effect of treatment group and an effect size of approximately 25 points on neuropathic pain scale. Effect of treatment replicated in crossover control subjects. Significant reduction in all 3 variables during MIP maintained for at least 6 weeks post treatment, $p < 0.01$.	"The results uphold the hypothesis that a MIP initially not involving limb movement is effective for CRPS I and support the involvement of cortical abnormalities in the development of this disorder."	Baseline differences in mean duration of CRPS somewhat favored MIP group (51 vs. 65 weeks). Score (7.0) based on RCT, but crossover results 6 weeks later further strengthen results. Study lends credence to concept that exercise is critical for recovery from CRPS.

Moseley 2006 (score = 6.5)	Motor imagery programs	RCT	No COI. No mention of sponsorship	N = 51 with CRPS Type I or phantom limb pain	Mean age not reported, gender not identified	Graded MIP with physiotherapy treatment (n = 25) vs. maintained usual medical care (n = 26); 37 of 51 had CRPS I (5 brachial plexus avulsion injury, 9 amputees of 1 limb). Intervention group received motor imagery program consisting of 2 weeks each of limb laterality recognition, imagined movements, and mirror movements. Control group received PT once a week, home therapy with training load, and ongoing medical care.	Follow up-6 month	In follow-up period, 100% of controls vs. 11 in intervention group sought treatment. Number needed to treat for 50% pain reduction or 4-point increase in function at 6 months was 2; 11 patients in treatment group vs. all in control group sought treatment for pain during follow-up period, p <0.001.	"Motor imagery reduced pain and disability in these patients with complex regional pain syndrome type I or phantom limb pain, but the mechanism, or mechanisms, of the effect are not clear."	Data suggest motor imagery effective for CRPS or phantom pain.

Moseley 2005 (score = 6.0)	Motor imagery programs	RCT	This study was sponsored by a Clinical Research Fellowship from the National Health and Medical Research Council of Australia ID 210348. No mention of COI	N = 20 with CRPS Type I diagnosed by Bruehl criteria after complicated wrist fracture (>6 months duration)	Mean age 34 gender not identified	Group 1, n = 7 (received hand laterality recognition, imagined movements, mirror movements) vs. Group 2, n = 6 (received imagined movements, recognition, imagined movements), or Group 3, n = 7 (received recognition, mirror movements, recognition) with 12 week follow-up.	Follow up at week 12	At 6 and 18 weeks, reduced pain and disability greater for Group 1 than other groups. Increase in task specific NRS more in Group 1 vs. 2 and 3, p <0.05 for both. At 12 weeks, reduction in total NPS and increase in task specific NRS greater for Group 1 vs. 2 or Groups 3, p <0.05 for both.	"Hand laterality recognition imparted a consistent reduction in pain and disability across groups, however, this effect was recognition. Imagined movements imparted a further reduction in pain and disability, but only if they followed hand laterality recognition. Mirror movements also imparted a reduction in pain and disability, but only when they followed imagined movements."	Best results obtained from viewing unaffected limb and performing activities as fast and accurately as possible with affected hand.

Vural 2016 (5.5)	Chronic, CRPS	RCT	No mention of conflict of interest.	N = 30 patients with first-time stroke and CRPS in the stage of dystrophy.	Mean age of 65.15, 13 females, 17 males.	Each group received patient-specific conventional stroke rehabilitation for 2-4 hours per day, 5 days a week for 4 weeks. The mirror therapy group (N = 15) received an additional 30 minutes per day of mirror therapy compared to control group (N = 15).	At baseline and after 4 weeks of therapy, the following assessments were performed: Brunnstrom recovery stages of the arm and hand for motor recovery, Fugl-Meyer Assessment (FMA, subsections of wrist and hand), FIM-motor for functional status (motor items only), Modified Ashworth Scale (MAS) (to measure Spasticity), and visual analog scale (VAS, to measure pain severity).	Compared to baseline, statistically significant results were seen in both groups for FIM-motor and VAS scores, with greater improvements in the mirror therapy group (P=.03, P=.01, respectively). Additional significant results were in the mirror group for Brunnstrom recovery stages (P=.01) and FMA (P<.001)	"This study demonstrates that in patients with stroke with CRPS type 1, addition of mirror therapy to a conventional physical therapy and rehabilitation program provides greater improvement in motor recovery and upper limb motor function of the paretic side. Mirror therapy is a noninvasive, inexpensive, and simple applicable rehabilitation modality with no significant complications. "	Significant difference in pain and function between groups. Conventional stroke comparison treatment not well described or reproducible, all stroke patients with mirror therapy adjuvant to poorly described standard stroke therapy.

Evidence fo Desensitization Techniques for CRPS

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Length of Follow-up:	Results:	Conclusion:	Comments:
Karlijn Barnhoorn (4.5)	Treatment	RCT	Funded by the Netherlands organization for health research and development (ZonMw) (grant number 170991004).	N = 56	(11 males, 45 females); mean age is 44.3 years.	(N = 28) Pain Exposure Physical Therapy (PEPT) vs (N = 28) Conventional Treatment	*3,6, and 9 month follow-up.*	63 percent of the PEPT group achieved MCID compared to 56 percent in the conventional treatment (CONV) group (95% CI .72 to 1.77). The PEPT group had a decrease in ISS-RV of 6.7 points and 6.2 points for CONV (95% CI 1.56 to 3.48 p = 0.45). There was a significant difference for the AROM with a decrease in PEPT and CONV group (95% CI .07 to .94 p = 0.02). Greater improvement between treatment groups in favor of PEPT (95% CI .1 to 5.7; p = .04).	"We cannot state that PEPT is superior to CONV for patients with CRPS-1. However, patients allocated to PEPT did experience a greater improvement in AROM compared to those allocated to CONV."	Intervention is poorly defined and described. Intention to treat analysis yields only one statistically significant difference between treatment groups; range of motion.

Evidence for the Use of NSAIDs and Acetaminophen

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Length of Follow-up:	Results:	Conclusion:	Comments:
Kalita 2006 (score = 6.0)		[RCT, prospective, etc.]	No mention of Sponsorship or COI.	N = 60 with CRPS I following stroke	Mean age: 56 years Sex (M:F) 40:20	Prednisolone 40mg (n = 30) or piroxicam 20mg daily (n = 30) for 14 days.	1 month	Total CRPS score (initial/1 month): prednisolone (10.73±1.95/4.27±2.83) vs. piroxicam (9.83±2.34/9.37±2.89). Sensory: (3.97±0.85/1.13±1.31) vs. (4.00±0.87/3.67±1.35). Autonomic: (2.17±0.70/0.77±0.73) vs. (2.00±0.53/1.70±0.65). Humeral abduction: (2.30±0.70/1.27±0.87) vs. (2.03±0.85/1.97±0.93). Humeral extension rotation: (2.37±0.72/1.13±0.94) vs. (2.07±0.87/2.07±0.91). Barthel index (BI) score: (1.97±4.94/9.87±4.43) vs. (2.57±4.32/7.07±5.56).	"[A] short course of oral prednisolone significantly reduces the symptoms and signs of CRPSI following stroke compared to piroxicam, and both drugs improve the activity of daily living as assessed by BI score."	Stroke patients. In upper extremity CRPS I post-stroke prednisolone improves symptoms over piroxicam. After 1 month, no mention of co-intervention. Data suggest steroid superior to piroxicam.
Frade 2005 (score = 5.5)		RCT	No mention of Sponsorship or COI.	N = 30 with CRPS Type I in upper limb	Mean age: CG group 41, IVRAPG group 41, SPG group: 44. Sex(M:F) 13:17	30µg clonidine plus 1mg/kg lidocaine plus 0.9% physiologic solution (control, CG, n = 10) vs. 30µg clonidine plus 1mg/kg lidocaine plus 0.9% physiologic solution plus 5mg parecoxib (group IVRAPG,	3 weeks	VAS before/60 minutes after each intervention: CG Week 1 (8±1.15/2.6±1.9), Week 2 (5.9±1.1/1.5±0.97), Week 3 (5±1.66/2.1±1.97); IVRAPG Week 1 (8±1.56/2.4±2.67), Week 2 (5.8±2.4/1.2±1.98), Week 3 (3.1±1.66/0.6±1.26); SPG Week 1 (8.3±1.25/2.6±3.1), Week 2 (6±1.83/1.5±1.08), Week 3 (5±1.56/2.2±1.8), CG vs. SPG decrease Week 1 to 2. Mean daily oral ketoprofen consumption end of each week (1st/2nd/3rd week): CG	"[I]n contrast to IV systemic 20 mg of parecoxib, IV 5 mg of parecoxib was an effective coadjuvant combined with weekly clonidine/lidocaine loco-regional block for CRPS type 1."	Data suggest parecoxib may have additive benefit when combined with clonidine.

						n = 10) v. 30µg clonidine plus 1mg/kg lidocaine plus 0.9% physiologic solution (SPG, n = 10) 3 times at weekly intervals.		(180±92/150±97/170±106) vs. IVRAPG (170±106/60±70/70±80) vs. SPG (190±74/150±108/160±96), IVRAPG smaller consumption 2nd and 3rd week vs. other groups, p <0.05.		
Breuer 2014 (score=5.0)	CRPS	RCT	No COI. Supported by grant from the Ruhr University Bochum.	N = 20 with diagnosis of CRPS in the upper limb	10 female, 10 male. Mean age parecoxib group 46.5 years, placebo 51.0 years	40 mg of Parecoxib twice a day for two days (N = 10) vs 40 mg of placebo (NaCl 0.9%)	1 day after final injection	Pressure pain threshold (PPT) – Placebo (day 3 – day 0 change): -14.7 kPA, Placebo 26.5 kPA (difference not significant, P=0.6). Heat pain threshold (HPT) – Parecoxib 1.6°C, Placebo 0.7°C (P=0.29). Numeric Rating Scale for Pain – Parecoxib -0.6, Placebo -0.7 (P=0.32).	"In the present proof-of-concept trial, short-term treatment with the selective COX-2-inhibitor parecoxib influenced neither PPT nor edema or pain. COX-2 might be less important than previously assumed."	Small sample size (n=20) post hoc analysis of COX-2 with a short duration of follow up (2 days) no meaningful differences were observed between groups

Evidence for the Use of Gabapentin or Pregabalin for CRPS

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
van de Vusse 2004 (score = 8.0)		Crossover Trial	Sponsored by Parke-Davis. COI, Parke-Davis supplied gabapentin and matching placebo capsules for this trial. Drs. Van de Vusse and Weber have received financial support from Parke-Davis	N = 58 with CRPS I in affected limb	Mean age: 44 Sex(M:F) 11:48	Gabapentin 600mg once a day for Day 1-2, then 600mg BID Day 3-4, then 600mg TID. Day 5-21 vs. placebo for 3 weeks each, separated by 2-week washout period.	3,5,8 weeks	Symptom durations averaged 43 to 44 months. Intervention group received gabapentin, followed by washout period and placebo treatment. Control received placebo treatment, followed by washout period and gabapentin treatment. Both gabapentin and identical placebo capsules delivered immediately before start of 2-medication period. Global perceived effect showed more improvement in gabapentin (43% vs. placebo 17%). However, no benefit in second 3-week course of treatment.	"Patients reported significant pain relief in favor of gabapentin in the first period. Therapy effect in the second period was less; finally resulting in no significant effect combining results of both periods. The CRPS patients had sensory deficits at baseline. We found that this sensory deficit was significantly reversed in gabapentin users in comparison to placebo users."	Blinding questionable due to adverse events. Patients were CRPS I both upper and lower extremity. Adverse events were significantly greater with the use of Neurontin. Only numbness affected significantly by Neurontin, not pain or ROM

Evidence for the Use of Bisphosphonates

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Manicourt 2004 (score = 8.0)		RCT	Supported by Merck Sharpe and Dolme. No mention of COI.	N = 40 with post-traumatic CRPS Type I of lower extremity meeting Harden diagnostic criteria for 7 to 8 months; sprain/strain injuries, surgery, fracture, and contusion; excluded recent inefficacious calcitonin therapy	Mean age: Alendronate group: 44.6±12.3 Placebo group: 45.2±12.5 Sex(M:F) 19:21	Alendronate 40mg a day (n = 20) vs. placebo (n = 20) for 8 weeks.	8 weeks	Alendronate group had significant improvement within 4 weeks vs. placebo. Was a subsequent open trial; those previously on placebo also experienced similar, significant improvements on active medication. At Week 12, significant reduction in mean VAS score in placebo group, p <0.05. Alendronate group saw reductions in mean VAS scores at Weeks 4, 8, and 12 (p <0.05), and sharp increase in mean pressure tolerance score at Week 4, p <0.05. Mean joint mobility score significantly better in treatment group vs. placebo throughout study, p <0.05.	"Our findings support the use of oral alendronate in posttraumatic CRPS I. By reducing local acceleration of bone remodeling, alendronate might relieve pain by effects on nociceptive primary afferents in bone, pain-associated changes in the spinal cord, and possibly also through a central mechanism."	Small numbers. CRPS I of lower extremity appears to benefit from high dose alendronate therapy for up to 16 weeks.
Varenna 2000 (score = 8.0)		RCT	No mention of Sponsorship or COI.	N = 32 recruited with RSDS by Kozin's criteria	Mean Age: 55.6±8.6 Sex(M:F) 13:19	Clodronate 300mg IV QD (n = 15) over 3 hours vs. saline solution (n =	40, 90, 180 days	RSD causes: 28.1% sprain/trauma, 28.1% unknown, 25% fracture, 12.5% post-op/post-arthroscopy, 1 each post acute gouty arthritis and	"A 10 day IV clodronate course is better than placebo and effective in the treatment of RSDS. Urinary excretion	Study suggests 10 day IV clodronate provided benefit for CRPS outcomes of clinical pain

						17) for 10 days.		diabetes. VAS (time 0/time 40): clodronate (58.4±23.1/22.3±20.2) vs. placebo (62.5±29.0/56.4±31.4), p ≤0.001 at T40. Clinical global assessment: (2.3±0.6/0.9±0.6) vs. 2.2±0.6/1.9±0.7), p ≤0.001 at T40.	of NTx (N-telopeptide), a marker of bone resorption, seemed to be a predictive factor for clodronate efficacy."	global assessment in this select population, which mostly included post traumatic musculoskeletal injuries, although sample size small.
Adami 1997 (score = 5.5)		RCT	No mention of Sponsorship or COI.	N = 20 with RSDS of foot and hand; apparently met Kozin's criteria; duration 5 to 34 weeks	No mention of mean age: Age Range: Alendronate group: 39-79 Placebo group: 48-80 Sex(M:F) 12:8	Alendronate 7.5mg IV daily (n = 10) for 3 days vs. saline (n = 10).	4 weeks	All but 1 improved on alendronate vs. 3/20 improving on placebo. All on placebo improved in subsequent open-label phase. Pooling RCT and open phases, 5 patients improved at least 75%, and another 8 improved at least 50%.	"[B]isphosphonates should be considered for the treatment of RSDS, producing consistent and rapid remission of the disease."	No mention of co-interventions; small numbers. No differentiation between CRPS I or II. Bisphosphonates appear to help in CRPS.
Robinson 2004 (score = 5.0)		RCT	No mention of Sponsorship or COI.	N = 27 with CRPS who met IASP diagnostic criteria; duration 3 months to 6 years	Mean age: 45 Sex (M:F) 9:18	One dose of pamidronate 60mg IV 9n = 14) vs. saline (n = 13).	1 & 3 months	Pain scores lower in pamidronate group vs. placebo at 3 months (p = 0.043), as were functional scores (p = 0.047).	"Pamidronate may be a useful treatment option in the management of patients with CRPS Type I. Although treatment response was variable, the majority of patients improved. Early administration in tandem with other	Small numbers. Treatment response was variable showing a subset of patients may benefit more than others i.e. upper vs. lower extremity CRPS I patients. No mention of physical activity level or PT during study.

									treatment measures is recommended."	Baseline pain was greater in treatment group.
Varenna 2012 (6.0)	Chronic, CRPS	RCT	The authors declare no conflict of interest.	N = 82 participants with either foot or hand CRPS.	Mean age 57.6, 29 males, 53 females.	Both groups received four 100-mg infusions over 10 days for 40 days. The control group (N = 41) received an intravenous placebo, with the comparison group (N = 41) receiving neridronate.	Outcome assessments were taken previous to randomization and prior to the first day of treatment, then follow-ups at day 10, 20 and 40 days of treatment. 10 days after the study, the placebo group received the neridronate treatment with a follow-up performed at day 40.	At day 20 of treatment, statistically significant results were see in the neridronate group in a decreased visual analogue (VAS, measures pain) score (P=0.043).	"In patients with acute CRPS-I, four i.v. infusions of neridronate 100mg are associated with clinically relevant and persistent benefits. These results provide conclusive evidence that the use of bisphosphonate, at appropriate doses, is the treatment of choice for CRPS-I."	Meaningful improvements in pain, function, emotional well being, physical and mental components of outcome assessments, favoring neridronate treatment. (Medication not approved for use in USA).

Evidence for the Use of Calcitonin

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Bickerstaff 1991 (score = 7.0)		RCT	Supported by Sandoz Pharmaceuticals PLC, and an MRC Programme Grant. No mention of COI.	N = 40 with chronic reflex sympathetic dystrophy (algodystrophy) screened 2 weeks after cast removal for Colles' fracture with diagnoses made based on pain/tenderness, vascular instability, swelling and stiffness	Mean age: Calcitonin group: 60.8 ± 1.8 Placebo group: 65.5±1.8 Sex(M:F) 6:34	Nasal calcitonin 400IU daily (n = 20) vs. normal saline (n = 20) for 4 weeks.	12 weeks	No statistically significant results for any major outcomes such as pain, vascular instability, dolorimetry, hand swelling or grip strength, all of which improved over time in both groups. Graphs suggest trends in favor of placebo over calcitonin; however, dolorimetry and stiffness favored calcitonin.	"Although this study demonstrates a rapid effect of calcitonin [sic], it also confirms that spontaneous resolution of symptoms occurs commonly in algodystrophy. Consequently, open studies evaluating the use of calcitonin should be interpreted with caution" as "no demonstrable effect on the clinical or skeletal progression of the disorder using sensitive methods of measuring the response to treatment" was found.	Study negative. Authors questioned whether amount of calcitonin in nasal inhalation formulation had been sufficient.

Gobelet 1992 (score = 6.5)		RCT	No mention of sponsorship or COI.	N = 66 with post-traumatic reflex sympathetic dystrophy (8 to 10 weeks duration) eligible fulfilled Kozin's criteria, Steinbrocker's stage	Mean age: Group 1: 50.2±16.7 Group 2: 49.8±12.3 Sex(M:F) 41:25	Physical therapy and 100 units TID of salmon calcitonin intranasally (n = 35) vs. physical therapy and placebo (n = 35) for 3 weeks.	60 days	Statistically significant differences between groups in pain on motion end of 1st week ($p < 0.005$) and persisting thru 2 months ($p < 0.04$). Pain at rest significant for calcitonin at Weeks 3 ($p < 0.02$) and 8 ($p < 0.007$). ROM improved in calcitonin Weeks 1 ($p < 0.04$) and 8 ($p < 0.04$). NS for edema.	"[S]almon calcitonin has an effect but that this effect was not equally observed on all parameters analyzed. It was most marked on pain (at rest and on movement) and on the ability to work."	No mention of co-interventions. No differentiation between CRPS I or II. Data suggest modest efficacy.
Sahin 2006 (score = 5.0)		RCT	No mention of sponsorship or COI.	N = 35 with CRPS Type I, Stage I, after fractures in Turkey; Steinbrocker criteria used for ascertaining Stage I	Mean ageL Paracetamol group: 60.0±12.32 Calcitonin Group: 57.72±12.33 Sex(M:F) 10:25	Intranasal salmon calcitonin (200 IU a day plus calcium 500mg a day) (n = 18) vs. paracetamol (1,500mg a day) (n = 17) for 2 months.	3 weeks	Mean durations of symptoms: 5.4 and 6.0 weeks with trauma 12.7 weeks previously; casting in all 1st 5.5-5.8 weeks after trauma. PT 5 times a week for 3 weeks. PT included "stellate ganglion blockage with ultrasound," TENS to affected hand (20 minutes), contrast bathing, and ROM exercises. VAS scores (baseline/2 months): paracetamol 6.12±1.5 to 3.12±1.8 vs. calcitonin 5.83±1.54 to 2.22±1.93. Other ROM and temperature favored calcitonin, but not significant between groups.	"[C]alcitonin does not make any favourable contribution in the treatment of patients with acute CRPS I; physical therapy combined with only a simple analgesic is an efficient means of therapy."	Data suggest that calcitonin has weak effect over that of paracetamol, but study not powered to detect that effect.

Evidence for the Use of Clonidine

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Rauck 1993 (score = 5.0)		RCT, Crossover trial	No mention of Sponsorship or COI.	N = 26 with RSD	Mean age: 38±1.8 No mention of sex.	Normal saline vs. 300µg clonidine vs. 700µg clonidine with follow-ups at 20, 40 60, 120, 180, 240 and 360 minutes after injection.	6 hours	McGill scores decreased with placebo from 36.0 to 35.7; in 300µg from 38.0 to 29.9; and 700µg dose from 37.2 to 25.7.	"[E]xtensive analgesia may be obtained by epidural administration. Sedation and hypotension may limit bolus epidural clonidine administration for RSD. The role for chronic epidural infusion of clonidine has not been established."	Blinding not well described; no long-term results reported despite continued treatment offered. Longer term infection complication rate of 31.6% (1 case of meningitis) over 40 days treatment is concerning.
Frade 2005 (score = 5.5)		RCT	No mention of Sponsorship or COI.	N = 30 with CRPS Type I in upper limb	Mean age: CG group 41, IVRAPG group 41, SPG group: 44. Sex(M:F) 13:17	30µg clonidine plus 1mg/kg lidocaine plus 0.9% physiologic solution (control, CG, n = 10) vs. 30µg clonidine plus 1mg/kg lidocaine plus 0.9% physiologic solution plus 5mg parecoxib (group IVRAPG, n = 10) v. 30µg clonidine plus 1mg/kg lidocaine plus 0.9% physiologic solution (SPG, n = 10) 3 times at weekly intervals.	3 weeks	VAS before/60 minutes after each intervention: CG Week 1 (8±1.15/2.6±1.9), Week 2 (5.9±1.1/1.5±0.97), Week 3 (5±1.66/2.1±1.97); IVRAPG Week 1 (8±1.56/2.4±2.67), Week 2 (5.8±2.4/1.2±1.98), Week 3 (3.1±1.66/0.6±1.26); SPG Week 1 (8.3±1.25/2.6±3.1), Week 2 (6±1.83/1.5±1.08), Week 3 (5±1.56/2.2±1.8), CG vs. SPG decrease Week 1 to 2. Mean daily oral ketoprofen consumption end of each week (1st/2nd/3rd week): CG (180±92/150±97/170±106) vs. IVRAPG (170±106/60±70/70±80) vs. SPG (190±74/150±108/160±96), IVRAPG smaller consumption 2nd and 3rd week vs. other groups, p <0.05.	"[I]n contrast to IV systemic 20 mg of parecoxib, IV 5 mg of parecoxib was an effective coadjuvant combined with weekly clonidine/lidocaine loco-regional block for CRPS type 1."	Data suggest parecoxib may have additive benefit when combined with clonidine.

Evidence for Intravenous Regional Anesthesia with Clonidine

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Reuben 2004 (score = 7.5)		RCT	No mention of sponsorship or COI.	N = 84 with history of upper extremity CRPS undergoing surgery on affected extremity	Mean age: IVRA-L group: 47±11 IVRA-C: 52±14 Sex(M:F) 17:67	Intravenous regional anesthesia with 0.5% lidocaine (IVRA-L) 1mL NS added to IVRA solution (n = 42) vs. intravenous regional anesthesia with clonidine 1µg/kg (IVRA-C) (n = 42).	1 year	Recurrence rate of CRPS significantly lower in patients receiving IVRA with lidocaine and clonidine vs. IVRA lidocaine only, p <0.001.	"Intraoperative IVRA with lidocaine and clonidine on patients with a history of CRPS can significantly reduce the recurrence rate of this disease process."	No differentiation between CRPS I or II. No mention of co-interventions during follow-up period.

Evidence for the Use of Oral Glucocorticosteroids

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Kalita 2006 (score = 6.0)		RCT	No mention of sponsorship or COI.	N = 60 with CRPS I following stroke diagnosed with a severity scale	Mean age: 56 Sex (M:F) 40:20	Prednisolone 40mg daily for 14 days and then 10 mg/ week taper (n = 30) vs. piroxicam 20mg daily (n = 30) for 1 month.	1 month	All measures improved in prednisolone; only autonomic improved in piroxicam group. Improvement observed in symptoms and signs of CRPS I following stroke in 83.3% in prednisolone group and 16.7% in piroxicam. CRPS total score (prednisolone vs. piroxicam): 19.07 vs. 41.93, p <0.0001.	"Prednisolone resulted in significant improvement in the symptoms and signs of CRPS I following stroke, compared to piroxicam. Both drugs produced an improvement in the BI [Barthel index] score."	Data suggest steroid effective.

Christensen 1982 (score = 4.0)		RCT	No mention of sponsorship or COI.	N = 23 with RDS due to Colles', humeral, olecranon, or other fracture, sequela of abscess incision	Mean age: 66 Sex (M:F) 3:20	Oral prednisone 10 mg TID (n = 13) vs. placebo (n = 10) for up to 12 weeks.	12 weeks	All 13 patients on prednisone improved at least 75% vs. 2 of 10 (20%) in the placebo.	"Prednisone appears superior to other treatment in RSD, although the mode of action is not known."	Inter-group difference statistically significant in favor of steroid.

Evidence fo the Use of Intrathecal Glucocorticosteroids

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Munts, 2010 (score=5.0)	CRPS	RCT	Sponsored by Dutch government grant (BSIK03016) and no COI.	N=21 patients	Mean age: 46±11 years; 5 males, 16 females.	Methylprednisolone group: single intrathecal administration of 60 mg methylprednisolone acetate vs Placebo group: 1.5 mL sodium chloride	12 weeks	Study was ended prematurely due to lack of reaching efficacy. No significant difference between groups was observed at 6 weeks (t=.65, d.f.=18, p=.53, difference in means 0.3, 95% CI -.7-1.3). Myoclonus deteriorated in ITM group while not in the placebo group which led to a significant difference (F(1,17=6.17, p=.02, partial eta squared=.27). No significant difference between groups was observed in any other outcome measures. No serious AE's occurred; however, 8 patients experienced headaches, 9 patients had backaches.	"(A) single bolus administration of ITM is not efficacious in chronic CRPS patients, which may indicate that spinal immune activation does not play an important role in this phase of the syndrome."	Possible randomization failure and small sample size. All participants were referred to the movement disorder outpatient clinic, may not be generalizable.

Evidence for the Use of Magnesium Sulfate

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Fischer 2013 (4.0)	CRPS	RCT	No COI. Supported by TREND via a government grant from The Netherlands.	N = 56 with CRPS-I (according to IASP Orlando critiera)	52 female, 4 male. Mean age 46.7 years	70mg/kg of magnesium sulphate (N = 29) vs placebo (NaCL 0.9%) (N = 27); both treatment given through intravenous infusion of 25mL/h for 4 hours a day for 5 days	12 weeks	Pain scores (numeric rating scale) at baseline, T1-T4: Placebo - 6.3, 5.4, 5.5, 5.3, 5.4, $MgSO_4$ – 6.1, 5.2, 5.3, 5.2, 5.1. No significant differences between groups in BOX-11 and ISS scores (P>0.05).	"Administration of the physiological competitive N-methyl-D-aspartate receptor antagonist magnesium in chronic CRPS provides insufficient benefit over placebo. Future research should focus on patients with acute CRPS and early signs and symptoms of central sensitization."	No meaningful differences between groups for any outcomes assessed at 12 weeks.

Evidence for The Use of Lenalidomide

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Manning 2014 (6.5)	Lenalidomide	RCT	Supported by Celgene Corporation. Manning was an employee of Celgene Corporation during trial period as well as Alexander and Arezzo.	N = 180 CRPS type 1 (via Budapest research criteria) for ≥1 year with unilateral or bilateral involvement of a distal hand or foot, with or without proximal spread, plus CRPS-related pain intensity score of ≥4 in index limb	144 female, 36 male. Mean age 44.5 years	Lenalidomide, 10 mg orally once daily (N = 68) vs Placebo (N = 79)	12 weeks post first treatment, possibility to continue to extension phase for 4 additional weeks	CRPS PI-NRS (Pain Intensity Ratings) Scores: Lenalidomide AM+PM time combined score - Baseline 7.1±1.4, Week 12 6.5±2.1, change -.7±1.7. AM scores - Baseline 6.9±1.5, Week 12 6.3±2.1, change -.6±1.7. PM scores - Baseline 7.3±1.4, Week 12 6.6±2.1, change -.7±1.7. Placebo AM+PM time combined score - Baseline 7.0±1.6, Week 12 6.6±2.3, change -.4±1.5. AM scores - Baseline 6.9±1.7, Week 12 6.5±2.3, change -.3±1.5. PM scores - Baseline 7.1±1.6, Week 12 6.7±2.3, change -.4±1.5. No significant differences in pain scores (AM+ PM (P=.26), AM (P=.28), PM (P=.27))	"In summary, because the current study found no evidence of efficacy of lenalidomide in the sample studied, despite its relative safety, it cannot be endorsed for the broad population of people with CRPS. Given that failure rates are high in parallel-group, placebo controlled trials of pain therapies, it may be reasonable to consider additional study of lenalidomide in specific subgroups of patients."	High dropout rate due to adverse events. No meaningful differences between groups.

Evidence for the Use of DMSO

Author Year (Score):	Category	Study type:	Conflict of Interest	Sample size:	Age/Sex	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Perez 2003 (score = 8.0)	DMSO, NAC, EMLA	RCT	Study supported by Dutch National Health Council. No mention of COI.	N = 145 with CRPS I affected limb (i.e., upper or lower) who met Veldman criteria and durations since trauma 86-102 days	49 males, 96 females; Mean age DMSO: 50.08±13.28, NAC: 48.94±15.39.	Intervention Group 1 received 50% DMSO 5 times a day to affected extremity (n = 71) vs. Intervention Group 2 received NAC 600mg effervescent tablets 3 times a day (n = 74). Both intervention groups received dummy placebos for 17 weeks.	Baseline, 6, 17, 32, 52 weeks.	At 52 weeks, CRPS-I treated with DMSO improved more than NAC. CRPS I-cold improved more with NAC than DMSO. Significant differences for subscores of lower extremity function favored DMSO. Subgroup analysis more favorable DMSO for warm CRPS I; NAC significantly better for cold. Results negatively influenced if duration of complaint longer. Treatment with DMSO and NAC equally effective in treating CRPS I. Strong indications for differences in effects of subgroups with warm or cold CRPS I: warm CRPS I, DMSO-treatment appeared more favorable, while for cold CRPS I, NAC-treatment appeared more effective.	"[B]oth DMSO 50% and N-acetylcysteine are equally effective in treatment of CRPS I. Treatment for cold CRPS I with DMSO 50% seems unadvisable , and N-acetylcysteine would be the preferred treatment."	Lack of a placebo limits conclusions on treatment efficacy. One interpretation that cannot be eliminated is that both treatments may be equally ineffective. Another conclusion could be substantial difference in paracetamol use between groups; it masked potentially greater efficacy in DMSO group, although tramadol use higher in DMSO. Results for stratification by cold vs. warm CRPS more impressive, suggest possible meaningful differences.

Evidence for the Use of Dimethyl Sulfoxide, N-Acetylcysteine, and EMLA Cream

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Perez 2003 (score = 8.0)	DMSO, NAC, EMLA	RCT	Study supported by Dutch National Health Council. No mention of COI.	N = 145 with CRPS I affected limb (i.e., upper or lower) who met Veldman criteria and durations since trauma 86-102 days	49 males, 96 females; Mean age DMSO: 50.08±13.28, NAC: 48.94±15.39.	Intervention Group 1 received 50% DMSO 5 times a day to affected extremity (n = 71) vs. Intervention Group 2 received NAC 600mg effervescent tablets 3 times a day (n = 74). Both intervention groups received dummy placebos for 17 weeks.	Baseline, 6, 17, 32, 52 weeks.	At 52 weeks, CRPS-I treated with DMSO improved more than NAC. CRPS I-cold improved more with NAC than DMSO. Significant differences for subscores of lower extremity function favored DMSO. Subgroup analysis more favorable DMSO for warm CRPS I; NAC significantly better for cold. Results negatively influenced if duration of complaint longer. Treatment with DMSO and NAC equally effective in treating CRPS I. Strong indications for differences in effects of subgroups with warm or cold CRPS I: warm CRPS I, DMSO-treatment appeared more favorable, while for cold CRPS I, NAC-treatment appeared more effective.	"[B]oth DMSO 50% and N-acetylcysteine are equally effective in treatment of CRPS I. Treatment for cold CRPS I with DMSO 50% seems unadvisable , and N-acetylcysteine would be the preferred treatment."	Lack of a placebo limits conclusions on treatment efficacy. One interpretation that cannot be eliminated is that both treatments may be equally ineffective. Another conclusion could be substantial difference in paracetamol use between groups; it masked potentially greater efficacy in DMSO group, although tramadol use higher in DMSO. Results for stratification by cold vs. warm CRPS more impressive, suggest possible meaningful differences.

Evidence for the Use of Intravenous Immunoglobulin (IVIG)

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Goebel, 2010 (score=8.0)	CRPS	Crossover RCT	Sponsored by University College London Hospitals/University College London. No mention of COI.	N = 13 patients with long-standing CRPS.	Mean age: 41 Sex (M:F) 3:10	Group 1 (N =7) received intravenous immunoglobulin (IVIG) for their first intervention. After a 28 day washout period, a second intervention of saline was administered. vs Group 2 received a saline intervention first. After a 28 day washout period, an IVIG intervention was administered. (N =)	8 weeks	An average decrease of 1.55 units in pain scores after IVIG compared with saline ($P < 0.001$).	"IVIG, 0.5 g/kg, can reduce pain in refractory CRPS. Studies are required to determine the best immunoglobulin dose, the duration of effect, and when repeated treatments are needed.."	Quite small sample size, highly selective exclusion. Data suggest immunoglobulin is superior to saline for pain.

Evidence for the Use of Vitamins

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Zollinger 2007 (score = 8.0)	Vitamins	RCT	Sponsored by Stichting Achmea Slachtoffer en Samenleving. No COI.	N = 416 mostly elderly females with 427 wrist fractures	75 males, 341 females; Mean age Vit C: 62.7±16.8, Placebo 61.4±18.	Placebo (n = 99) vs. vitamin C 200, 500, or 1,500mg a day (n = 317) for 50 days for prevention of CRPS.	Baseline, 1 wk, 4-5 wks, 6-7 wks, 12 wks, 26 wks.	Risk for developing CRPS 10.1%, 4.2%, 1.8%, 1.7%. In 500mg group, RR = 0.17.	"Vitamin C reduces the prevalence of complex regional pain syndrome after wrist fractures. A daily dose of 500mg for fifty days is recommended."	Nutritional status of population not apparent, but as it is the Netherlands, it is expected to be comparable to U.S. Data suggest efficacy.
Ekrol 2014 (score = 7.5)	Vitamins	RCT	Sponsored by the Chief Scientist's Office for Scotland and the Scottish Orthopaedic Research Trust into Trauma (SORT-IT).	N= 336 adults with displaced or non-displaced distal radial fractures.	90 males, 246 females; Mean ages Vitamin C displaced 58±20, placebo displaced 62±18, nondisplaced vitamin C 51±19, nondisplaced placebo 54±21.	Stratified by displaced and nondisplaced fracture. Placebo vs. vitamin C 50mg QD for 50 days.	Baseline, 6, 12, 26, 52 weeks.	(Scores displaced VC/placebo; nondisplaced VC/placebo) CRPS (1.3/1.4; 0.7/0.6). CRPS scores at 6 wks >3 (33/35; 27/13,p=0.022). No differences in other outcomes at 52 wks.	"This study demonstrated no significant difference at one year in the DASH score, other functional outcomes, the rate of CRPS, or osseous healing of nondisplaced or diplaced distal radial fractures treated with vitamin C compared with placebo."	Data suggest lack of efficacy for time to heal fracture. Data also suggest higher pain, complications, and no prevention of CRPS.
Zollinger 1999 (score = 7.5)	Vitamins	RCT	No mention of sponsorship or COI.	N = 123 adults with 127 wrist fractures	25 males, 98 females; Mean age Vit C: 57 (27-88) Placebo: 60 (24-85)	Placebo (n = 66) vs. 500mg vitamin C daily (n = 57) for 50 days for prevention of CRPS.	Patients were assessed after 1 week, 4–5 weeks (when the plaster cast was removed), 6–7 weeks, 12 weeks, and 26 weeks.	Risk for RSD in vitamin C group was RR = 0.17.	"[V]itamin C was associated with a lower risk for RSD after wrist fractures. Our hypothesis is that this beneficial effect of prophylaxis would be useful in other forms of trauma."	Co-interventions not well controlled such as type of exercise/therapy. Vitamin C in did not evaluated. Data suggest evidence of efficacy.

Evidence for the Use of Mannitol

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Perez 2008 (5.0)	CRPS	RCT	No mention of COI. Supported by the Pain Knowledge Center Maastricht.	N = 41 with CRPS I in either 1 arm or 1 leg	33 female, 8 male. Mean age 45.3 years	10% mannitol IV in 1 L 0.9% NaCL for 4 hours for 5 consecutive days (N = 22) or placebo of 0.9% NaCL in equal volumes (N = 19)	2, 6, and 9 weeks	Visual analog scale (VAS) pain scores for T2, T6, and T9: Max – placebo 71.1, 63.3, 62.2, mannitol 68.5, 67.8, 63.3, Min – placebo 46.2, 45.1 45.1, mannitol 50.6, 47.3, 49.7. VAS diff for placebo and mannitol, respectively: T0 vs T2 - -1.1, 2.5, T0 vs T6 0.0, 5.8, T0 vs T9 -0.1, 3.4. No significant differences found (P > 0.05)	"In summary, we conclude that intravenous administration of 10% mannitol is not more effective than placebo in reducing complaints for CRPS I patients and provides no addition to already-established interventions for CRPS I."	No meaningful differences between groups. High co-intervention use, not well controlled.

Evidence for the Use of Hyperbaric Oxygen

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Kiralp 2004 (score = 6.5)	Hyperbaric oxygen for CRPS	RCT	No mention of COI or sponsorship	N = 71 with post-traumatic CRPS Type I of upper extremity; disease duration 1.5 months	Mean age: 30.4 years. 49 males, 22 females	Hyperbaric oxygen (n = 37) vs. Room air (n = 34) in Turkey. Each group treated with 15 sessions for 90 minutes. PT not prescribed, rather paracetamol 500mg TID given for pain relief and to control for co-interventions.	Follow up period: not mentioned.	Significant reductions in VAS scores, increases in ROM, reductions in wrist circumference HBO vs. room air group. HBO had reductions in pain, edema, ROM, "significantly better results with the exception of wrist extension." Wrist extension (degrees): NS between groups all time periods.	"HBO is an effective and well-tolerated method for decreasing pain and edema and increasing the range of motion (ROM) in patients with CRPS."	No mention of co-intervention other than medication and PT. HBO decreased symptoms compared to sham.

Evidence for the Use of Magnets and Magnetic Stimulation

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Durmus 2004 (score = 6.0)	Use of magnets or magnetic stimulation	RCT	No mention of COI or sponsorship	N = 40 with CRPS Type I subsequent to trauma (Colles fracture)	Mean age: 39.12 years, 20 males, 20 females	Compared electromagnetic field treatment administered with calcitonin and exercise. All patients pre-treated with calcitonin (100 units) and half (Group 1, n = 20) received electromagnetic field treatment 5 times a week for 6 weeks. vs. Other half (Group 2, n = 20) received placebo treatment by being placed in same device without it being switched on (60 minutes a session).	No mention of follow up	VAS-activity: EFT (4.25±2.10) vs. placebo (3.00±2.20), p= 0.033. NS between groups for all other outcomes.	"The absence of a significant difference between the two groups in the assessment parameters has been interpreted as evidence that electromagnetic field treatment does not provide additional benefit to calcitonin and exercise treatment."	Blinding measures not well described. Baseline differences in pain scales not significant, but treatment group has higher baseline pain values than controls, and post-treatment those differences disappeared, so suggestion that reduction in pain ratings is significant may be misleading.

Evidence for the Use of Occlusal Splints

Author Year (Score):	Category	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Fischer 2008 (5.0)	CRPS	RCT	No mention of COI. Supported by grant from the German Society of Manual Medicine-Forschungsgemeinschaft für Arthrologie und Chirotherapie (FAC).	N = 20 with CRPS according to International Association for the Study of Pain	15 female, 5 male. Mean age 48 years	An occlusal splint (OS) was fitted for the intervention group (N = 10) and instructions given to wear this through the night and 3 hours a day for 7 weeks. Comparison group (N = 10) received no treatment. All patients received occupational (2 X week for 30 min) and physical therapy (2 X week for 30 min) to treat CRPS.	Follow-up consisted of self-report. Participants rated minimum, average, and maximum pain related to CRPS daily, with self-administration of the Short Form 36 Health Survey (SF-36) at baseline and 7 weeks post treatment.	NRS pain score mean values: Maximum pain intensity – OS 7.0±1.4 group, Control 7.0±2.1, Minimum pain intensity – OS 5.0±1.9, Control 4.1±2.0, Average pain intensity – OS 6.0±1.6, Control 5.7±1.7. No significant difference from baseline to end of treatment - maximum pain (P=0.708), minimum pain (P=0.100), and average pain (P=0.736)	"The present pilot study indicated that the use of OS for 7 weeks has no impact on CRPS-related pain but improved signs and symptoms of TMD pain. Future studies should include an active control group and evaluate if long-term changes in measures of oral health could have an impact on general health in CRPS-related pain."	Small sample size (n=20). Proof of concept study, not powered to detect differences. However, data suggest lack of efficacy for treatment of CRPS.

Evidence for the Use of Acupuncture

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Korpan 1999 (score = 5.0)	Acupuncture	RCT	No mention of COI or sponsorship	N = 14 with early RSD (1 to 6 months duration)	Mean age: 51.8 years, 10 females, 4 males	Double-blind design assessed classic Chinese acupuncture (5 times a week for 3 weeks) vs. sham acupuncture.	1, 3 and 6 months after completion of acupuncture treatment	No significant results between groups.	"No differences between sham and treatment group could be recognized."	Possibility results may have been positive for both if sham group was in fact an active control. Blinding not well described.

Evidence for the Use of External Irradiation for Sympathectomy

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Basford 2003 (score = 6.5)	Use of external irradiation for Sympathectomy	RCT/Crossover Trial	No mention of COI or sponsorship	N = 6 with unilateral upper extremity CRPS I	Mean age: 40 years, 1 males, 5 females.	Transcutaneous irradiation of right stellate ganglion with linearly polarized 0.6-1.6µm light vs. no medication or other exposures (Phase I, n = 6 with normal neurological exams). Phase II: double-blinded evaluation of active and placebo radiation in 12 subjects (6 upper extremity CRPS I/6 "normal" controls). Skin temperature, heart rate, sudomotor function, vasomotor tone monitored before, during, 30 minutes following irradiation. Analgesic and sensory effects assessed over same period and 1 and 2 weeks later.	Follow up: not mentioned	Pain not statistically significantly reduced. Authors noted that 3 of 6 CRPS I subjects, but no control subjects, experienced sensation of warmth following active irradiation, and 2 CRPS I subjects reported more than 50% pain reduction.	"However, four noted minimal or no change and improvement did not reach statistical significance for the group as a whole. No statistically significant changes in autonomic function were noted."	Tiny sample size. No adverse consequences observed. Study found preliminary evidence that external radiation for purposes of producing a permanent sympathetic block is technically possible. Likely underpowered to detect pain reduction. Study does not show evidence of efficacy of intervention, especially long-term improvements.

Evidence for the Use of Intrathecal Baclofen

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
van Hilten 2000 (score = 8.0)	Intrathecal baclofen	RCT	No mention of COI or sponsorship	N = 7 females previously diagnosed with CRPS with multifocal or generalized tonic dystonia (symptoms for a mean of 13 years)	Mean age: 45 years; 7 females	Compared daily boluses of 25, 50, or 75µg of baclofen vs. placebo. Patients followed from 0.5 to 3 years (average 1.7 years).	Patients were followed for 0.5 to 3 years.	Per patient assessments, injections of 50 and 75 micrograms baclofen resulted in significant decreases in severity of dystonia vs. placebo and to 25 micrograms. Treatment highly effective for dystonia in hands, but not lower extremities. Pump implanted in those experiencing at least 50% improvement above placebo response. During continuous therapy, 3 regained normal hand function, and 2 of 3 regained ability to walk (1 only indoors). In 1 who received continuous therapy, pain and violent jerks disappeared and dystonic posturing of arm decreased. In 2, spasms or restlessness of legs decreased without any change in dystonia.	"In some patients, the dystonia associated with reflex sympathetic dystrophy responds markedly to intrathecal baclofen."	Data suggest intrathecal baclofen reduces dystonia in CRPS over short term. Pumps then used. Not randomized.
Van der Plas 2011 (6.0)	Intrathecal baclofen	Crossover RCT	Sponsorsed by Medtronic sàrl, Tolochenaz Switzerland. No COI.	N = 14 patients with CRPS-related dystonia	Mean age 45.5. 1 males, 13 females.	Slower infusion rate delivery (SIRD) system of intrathecal baclofen (ITB) (N = 7), vs four-times faster infusion rate delivery (FIRD) of ITB (N = 7).	Follow-up at week 2, 3 and 5.	Following 2 weeks of 3 mg/mL daily of baclofen in the SIRD group, and .75 mg/mL of baclofen daily in the FIRD group, there was a week wash-out period before groups switched procedures. After group cross-over, the same procedures continued for another 2 weeks. No statistically significant results were seen comparing FIRD and SIRD in dystonia, pain, or secondary outcomes. One exception of secondary outcomes came from significantly higher adverse events (P = 0.01) during FIRD.	**"Increasing the IR at a fixed daily dose is not associated with improvement of dystonia or pain but warrants further investigation in patients in whom side effects prevent further dose escalation. "**	Small sample size crossover study demonstrated significant differences in favor of intrathecal baclofen infused at a high rate.

Evidence for the Use of Regional Sympathetic Blocks

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Price 1998 (score = 8.5)	Stellate Ganglion Blocks for CRPS	Crossover Trial		N = 7 with CRPS Type I or II (IASP criteria); duration 18 months to 7 years (median 21 months)		Compared 15mL 1% lidocaine followed by 10mL 0.25% bupivacaine with saline stellate ganglion (n = 4) vs. lumbar sympathetic blocks (n = 3). Follow-ups at 15, 30, 45, 60, 75, 90 minutes; journal kept for 7 days.		No significant differences found.	"[D]uration of pain relief is affected by injection of local anesthetics into sympathetic ganglia. These results indicate that both magnitude and duration of pain reduction should be closely monitored to provide optimal efficacy in procedures that use local anesthetics to treat CRPS."	Retrospective analysis found mean duration of relief for those who achieved Horner's syndrome finding was 52.3±103.9 vs. 1.1±1.7 hours for those who did not. Skin surface temperature change findings similar; 7 day follow-up. Very small sample size. Data suggest lidocaine/bupivacaine sympathetic ganglia blocks superior to placebo for very short term.

Evidence for the Use of Guanethidine, Bretylium, Methylprednisolone, Phentolamine, or Reserpine Bier Blocks

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Livingstone 2002 (score = 8.5)	Bier Blocks – Guanethidine	RCT	Funding by grants from Arthritis Research council.	N = 57 with CRPS Type 1, 9 weeks after an isolated closed Colles' fracture	Mean age 61.3 males 54 females	Serial intravenous regional blockade (IVRB) with 15mg of guanethidine in 30ml of 0.5% prilocaine (n = 27) vs. serial IVRB 30ml normal saline (n = 30) at weekly intervals; duration 6 months.	6 months.	Pain on exercise, at 1 week, favored placebo group (p = 0.035). Guanethidine group experienced greater amount of color change in hands (p = 0.015).	"[T]here is no benefit in using such blocks in early CRPS type 1 of the hand and also suggests that its use may delay the resolution of some features of the condition."	Data suggest lack of efficacy.
Jadad 1995 (score = 8.0)	Bier Blocks – Guanethidine	RCT/Crossover Trial	No mention of sponsorship or COI	N = 10 with RSD and at least 4 of following: persistent pain, hyperesthesia, edema, hyperhidrosis, color changes, radiographic evidence of Sudeck's atrophy, or history of injury	Mean age 58.25. 4 males 12 females.	Saline vs. guanethidine low dose 10mg vs. guanethidine high dose 30mg for 3 sessions at weekly intervals. Study duration 4 weeks.	1 week.	No significant differences between groups.	"Patients in all groups reported less than 30% of the maximum possible relief during the first week after the injections, and on only two occasions (one saline and one guanethidine low dose) was relief reported for longer than a week. There was no evidence of a dose response	Data suggest lack of efficacy.

									for guanethidine. The use of guanethidine in IRSBs [intravenous regional sympathetic blockades] for patients with RSD was not supported by the systematic review or by the double-blind study."	
Ramamurthy 1995 (score = 6.5)	Bier Blocks – Guanethidine	RCT	Sponsorship by a grant from Ciba-Geigy corporation. No mention of COI	N = 57 with severe RSD/causalgia for upper extremity <3 months duration	Mean age 39.5. 24 males 33 females.	1 block (active drug for 2nd IVRB) (n = 20) vs. 2 Block (active drug on 2nd and 3rd IVRBs) (n = 19) vs. 4 block (active drug all IVRBs) (n = 18). At 4-day intervals, series of 4 IVRBs with either guanethidine or placebo in 0.5% lidocaine. Study duration 6 months.	6 months	Guanethidine group favored for PRI over placebo (p = 0.031).	"[T]herapeutic benefits provided by IVRB guanethidine were not different from those provided by the IVRB placebo. While pain and other symptoms tended to decrease over time, there was no relationship between the number of IVRB guanethidine blocks and relief of symptoms."	Blinding procedures not well described. Data suggest lack of efficacy.
Blanchard 1990 (score = 5.5)	Bier Blocks – Guanethidine	RCT	No mention of	N = 21 with reflex sympathetic	Mean age 66.6.	Saline 30-50ml (n = 12) vs. guanethidine	12 weeks.	No significant	"There was significant pain relief in all	Saline group's high rate of

			sponsorship or COI.	dystrophy of an upper or lower extremity	12males 9 females.	20mg UE and 30mg LE (n = 14) intravenous regional blocks with follow-ups for greater than 12 weeks.		differences.	three groups at 30 minutes. There were no significant differences among the three groups in the degree of pain relief, the number of patients obtaining pain relief in the 30 minutes after the block, or the number of patients reporting more than 50% pain relief for more than 24 hour."	pain relief could be partially due to a mechanism of tourniquet-induced analgesia.
Hord 1992 (score = 5.5)	Bier Blocks – Bretylium	RCT/Crossover Trial	Sponsorship a grant from Journal of Bone and Joint Surgery of the Orthopedic Research and Education Foundation. No mention of COI.	N = 12 with history of RSD and Type II or III response on isolated cold stress testing	No mention of age or gender.	Each patient received 2 control treatments (local anesthetic only) and two treatments with Lidocaine 40ml with and without bretylium 1.5mg/kg for CRPS in random order.	40 days	Bretylium plus lidocaine produced more days with >30% pain relief than lidocaine alone. Temperature increase after IVR bretylium statistically significant.	"[I]ntravenous regional bretylium in combination with lidocaine blockade provides significant short-term pain relief when compared with IVR lidocaine for treatment of RSD."	Dropout rate high. Data suggest bretylium plus lidocaine may be superior to lidocaine IV block alone for RSD.
Taskaynatan 2004 (score = 6.0)	Bier Blocks – Methylprednisolone	RCT	No mention of	N = 22 with CRPS in upper limbs in Turkey	Mean age 22.3.	Intravenous regional anesthesia (bier block)	follow-up for up to 1.5 months.	No significant differences	"Bier block with methylprednisolone and lidocaine in	Data suggest lack of efficacy.

			sponsorship or COI.		22 men.	methylprednisolone 40mg and lidocaine 10ml of 2% (n = 12) vs. placebo (n = 10) for 3 sessions. Treatment once a week		between groups.	CRPS type 1 does not provide long-term benefit in CRPS, and its short-term benefit is not superior to placebo."	
Rocco 1989 (4.0)	Resperine vs guanethidine	RCT	No mention of sponsorship or COI.	N=12 patients who were diagnosed with reflex sympathetic dystrophy (RSD), or Causalgia, and experienced temporary pain relief by stellate or lumbar sympathetic block.	6 males, 6 females; Casaulgia mean age 29.8, RSD mean age 34.3.	Group 1 received 20 mg guanethidine in 50 ml or 0.5% lidocaine vs Group 2 received 1.25 mg reserpine in 50 ml 0.5% lidocaine vs Group 3 received 50 ml 0.5% lidocaine.	Each patient received each medication in one week intervals. Total of 6 weeks.	No difference in pain relief 90 min post tourniquet release between all groups. Reserpine average pain scores were higher, but not significant towards the end of the week. Side effects: 2 occurrences of depression, diarrhea, and nausea in reserpine. One occurrence of depression	"[N]o difference was found in the therapeutic efficacy between reserpine and guanethidine. Regional intravenous reserpine or guanethidine is a reasonable alternative to stellate or lumbar sympathetic block."	Small sample size (n=12). No meaningful differences between groups.

Toshniwal, G 2007 (Score=4.5)	Brachial plexus blocks Vs Stellate ganglion blocks	RCT		N = 30 with CRPS type 1 of upper extremity.	17 females, 13 males; mean age 43.2	Continuous stellate ganglion (CSG) block a bolus of 10ml (5 + 5 mL) 0.25% bupivacaine was injected after negative aspiration. An elastomeric pump containing a solution of 0.125% bupivacaine 280 mL delivering a 2 mL/h was attached to the cannula. The bump was changed on day 5 and continuous infusion of 0.125% bupivacaine was maintained for 7 days. Vs Continuous Infraclavicular brachial plexus (CIBP) block. A bolus of 30 mL 0.25% Bupivacaine	4 weeks	with guanethidine and control. Intensity of pain, unpleasantness were lower ($p < 0.05$) in the CIBP group at 30 min, 2/h, and 12/h vs the CSG. CIBP patients had reduction in deep pain scores at 30 minutes, 2 hours, 12 hours, and 24 hours. Dull pain score was lower in CIBP group at 2, 12, and 24 hours compared with CSG. No significant difference for all other components in NPSS. Improvement in quality of pain in both group. 100% of patients in	"This preliminary study suggests that both CSG and CIBP blocks may be feasible and effective interventional techniques in management of upper limb CRPS type I. Even though the overall satisfaction of the patients with either of the blocks was not significantly different, CIBP block is much easier to perform and manage. Hence, contrary to the present practice of limiting the use of somatic nerve blocks in those patients who have failed sympathetic block, we suggest that CIBP block can be used as a	SmalSS (N = 30) Unequal randomization, possible randomization failure. Data suggest differences between treatment arms within 24 hours but no difference between 1 & 4 weeks.

						was injected through the catheter after negative aspiration. Catheter was connected to an elastomeric pump containing 0.125% bupivacaine 400mL delivering at 5mL/h. the pump was changed on day 3 and 6 continuous infusion of 0.125% bupivacaine was maintained for 7 days.		CSG group and 91.7% of the patients in the CIBP group had background pain with intermittent flare-ups. At week 4 four of 18 (22.2%) in CSG had back group pain with flare-ups vs 1 out of 12 (8.3%) in CIBP group. Constant back group pain was persisten in 11.1% (2/18) in CSG vs 8.3% (1/120 of CIBP. Occasional intermittent pain was 66/7% (12/18) in CSG vs 83.4% (10/12) in CIBP at 4 weeks. Overall patient satisfaction was 7.78 ±	first line interventional technique for management of CRPS type I of upper extremities."	

								1.309 in CSG vs 7.92 ± 0.996 in CIBP.		

Evidence for the Use of Spinal Cord Stimulators

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Kelmer 2000, 2001, 2002, 2004, 2006, 2008 (score = 7.0)	Use of Spinal Cord Stimulators	RCT		N = 54 with CRPS diagnosed with IASP criteria;18 not working due to CRPS required to have at least a 50% pain reduction to be eligible for SCS implantation		Spinal cord stimulation (SCS) with physical therapy (graded exercises designed to improve strength, mobility, and function of affected hand or foot for 30 minutes twice a week with a minimum of 2 days in between sessions for 6 months duration) (n = 36) vs. PT alone (n = 18).		SCS had lower pain score at 6 months vs. PT group. Of 36 assigned to SCS and PT, 39% scored 6 for global perceived effort vs. 6% for PT-alone; 50% had at least 50% reduction in baseline pain score. Six of 24 SCS patients had 11 infection-related complications. Follow-up evaluation of same patient set described above noted no changes in detection and pain thresholds for pressure, warmth, or cold. (Kelmer 2001) The 2-year follow-up found health-related quality of life improved in group receiving spinal cord stimulation. (2002) Based on VAS scores, results for 2 years not appreciably different than at 6 months. Complications in 38%, mostly 1st year; 3 of 24 SCSs (12.5%) removed first 2 years. After apparent initial significant benefit 1st year, those with SCS gradually had increasing pain scores. By Year 3, while modest reductions in PT group, SCS of no statistically significant benefit. (2006)	"In carefully selected patients with chronic reflex sympathetic dystrophy, electrical stimulation of the spinal cord can reduce pain and improve health-related quality of life."	Content of PT not well described, nor if it differed among groups. Data suggest short- to intermediate-term improvements, but no long-term benefits.

North 2005 (score = 5.5)	Use of Spinal Cord Stimulators	RCT	No mention of sponsorship or COI.	N = 50 with surgical remediable nerve root compression and concordant complaints of persistent or recurrent radicular pain, with or without LBP after 1 or more lumbosacral spine surgeries	Mean age 57. 16 females 8 males.	Spinal cord stimulation (SCS) (n = 24) vs. repeated lumbosacral spine surgery (n = 26) for 3 years of follow-up.	2.9 years	Surgical treatment individualized and among randomized group included discectomy (n = 9 refused, n = 15 accepted), laminectomy (28/47), foraminotomy (24/40), fusion (10/11), and instrumentation (9/12). Long-term success rates at 2.9±1.1 years were SCS 9/19 (47%) vs. reoperation 3/26 (12%).	"[S]CS is more effective than reoperation as a treatment for persistent radicular pain after lumbosacral spine surgery, and in the great majority of patients, it obviates the need for reoperation."	Study tests SCS vs. re-operation, but does not document how it would compare with a quality functional restoration program. Re-operation may be critiqued for being analogous to "more of the same" that had previously failed, thus producing a potential bias in favor of the new treatment.
Kriek, 2016 **(score=6.5)**	Spinal Cord Stimulation	RCT, crossover study	Sponsored by St. Jude Medical. FH is a paid consultant for Grünenthal GmbH; DdR has a patent on burst stimulation and is a paid consultant for St. Jude Medical. The remaining authors declare no conflict of interest.	N=43 patients with complex regional pain syndrome.	Mean age: 42.55 years; 4 males, 25 females.	Standard (n=35) – patients received 40 Hz of stimulation in the CRPS-affected area. Vs 500 Hz (n=35) – patients received 500 Hz of stimulation in the CRPS-affected area. Vs 1200 Hz (n=35) – patients received 1200 Hz of stimulation in	At 3 months (10 week follow up period).	The VAS scores for the standard, 500 Hz, 1200 Hz, Burst, and Placebo groups were 39.83, 40.13, 42.89, 47.98, and 63.74, respectively. The overall statistical outcome was $F_{(1,4)}$=7.834; p<0.001. The McGill pain scores for average pain were 4.70, 5.10, 5.31, 5.66, 7.07, respectively the overall statistic outcome was $F_{(1,4)}$=11.370; p<0.001. For Minimal pain: 3.17, 3.57, 3.69, 4.31, 5.59, $F_{(1,4)}$=13.009; p<0.001. For maximum pain: 6.31, 6.86, 6.52, 7.28, 8.35, $F_{(1,4)}$=5.902; p<0.001. For Pain during exertion: 6.35, 6.66, 6.86, 7.35, 8.41,	The results from this trial allow to conclude that stimulation with 40, 500, 1200 Hz and burst are equally effective in relieving neuropathic pain related to CRPS and are significantly better than placebo.	Crossover trial. Data suggest variation in patient preferences for various frequencies in SCS but suggest all stimulation settings improved compared with placebo/sham.

						the CRPS-affected area. Vs. Burst (n=35) – Patients received multiple burst complexes with an overall frequency of 40 Hz. Vs. Placebo (n=35) – patients received 100 Hz stimulus, however the IPG was switched off after "programming" the stimulus.		$F_{(1,4)}$=8.152; p<0.001. The Global Perceived effect Scores are: Satisfaction: 5.28, 5.31, 4.97, 4.72, 3.52, $F_{(1,4)}$=58.081; p<0.001. Improvement: 4.93, 5.00, 4.72, 4.55, 3.79, $F_{(1,4)}$=4.795; p<0.001.		
Deer, 2017 (score= 4.5)	Spinal Cord Stimulation	RCT	Sponsored by Spinal Modulation, LLC and St. Jude Medical. Several authors had conflicts of interest.	N= 152 patients with chronic, intractable neuropathic pain of the lower limbs associated with a diagnosis of CRPS or causalgia.	Mean age: 52.5 years; 74 males, 78 females.	DRG (n=76) – patients received dorsal root stimulation. Vs SCS (n=76) – patients received spinal cord stimulation.	3 months, 6 months, 9 months, and 12 months.	At 3 months, 69 (DRG) and 70 (SCS) subjects met the composite end point of success, defined as ≥50% in pain reduction at both the trial phase and the indicated follow up without a stimulation-related neurological deficit in the modified intent-to-treat population, p<0.001. At 6 months: 69 (DRG) and 68 (SCS), p=0.04. At 9 months: 66 (DRG) and 65 (SCS), p=0.02. At 12 month: 66 (DRG) and 66 (SCS), p=0.005.	"In conclusion, CRPS I and causalgia, in their chronic forms, are difficult to treat with variable outcomes with conservative symptom management."	No sham/placebo control. Data suggest dorsal root ganglion stimulation may benefit some patients with CRPS who failed other treatments at up to 12 months.

Evidence for Work Conditioning, Work Hardening, and Early Intervention Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow Up Duration:	Results:	Conclusion:	Comments:
Sundstrup, 2014 (score=6.0)	Working Conditioning, Hardening, Early Intervention	RCT	Supported by a grant from the Danish Parliament and Danish Working Environment Research Fund. No COI.	N = 66 patients with chronic pain in shoulder, elbow/forearm or hand/wrist.	Mean age: 45.5; Sex: 51 males, and 15 females.	Resistance Training (RT) group received 10 weeks of resistance training in order to increase physical capacity on pain and disability. (N =33) vs Ergonomic Training (ET) group received ergonomic training and education based on practical outcomes of worksite analysis. (N=33)	10 weeks	Group differences (RT vs EG): Average pain intensity (-1.5, ($p<0.001$)), DASH-W score (-8.8 ($p<0.05$)), Shoulder Rotation Strength (37, ($p<0.001$)), Wrist Extensor Strength (42, ($p<0.001$)).	”Resistance training at the workplace results in clinical relevant improvements in pain, disability, and muscle strength in adults with upper limb chronic pain exposed to highly repetitive and forceful manual work.”	Usual care bias. Data suggest resistance training is advantageous for reducing pain and disability and improving muscle strength for manual workers who perform repetitive and force related tasks.

Hlobil, 2005 (score=6.5)	Work conditioning, work hardening, early intervention program	RCT	Support was by the Dutch Health Insurance Executive Council (CVZ), grant no. DPZ 169/0. No mention of COI.	N = 134 KLM airline workers on site at Schiphol Airport	Mean age: 38 years; 126 males, 8 females.	Usual treatment (n = 67) vs. graded exercise program (n = 67). Intervention 60-minute exercise sessions 2 times a week up to 3 months	6 months	Median lost time after intervention in interventional group 54 vs. 67 days in usual care group. Hazard ratio from 50 day after randomization and onwards favored graded exercise group, p = 0.01. Hazard ratio from 50 days onwards favored graded exercise, p <0.01. NS between groups for total days of sick leave due to recurrent episodes of LBP during 12 month follow-up.	"Graded activity intervention is a valuable strategy to enhance short-term return to work outcomes."	Program had less exercise time than typical in U.S., thus benefits may be underestimated. Noteworthy that at this time, "completing 365 sick leave days entitled the worker to receive disability benefits," thus providing governmental, policy bias against success of program. Demographic information not provided.
Li, 2006 (score=6.5)	Work conditioning, work hardening, early intervention program	RCT	No industry sponsorship or COI.	N = 64 with musculo-skeletal injury and long-term sick leave	Mean age: 43.97 years; 40 males, 24 females.	3-week training on work readiness (n = 34) vs. advice on employment placement (n = 30).	3 weeks	MB knees had larger incremental increase in tibial internal rotation than FB 4.3°, 7.5°, 9.5° vs. 3.0°, 3.0°, 4.2° respectively (at 30, 60, and 90 degrees). 90° difference significant (p =	"[T]raining on work readiness program appeared to be effective in reducing the anxiety and stress levels of the injured workers, improving their self-perception of health conditions, thus	Function comparable but less radiolucency at 2 years with mobile bearing. Demographic information not provided.

								0.043). Incidence of radiolucent lines at tibia implant interface higher in FB knee (p = 0.005). Knee society, WOMAC, and sf-36 scores increased in both groups but did not differ from each other significantly in any area.	gradually creating behavioral changes on their work readiness."	

Evidence for Back Schools

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Ribeiro, 2008 (score=5.5)	Rehabilitation for delayed recovery	RCT	No mention of sponsorship. No COI.	N = 60 with cLBP.	Mean age: 50.45 years; 10 males, 45 females.	Intervention group (IG, N = 29): back school with anatomy ergonomics, ab and back strengthening, and relaxation postures for 1 h/week for 4 weeks, and 1 h session at 30 days vs Control group (CG, N = 31): 3 medical check-up visits with a rheumatologist over 4 weeks, and once 30	Follow-up at baseline, 30, 60, and 120 days.	Acetaminophen intake for IG at day 30 (p=0.039), and a difference between groups at day 120 with less intake for IG (p=0.046). All areas of the SF-36 domain did not have significant results except for improvement the general health domain for IG (p=0.018). There were no statistically significant results between groups in VAS scores (p=0.601), Rolland-	"The results of the present study demonstrate the limited effectiveness of the back school program in the management of chronic nonspecific low back pain when compared to medical visits without educational intervention."	Data suggest comparable efficacy between groups for pain, functional status, anxiety and depression but the back school program appeared to decrease acetaminophen and NSAID consumption.

						days later. Both groups received analgesic medication and acetaminophen.		Morris questionnaire (p=0.735), Schober's Test (spine mobility, p=0.983), and Beck Depression Inventory (traits p=0.697, anxiety p=0.706).		
Morone, 2011 (score=5.5)	Back School	RCT	No mention of industry sponsorship or COI.	N = 73 with chronic non-specific LBP	Mean age of BSG group: 61.2, CG group: 58.6. Sex(M:F) 25:45	Treatment group received intensive multidisciplinary back school program including brief education and active back exercises (n = 41) vs Control group received medical assistance (n = 29).	Follow-up at 3 and 6 months.	Treatment group favored in Waddell Disability Index (WI) at 3 months (p = 0.006) and 6 months (p = 0.009). ODI also similar at 3 months (p = 0.018) and at 6 months (p = 0.011). Both groups improved significantly in VAS scores, but treatment group favored at end of treatment (p <0.001), at 3 months (p <0.001), and at 6 months (p <0.001).	"Our Back School program can be considered an effective treatment in people with chronic non-specific LBP."	Higher baseline ODI in Back School. 1hr sessions for Back School is low for most programs. Baseline differences limit interpretation as does control group as equivalent to a wait-list control bias.
Paolucci, 2012 (score=5.5)	Back School	RCT	No mention of industry sponsorship or COI.	N = 50 with chronic non-specific LBP	Mean age of Back school group: 59, Control group: 57.25. Sex(M:F) 19:31	Treatment group received intensive multi-disciplinary back school program including brief education and active back exercises (n = 21)	Follow-up at 3 and 6 months.	Treatment subgroups only groups to show significant improvement in quality of life. Similar results seen in terms of WI, ODI, and VAS for treatment subgroups.	"[P]atients with chronic non-specific low back pain presenting elevation of one or more scale scores of MMPI-II may benefit by specific educational exercises, such as Back School Program, similarly	Secondary analysis to Morone 2011.

						vs. Control group received medical assistance (n = 29).			to other patients in terms of physical improvement and even more in terms of mental improvement."	
Jaromi, 2012 (score=4.5)	Rehabilitation for delayed recovery	RCT	No mention of sponsorship or COI.	N = 124 nurses with CLBP	Mean age: 31.9 years; 18 males, 93 females.	Intervention group: ergonomics training and back school (ergonomics training exercise and muscle strengthening and stretching) for 50 min sessions 1x/w for 6 weeks, and to continue exercises at home during the week (N = 56) vs Control group: passive physiotherapy (TENS and heat therapy, ultrasound and Swedish massage on lumbosacral region) 1x/w for 6 weeks (N = 55).	Follow-up at 6 and 12 months.	LBP intensity from pre to post-therapy (p=0.000). The intervention group at 6 and 12 months compared to pre-therapy (p=0.000) in reduced LBP intensity. There were also significant results only for the intervention group at post-therapy, 6 month, and 12 month follow-up compared to pre-therapy for body posture in thoracic kyphosis angle, and lumbar lordosis angle (p=0.000 for each).	"The data from the current study showed that for the group who participated in the BS programme, and thus received education and ergonomics skills, the body posture improved, pain was significantly decreased in post-therapy and at the long term at the followup visits as well."	Time of exercise therapy per week dissimilar between groups. Data suggest significant improvement in pain intensity in both groups but at both 6-months and 1-year following the BS group shoved improved pain and posture over control group.
Paolucci, 2016 (score=4.5)	Rehabilitation for delayed recovery	RCT	No COI. No mention of sponsorship.	N = 53 with a diagnosis of chronic low back pain.	Mean age: 60.96 years; 11	Feldenkrais group (N = 26) vs	3 - months	At the end of treatment (Tend), between groups regarding	"The efficacy of the Feldenkrais method was comparable with	Data suggest comparable efficacy.

					males, 42 females.	Back School group BS (N = 27),		chronic pain reduction (p=0.290); VAS and MAIA-N sub scores correlated at Tend (R=0.296, p=0.037). By the Friedman analysis, changes in pain (p<0.001) and disability (p<0.001) along the investigated period.	that of the BS for nonspecific CLBP."	
Constantino, 2014 (score=4.5)	Rehabilitation for delayed recovery	RCT	No mention of sponsorship or COI.	N = 56 with chronic NSLBP.	Mean age: 73.46 years; 30 males, 24 females.	Back school program: education on anatomy, ergonomic positions, psychological management, and muscle strengthening and stretching (N = 28), vs Hydrotherapy program: pool exercises of strengthening and stretching (N = 28). Each group had 1 hour treatment sessions 2x/w for 12 weeks.	Follow-up at baseline (T0), 12 [339], and 26 weeks (T2).	Statistically significant results were seen from T0 to T1 in improvement in RMDQ and SF-36 scores for both Back School (p<0.001, p<0.001 respectively), and Hydrotherapy (p<0.001, p<0.001 respectively). The same significant results were seen from T0 to T2 in both groups. There were no statistically significant difference between the two groups at T0, T1, and T2 (p=0.096, p=0.925, p=0.885 respectively).	"[T]he lack of significant difference between the two programs highlighted by the data proved that both therapeutic options could be equally effective in treating CLPB in elderly people".	Comparable efficacy between groups.
Henchoz, 2010 (score=4.0)	Back School	RCT	No mention of industry sponsorship or COI.	N = 109 with subacute (> 6 weeks) or chronic (> 12 weeks) LBP	Mean age: 39.6;	Functional multi-disciplinary (FMR)	12 months	At 12 months the FMR improved significantly compared to OP in work status (p =	"[T]he FMR group evolved significantly more favorably compared to the	Much missing data, especially OP group. Baseline differences

					Sex: 69 males, 33 females.	(n = 56) vs Outpatient physiotherapy (OP) (n = 23).		0.012). Fingertip-floor distance was also significantly improved in the FMR group compared to OP at 12 months (p = 0.037). There were no other significant findings between groups at 12 months follow-up.	OP group in disability in the short and long terms, and in work status at long term."	including better fitness in MDRP group, possible moderate randomization failure. As all of work <6mo, likely had PT, which would bias in favor of other treatment. Data favor MDRP.
Durmus, 2014 (score=4.0)	Rehabilitation for delayed recovery	RCT	No mention of sponsorship. No COI.	N = 127 with CLBP	Mean age: 53.06 years; 0 males, 121 females.	Group 1: exercise treatment (flexibility and strengthening, N = 63), vs Group 2: low back school (ergonomics, anatomy, functional ADL movement and rest) and exercise treatment (N = 64). Both groups had 60 min of exercise therapy 3x/week for 3 months, with Group 2 having an additional 30 min 8 sessions over 4 weeks.	Follow-up at baseline [340], 3 (AT) and 6 months (F).	Group 1 from BT to AT, and BT to F in ODQ, 6MWT, VAS pain, FMS, EMS, AET, QMS (right and left), EET, Beck depression score, and SF-36 (all P < 0.05).	"The results of this study showed greater improvements in pain, disability, trunk and knee muscle strength, walking performance, QOL, and depression in the back school and exercise group than the exercise group. The benefits were persisted at 6 months follow-up."	Both groups showed significant improvement but mobility improved more in the combined back school program with exercise group.

Norbye, 2016 (score=3.5)										Wait list control bias. Data suggest similar efficacy at 12 month follow-up between groups for return to work (RTW) between groups with a slight trend toward WL group returning earlier.
Pain Management										
Kool, 2005 (score=8.0)	Back School	RCT	Supported by Swiss Federal Office of Health (Grant no. 00.00437). No mention of COIs.	N = 174 age 20-55 and non-acute non-specific LBP	Mean age of FCT group: 41.6, PCT group: 42.5; 137 males, 37 females.	Pain centered (PC) treatment to reduce pain 2.5 hours a day, 6 days a week for 3 weeks (n = 87) vs. Function centered (FC) treatment to increase work related capacity 4 hours/day, 6 days a week for 3 weeks (n = 87).	Follow-ups to 3 months.	Days at work after 3 months post-treat: FC 25.9±32.2 vs. PC 15.8±27.5, p = 0.029. Lifting capacity change after treatment: floor-waist 2.3±5.4 vs. 0.2±3.9, p = 0.004. Perceived effect after treat: physical capacity 4.1±2.1 vs. 2.9±1.7, p <0.001; general well-being 4.0±2.1 vs. 3.1±1.9, p = 0.005; overall improvement 4.4±2.0 vs. 3.6±2.0, p = 0.009. Pain change: post treat: 0.25±2.1 vs. 0.55±1.9, p = 0.23; 3 months NS.	"Function-centered rehabilitation increases the number of work days, self efficacy, and lifting capacity in patients with nonacute nonspecific LBP."	Data suggest pain-centered treatment inferior to function-centered over 3 months. No long-term follow-ups. Study in Switzerland and not clear how applicable elsewhere.

Buhrman, 2011 (score=6.0)	Back School	RCT	Grant from Swedish Council for Working and Life Research. No mention of COIs.	N = 54 with chronic back pain ≥3 months, on sick leave from work, who have internet access.	Mean age: 43.2 Sex(M:F) 17:37	Self-help on-line management program (iCBT) (n = 26) vs. Control (n = 28).	12 weeks	Groups not different in any variables except catastrophizing (p=0.003). Quality of life decreased in controls (1.8 (SD 1.5) to 1.1 (SD 1.6)) vs. intervention (1.2 (SD 1.4) to 1.7 (1.4).	"[T]his study suggests that iCBT can result in a decrease in catastrophizing and an improvement in quality of life…"	Data suggest reduced catastrophizing although most results not significant.
Chiauzzi, 2010 (score=4.0)	Back School	RCT	Small Business Innovation Research [341] Phase II grant (#9R44DA022802-02) from National Institute on Drug Abuse. No mention of COIs.	N = 209 with back pain lasting 10 days each month for 3 months with spinal origin of pain.	Mean age: 46.14. Sex(M:F) 64:134	ACTION-Back Pain educational web site (n = 104) vs Back pain information only (n = 105).	3, 6 months	At posttest the treatment group reported greater improvements of global pain intensity compared to control (p <0.05).	"[P]ainACTION-Back Pain, an online self-management program for persons with chronic back pain, is helpful in reducing pain and stress, and improving coping abilities."	Data suggest intervention may be more efficacious for multiple outcomes.
Other										
Frost, 1995 (score=7.5)	Back School	RCT	No mention of COIs.	N = 81 moderately disabled chronic LBP subjects for at least 6 months	Mean age of fitness group: 34.2, Control group: 38.5. Sex(M:F) 34:37	Fitness program plus back school (n = 36) vs. Back school (n = 35). Fitness program 8 1-hour sessions for 4 weeks (warm up and stretching, then circuit of 15 progressive exercises, then stretching and "light aerobic" exercise,	6 months	Sensory pain score mean±SD before/after for fitness group vs. education group: 20.9±12.3/12.1±9.9 vs. 25.6±17.9/22.1±20.1, p <0.05. Disability Oswestry scores: 23.6±9.7/17.6±10.9 vs. 23.6±12.3/21.7±13.6, p <0.005. Walking distance (m): 445±140.8/553.7±154.5 vs.	"[M]oderately disabled patients with chronic low back pain who attend a back school and fitness programme benefit more in the short and long term than patients who attend a back school and exercise independently at home."	Data suggest fitness exercise of additive benefit to back school, including at 6 months.

						psychological principles taught by physiotherapist, and avoidance of discussion of pain). All given exercises to perform at home.		408.9±166.4/421.4± 167.4, p <0.005.		
Cherkin, 2001 (score=7.0)	Back School	RCT	Grant from Group Health Cooperative, The Group Health Foundation, and John E. Fetzer and Grant (HS09351) from Agency for Healthcare Research and Quality. No mention of COIs.	N = 262 with subacute and chronic LBP	Mean age: 44.9 Sex(M:F) 110:152	Traditional Chinese acupuncture (n = 94) vs. Massage (n = 78) vs. Self-care education (n = 90) for 10 weeks	4, 10, and 52 weeks.	At 10 weeks, massage superior to self-care for symptom scale, (3.41 vs 4.71; p = .01) and disability scale (5.89 vs 8.25; p = 0.01). Massage also superior to acupuncture on disability scale (3.08 vs 4.74; p = .002) After 1 year, massage no longer better than self-care but still superior to acupuncture on symptom scale (3.08 vs. 4.74, p = 0.002), dysfunction scale (6.29 vs 8.21, p = .05).	"Traditional Chinese Medical acupuncture was relatively ineffective. Massage might be an effective alternative to conventional medical care for persistent back pain."	Lack of control group limits conclusions. Study results suggest all groups improved, with additional benefit in therapeutic massage group compared with acupuncture. However, outcome is of uncertain clinical significance. Massage not well described.
Lamb, 2010 (score=6.0)	Back School	RCT	Funding National Institute for Health Research Health Technology Assessment	N = 705 with at least moderate LBP for >6 wks.	Mean age of Control group: 54, Intervention group: 53.	Active management + Cognitive behavioural intervention or AM + CBA for 2-	Follow-up at 3, 6, 12 months.	Advice plus cognitive behavioral group improved significantly compared to the control group in every measurement	"[C]ognitive behavioral intervention package for low-back pain has an important and sustained effect at	Large sample size. Subacute and chronic low back pain. Data suggest less disability with

			Programme. No mention of COIs.		Sex(M:F) 285:420	day training on goal setting + pacing + challenging beliefs + managing pain + improving communication (n = 468) vs. Advice management alone for 15 minutes nurse consultation + back book (n = 233).		except short-form health (SF-12) survey (p <0.001) at 12 months.	1 year on disability from low-back pain at a low cost to the health-care provider."	CBI group over 1 year.
McKenzie Approach										
Cherkin 1998 (7.0)	Back School	RCT	Grant (HS07915) from Agency for Health Care Policy and Research. No mention of COIs.	N = 323 who saw primary care physician and still had LBP 7 days after	Mean age: 40.7±10.7 Sex(M:F) 167:154	McKenzie approach PT (9 sessions, n = 133) vs. Chiropractic manipulation (short-lever, high-velocity thrust/9 sessions, n = 122) vs. educational booklet (n = 66) for 4 weeks.	2 years	Booklet (n = 65) vs. chiropractic (n = 119) vs. PT (n = 129) bothersome of symptoms mean (95% CI), and Roland Disability mean (95% CI) measured at baseline: 5.3 (4.9-5.7)/5.5 (5.1-5.8)/6.0 (5.6-6.5)/p unadjusted = 0.04, 11.7 (10.4-13.0)/12.1 (11.2-13.1)/12.2 (11.2-13.1)/p unadjusted = 0.83. Booklet (n = 63) vs. chiropractic (n = 118) vs. physical therapy (n	"[T]he McKenzie method of physical therapy and chiropractic manipulation had similar effects and costs, and patients receiving these treatments had only marginally better outcomes than those receiving the minimal intervention of an educational booklet."	Considerable prescription of exercise in chiropractic group, thus assessment of value of manipulation not possible. Data suggest PT and manipulation/ exercise superior to educational booklet, although magnitudes of benefits modest. Baseline

								= 117) at 12 weeks: 3.2 (2.4-4.0)/2.0 (1.6-2.4)/2.7 (2.2-3.2)/p unadjusted = 0.02/p adjusted = 0.06, 4.3 (3.1-5.5)/3.1 (2.4-3.9)/4.1 (3.2-5.0)/p unadjusted = 0.15/ p adjusted = 0.28.		differences with less pain in chiropractic group. No differences in outcomes other than costs reported between booklet, and McKenzie exercise protocol.
Filiz, 2005 (score=6.5)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342].	N = 60 attending an outpatient clinic after having single-level discectomy	Mean age: 39.9; Sex: 31 males, 29 females.	Intensive exercise plus back school education (4 sessions a week plus 1.5 hour intensive exercise 3 times a week for 8 weeks, N = 20) vs. home exercise plus back school education (4 sessions a week plus McKenzie exercises 3 times a week, n = 20) vs. Control (n = 20). Subjects received interventions 30 days post-discectomy.	8 weeks	Intensive exercise+ back school vs. home exercise + back school vs. control post-treatment mean±SD for RTW (days), lumbar Schober (cm), VAS, back endurance, abdominal endurance, modified ODI, back depression inventory, LBP rating scale: 56.07± 18.66/75± 29.94/86.25±27.11/ p <0.001, 14.05±0.81/13.55±0 .86/12.75±0.79/p <0.001, 4.50±1.59/12±3.67/ 13.25±7.34/p <0.001, 294±90.45/188±73. 88/96±40.93/ p <0.001, 236±88.46/161.75±	"[P]ostoperatively applied education and exercise applications should be part of treatment with respect to the patients' earlier return to work and quicker recovery."	Data suggest intensive exercises superior.

								69.44/65.25 ±37.99/p <0.001, 7.05±4.87/11.65±7.21/ 15.10±8.55/p <0.001, 4.15±4/6.3±6.99/ 6.5±7.03/p <0.001, 7.40±6.92/22.45± 13.94/39.6±20.54/p <0.001.		
Stankovic, 1990 (score=4.5)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342].	N = 100 with acute LBP	Mean age: 34.4 ± 9.7; Sex: 77 males, 23 females.	McKenzie exercises for 20 for 2 weeks minutes (n = 50) vs. Mini-back school lesson once for 45 minutes (n = 50).	3 & 52 weeks.	McKenzie group RTW earlier (100% at 6 weeks vs. 11 weeks, p <0.001). Mean sick leave duration shorter with McKenzie (11.9±6.5 days vs. 21.6±15.3, p <0.001). More LBP recurrences in 1st year of observation for mini-back school (27 vs. 9, p <0.001). McKenzie group fewer episodes recurrent LBP (30 vs. 37, p <0.01) and sick leave (24 out of 47, 51.1% vs. 31 out of 42, 73.8%, p <0.03).	"Treatment according to the McKenzie principle is in this study superior to 'mini back school'."	Study suggests benefit of stretching/exercise per McKenzie protocol for acute LBP provides greater benefit than education alone. No details on co-intervention control and low compliance to protocol limits conclusions.
Stankovic 1995 (score=4.5)	Back School	RCT	See above.	See above.	See above.	See above.	5 years	After 4 years, McKenzie Group less LBP recurrences than mini back school group (p <0.01). McKenzie group less sick leave (p <0.03). No differences between groups for	"Two conclusions can be drawn from the study: 1) the difference between groups was much less after 5 years compared with 1 year, and 2) patients who received treatment	Five-year follow-up.

								help with treatment, ability to self help, number of attacks during recurrences, positions/activities that caused pain to recur, or physical activities and smoking.	according to McKenzie principle 5 years earlier had significantly less recurrences of pain and had significantly less sick leave."	
Back School Education										
Frost, 1998 (score=6.5)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342]	N = 81 moderately disabled chronic LBP subjects for at least 6 months	Mean age of Fitness group: 35.4 ± 9.1, Control group: 40.2± 9.2. Sex(M:F) 28:34	Fitness program plus back school (n = 31) vs. Back school (n = 31). Fitness program 8 1-hour sessions for 4 weeks (warm up and stretching, then circuit of 15 progressive exercises, then stretching and "light aerobic" exercise, psychological principles taught by physiotherapist, and avoidance of discussion of pain). All given exercises to perform at home.	2 years	Fitness plus back school vs. back school mean±SD (range) Oswestry questionnaire score (%) at pre-treatment, 6 months, and 2 years: 23.1±9.5 (2-46)/24.9±12.8 (4-48), 16.0±9.2 (0-38)/21.7±14.2 (0-50), 15.4±11.3 (0-52)/22.5±15.4 (2-64). Fitness plus back school with reduction (p <0.001) of 7.7% vs. 2.4% in back school (p >0.05). Difference in ODI mean (95% CI): 5.8 (0.3-11.4), p <0.04.	"Exercise can take many forms and we have demonstrated benefits of a general non-specific fitness programme designed for patients with chronic low back pain."	Data suggest fitness of additive benefit to back school and benefits persisted at 2 years. Used CBT.

Hazard, 2000 (score=6.5)	Back School	RCT	Grant H133E30014–95 from National Institute on Disability and Rehabilitation Research. No mention of COIs	N = 486 who filed an occupational back-related injury	Mean age: 37.6; Sex: 274 males, 176 females.	*Good News About Back Pain* pamphlet (sent 11 days after injury, n = 244) vs. No pamphlet (n = 245).	Final follow-up at 6 months.	Pamphlet vs. no pamphlet primary outcome for disability (% not working), and mean±SD lost work days measured at 3 months: 7.9%/7.7% (p = 1.00), 18.7±42.5/18.2±41.5 (p = 0.90). At 6 months: 6.5%/5.9% (p = 0.84), 19.1±43.2/18.1±42.8 (p = 0.83). Changed/modified jobs differed at 3 months, p = 0.002.	"The results of the present study do not suggest any advantage of psychosocially oriented recovery advice compared with the equivocal impact of more traditional biologic approaches common in back schools."	Data suggest education booklet ineffective.
Burton, 1999 (score=6.0)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342].	N = 162 with acute non-specific LBP <3 months	Mean age: 43.6; Sex: 73 males, 89 females.	Back book (evidence-based information and advice consistent with current clinical guidelines, N = 83) vs. Handy hints control (N = 79).	Final follow-up at 1 year.	Back book vs. handy hints mean±SD baseline pain at worst, baseline pain at best, pain at worst 1 year, and pain at best 1 year: 71.5±19.2/68.7±18.5, 15.8±17.5/15.6±18.7, 50.9±29.6/50.8±27.8, 10.1±16.6/10.6±17.8. Mean belief scores differed at 2 weeks (p = 0.02), 3 months (p = 0.02), and 1 year (p = 0.05).	"This trial shows that carefully selected and presented information and advice about back pain can have a positive effect on patients' beliefs and clinical outcomes, and suggests that a study of clinically important effects in individual patients may provide further insights into the management of low back pain."	Data suggest addressing FABs is effective.
Heymans, 2006 (score=6.0)	Back School	RCT	Granted by The Netherlands Organization for Health Research	N = 300 workers sick listed for 3 weeks	Mean age: 40.27;	High-intensity back school (1 hour sessions, 2	Final follow-up at 6 months.	Low intensity vs. usual care/high intensity vs. usual care/low intensity	"[L]ow-intensity back school has beneficial short-term effects	Study based in the Netherlands and unclear if prolonged

			and Development (Zon/Mw), Dutch Ministries of Health, Welfare and Sports and of Social Affairs and Employment. No mention of COIs.	because of non-specific LBP	Sex: 236 males, 63 females	times a week for 8 weeks and including CBT, n = 98) vs. Low-intensity back school (weekly group sessions for 4 weeks, n = 98) vs. Care as usual (n = 103).		vs. high intensity hazard ratios (95%CI) ITT, per protocol analysis, and complete case analysis: 1.4 (1-1.9)/1 (0.8-1.4)/1.3 (1-1.8), 1.4 (1-1.9)/0.9 (0.6-1.2)/1.6 (1.1-2.3), 1.4 (1-2)/1.1 (0.8-1.5)/1.3 (1-1.9). P value: p = 0.06/p = 0.83/p = 0.09, p = 0.06/p = 0.39/p = 0.01, p = 0.03/p = 0.68/p = 0.09. Differences in kinesiophobia and functional status for low intensity vs. usual care at 3 months: p = 0.00, p = 0.01.	compared with care as usual and a high-intensity back school on sick-leave, functional status, and kinesiophobia."	durations of time off work and population studied apply elsewhere.
Triano, 1995 (score=5.5)	Back School	RCT	Grants from Lincoln College Education and Research, and foundation for Advancement of Chiropractic Education. No mention of COIs.	N = 209 with chronic LBP >50 days duration or at least 6 episodes in prior year	Mean age: 41.6 Sex(M:F) 113:96	Chiropractic adjustments, n = (high-velocity, low-amplitude spinal manipulation) vs. sham adjustments (high-velocity, low-force mimic) vs. back education program (no exercises) for 2 weeks of	2 weeks after treatment.	Oswestry scores chiropractic manipulation 17.5±12.8 to 9.5±6.3 at 2 weeks to 10.6±11.7 at 4 weeks vs. sham 21.7±15.0 to 15.5±10.8 to 14.0±11.7 vs. education: 20.2±13.6 to 12.3±8.4 to 11.4±10.3, p = 0.012 between groups at 2 weeks. VAS scores: DC 38.4±23.4 to	"In human terms, however, there appears to be clinical value to treatment according to a defined plan using manipulation even in low back pain exceeding 7 weeks duration."	Attempted sham and blindings strengths, but study not truly blinded other than assessor and potentially blinded patient (belief in sham vs. true not reported). Many baseline data not given; dropouts high. No intermediate or long-term follow-up. ODI only favored

						treatment 6 days a week		13.9±15.3 at 2 weeks to 13.3±15.9 at 4 weeks vs. sham 37.4±23.7 to 19.8±18.3 to 21.7±24.4 vs. education: 35.6±23.0 to 19.6±17.6 to 15.1±19.4. Zung scores were not significant between groups.		manipulation at intermediate. At 4 weeks, no difference between chiropractic manipulation and back education. Data do not support conclusion of manipulation efficacy compared to education treatment.
Indahl, 1998 (score=5.5)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342].	N = 489 with sub chronic LBP lasting 4-12 weeks in Norway	Mean age: 41.6; Sex: 306 males, 183 females.	Standard medical care (control, n = 244) vs. Mini back school (intervention, n = 245).	Final follow-up at 5 years.	After 5 years, 81% of intervention group vs. 65% of controls had returned to work. Rates of permanent disability higher in controls (19% vs. 34%).	"Informing patients with subchronic LBP about the nature of their problem, in a manner designed to reduce fear and give them reason to resume light normal activity as a form of treatment, may reduce long-term disability."	Unclear if study population with such prolonged time away from work applies to U.S. or elsewhere. Those not returning to work were less physically active.
Leclaire, 1996 (score=5.0)	Back School	RCT	Grant RS-87-35 from Institiut de recherché en sante et en securite du travail du Quebec. No mention of COIs.	N = 168 workers with acute LBP <3 months (mean = 15 days)	Mean age of back school group: 31.9, Standard therapy group: 32.2. Sex(M:F) 98:70	Daily physiotherapy + back school (n = 82) vs. Daily physiotherapy (N = 86). Daily physiotherapy program consisted of rest, NSAIDS,	Final follow-up at 12 months.	Improvement in functional disability favored daily physiotherapy vs. back school with ODI and Roland-Morris scores, p = 0.02, p = 0.01. At end of treatment, improvements in mobility/SLR Schober test	"A back school intervention in addition to standard care resulted in no reduction in the time to return to work or the number or duration of recurrences of low back pain requiring	Rates of recurrences worse in back school group, and back school intervention in addition to standard care resulted in no reduction in RTW time or number or

						daily, and analgesics. Back school three 90-minute session at 0, 1, and 8 weeks.		favored daily physiotherapy vs. back school: p = 0.01. Back school showed gain in knowledge and performed exercise program better: p = 0.0001, p = 0.0001.	compensation over a period of 1 year."	duration of compensable LBP recurrences over 1 year.
Cairns, 2006 (score=5.0)	Back School	RCT	No funds received in support of this work. No benefits in any form have been or will be received from commercial party related directly or indirectly to subject of this manuscript. No mention of COIs.	N = 97 with chronic LBP mean 9.6 and 7.9 months duration	Mean age of Stabilization group: 37.5, Conventional group: 39.9. Sex(M:F) 47:50	Stabilization with physiotherapy (n = 47) vs. Usual physiotherapy (n = 50). Initial assessment 60 minutes with 30 minutes follow-up totaling 12 treatments over 12 weeks. Spinal stabilization exercise group focused on endurance training for deep abdominal and back extensor muscles.	6 & 12 months	Most received exercises other than stabilization exercises (100% of conventional group and 45/47 = 94% of stabilization), plus many other treatments and modest differences in manual therapy between 2 groups – manual therapy 38 (76%) vs. 32 (67%). No differences between groups for Roland and Morris disability, ODI, modified Zung, modified somatic perception questionnaire, distress risk assessment method, short form McGill pain questionnaire, or quality of life.	"Patients with LBP had improvement with both treatment packages to a similar degree. There was no additional benefit of adding specific spinal stabilization exercises to a conventional physiotherapy package for patients with recurrent LBP."	Dropout rate 30% in each group. Many co-interventions. No control or sham group. Data suggest stabilization specific exercise not beneficial in addition to conventional PT treatment; however, study weaknesses preclude strong conclusions.
Moseley, 2004 (score=5.0)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342].	N = 58 with CLBP >6 months.	Mean age of Experimental group: 42±10, Control	Education sessions on neurophysiology of pain (3 hour sessions 5 days	15 weekdays	Neurophysiology vs. back school had higher SOPAR + PCS scores at post-treatment, p <0.0001.	"[N]europhysiology education results in some normalization of pain cognitions and physical	Data suggest educational program efficacy.

					group: 45±6. Sex(M:F) 25:33	a week for 2 weeks, n = 31) vs. Back education (n = 27) for duration of 2 weeks.		Neurophysiology group vs. back school with difference in seeking care when in pain, controlling pain, and perceiving as less disabled: p = 0.024, p = 0.002, p = 0.022. Pre-/post-treatment raw scores for self-reported and physical performance effect size(95% CI) for RMDQ, SOPA (seeking care from others), SOPA(emotions affect pain), SOPA (pain controllable), SOPA total, PCS, SLR(°), and bending (cm from floor): 2 point (0.4 to 3.6), 1 point (-1.2 to -3.2), 2 (0.4 to 3.6), 2 (0.4 to 3.6), 4 (2.1 to 5.9), 9 (6.5 to 11.5), 6 (3.8 to 8.2), 5 (4 to 6), 4(0 to 8.2).	performance but not in self-perceived disability."	
Sorensen, 2010 (score=5.0)	Back School	RCT	Funding granted by IMK Foundation, Health Insurance Foundation (Sygekassernes Helsefond), Tryg Foundationen, Funen County Research	N = 207 age 18-60 with chronic LBP lasting at least 4 of last 12 months. Pain had to be greater in back than	Mean age: 39. Sex(M:F) 99:108	Educational program [343] (n = 105) vs. Physical training [344] (n = 102). Pragmatic trial.	2, 6, 12 months	Both groups improved in pain scores (p <0.001). The EDUC improved significantly in fear avoidance beliefs (p = 0.05) compared to baseline. Both groups did not significantly	"A cognitive intervention for cLBP resulted in at least as good outcomes as symptom-based physical training method despite fewer treatment sessions."	Different exercise Rx. Different approaches between groups. Higher dropouts in physical training, Data suggest

			Foundation, and Danish RheumatismAssociation. No mention of COIs.	associated leg pain.				improve in back beliefs (p = 0.16 and 0.13).		comparable results, although fewer contacts.
Lindström, 1992 (score=4.5) .	Back School	RCT	Supported by Arhetsmarknadens forsakringsaktiebolag (MA), Stockholm, Sweden; Volvo Company, Goteborg, Sweden; Medical Faculty of University of Goteborg, Goteborg, Sweden; AMF-Trygghetsforsakring, Stockholm, Sweden; Greta and Einar Asker Foundation Goteborg, Swedcn; and Knha and Felix Neuberg Foundarion, Goteborg, Sweden. No mention of COIs	N = 103 with subacute LBP off work for 6 weeks	Mean age of activity group: 39.4, Control group: 42.4. Sex(M:F) 71:32	Graded activity group (n = 51) vs. Controls: no treatment (n = 52) for 1 year. Graded activity group with measured functional capacity (mobility, strength and fitness), workplace visit, back school education, and an individual, submaximal gradually increased exercise program with operant conditioning.	2 years	Increases in arm strength, abdominal muscle strength, back muscles, and many other outcome measures preserved at 1 year in activity group. Activity group RTW 5.1 weeks earlier, p = 0.03.	"The patients with subacute, nonspecific, mechanical LBP who participated in the graded activity program regained occupational function faster than did the patients in the control group, who were given traditional care."	Involved orthopedic surgery and physiotherapy. GPs administered routine care, but not otherwise involved in trial. Social worker performed psychosocial screening. Graded activity program reduced long-term sick leave, especially in males. Intensive exercises, work-hardening exercises, or expensive equipment not necessary to regain occupational function.
Daltroy, 1997 (score=4.5)	Back School	RCT	Grant (AR36308) from National Institutes of Health. No mention of COIs.	N = 3,597 U.S. postal workers with LBP	Mean age of Interventio n group: 43.0 ± 12 0, Control group: 42.0±12.5.	Employee-back education programs (n = 1703) vs. Control (n = 1894).	Final follow-up at 5.5 years.	Differences in seasonal lifting-and-handling injuries between groups, p <0.001. Differences in total costs, medical costs, and personnel-replacements costs	"A large-scale, randomized, controlled trial of an educational program to prevent work associated low back injury found no long-term	No reductions in injuries, lost time, or recurrences of injuries. Data suggest no long-term benefits associated with training.

					Sex(M:F) 2681:916			for workers with LBP history vs. workers with no LBP history: p = 0.005, p = 0.03, p = 0.004.	benefits associated with training."	
Sahin, 2011 (score=4.5)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342].	N = 146 with chronic LBP longer than 12 weeks without neurological deficits.	Mean age of BSG group: 47.25, CG group: 51.36. Sex(M:F) 34:112	Back school plus physiotherapy [39] (n = 75) vs. Physiotherapy alone (CG) (n = 75) for 2 weeks.	3 months	BSG improved significantly compared to CG in VAS pain and Oswestry (ODQ) scores (p=0.010 and p <0.001) at post-treatment and 3 months (p = 0.002 and p <0.001).	"[A] back school programme has an effect on pain and disability when given in addition to physical treatment modalities and exercises."	Limited generalizability due to exclusion criteria.
Walsh, 1990 (score=4.0)	Back School	RCT	Grant 88-0331 Institutional Biomedical Research. No mention of COIs.	N = 90 grocery warehouse workers (to prevent LBP)	Mean age: 29.4; No mention of Sex.	Back school one 1-hour session (Group 2, n = 27) vs. Back school and lumbosacral orthosis (Group 3, n = 27) vs. control group (Group 1, n = 27) for 6 months.	6 months	Abdominal muscle strength increased in all groups and increased most in back school plus orthosis group. Lost days in controls changed from 0.4±0.2 to 0.8±0.5 (6 months previously vs. 6 months during the study). In back school group, lost days changed from 3.2±1.9 to 2.6±1.6 vs. 2.9±1.2 to 0.5±0.4 for combination group.	"It appears that the use of intermittent prophylactic bracing has no adverse effects on abdominal muscle strength and may contribute to decreased lost time."	Abdominal muscle strength measured, but not back muscle strength. Authors concluded results support combination of education and bracing but no bracing-only group, and education appeared to have no effect. Lost days in 6 months pre-study markedly different in groups at baseline, suggests randomization failure.
Hurri, 1989 (score=4.0)	Back School	RCT	No mention of industry sponsorship or	N = 188 workers with chronic LBP	Mean age: 46.1±9.5 for	Swedish back school (n = 95)	12 months	Differences for Swedish back school group for mean VAS	"[C]hronic low back pain patients may benefit from	VAS pain scores favored back school. No

			conflict of interest [342].	≥12 months in Sweden	treatment group, 45.4±9.2 for control group; 0 males, 188 females.	vs. handout containing information presented at back school (n = 93). Swedish back school consisted of 60 minute education plus exercise 6 times within 3 weeks. Final follow-up at 12 months.		at 6, 12 months: p = 0.01, p = 0.05. Swedish back school vs. control mean pain index differences at 6, and 12 months: p = 0.01/NS, p = 0.01/p = 0.05. Differences in Swedish back school for forward flexion 1(cm), right lateral flexion (cm), left lateral flexion (cm), stomach muscle exercises (max 10), static trunk extension strength (kp), flexion strength (kp), pain during forward flexion, pain during lateral flexion of spine, and pain during dynamic back muscle exercise at 12 months: p = 0.001, p = 0.001, p = 0.01, p = 0.05, p = 0.001, p = 0.001, p = 0.05, p = 0.05, p = 0.01. Differences in control for forward flexion2 (cm), right lateral flexion (cm), and left lateral flexion (cm) at 12 months: p = 0.01, p = 0.05, p = 0.05.	the back school regimen."	change in sick leave with back school. Impacts may be contextual (Finland).
Tao, 2005 (score=4.0)	Back School	RCT	Supported by Procter & Gamble Company. No mention of COIs.	N = 43 with work-related acute muscular LBP	Mean age of Treatment group: 35.0, Reference	Education only: written materials describing LBP (n = 18) vs.	Follow-up Days 4, 7, and 14.	Pain intensity (Day 0/Day 14): heat wrap (0.00/-3.85) vs. education (0.0/-2.22), p = 0.0046). Pain relief (Day	"[H]eat wrap therapy using ThermaCare Heat Wrap significantly reduced pain intensity,	Education as comparison may have biased in favor of Heat Wrap.

					group: 36.2. Sex(M:F) 7:36	Education with ThermaCare Heat Wrap: heat wrap worn 3 consecutive days during daytime hours and taken off at end of each day (n = 25).		0/14): heat wrap (0.00/4.04) vs. education (0.00/2.83), p = 0.0032. Roland Morris Score (Day 0/14): heat wrap (0.00/-6.55) vs. education (0.00/-2.53), p = 0.0026.	increased pain relief, and improved disability scores during and after treatment adjusting for sex, age, baseline pain intensity, and pain medications."	
Larsen, 2002 (score=4.0)	Back School	RCT	Industry sponsored by foundation funds. No COI.	N = 314 male present at regiment infirmary at prescribed medical check during first week of military service and willingness to participate.	Mean age: 21±1.5; Sex(M:F) 314:0	Intervention group at baseline, all conscripts participated in back school lesson lasting 40 minutes (n = 150) vs. Control group at baseline, there was no intervention in the control group, and no attempt was made to ensure that conscripts did not perform the same exercises (n = 164).	Follow-up for 10 months.	The baseline characteristics for the study population did not significantly differ on any characteristics from total baseline population. Intent-to-treat analysis; at follow-up there were no significant differences between the two groups the last 3 weeks. No significant differences between groups at follow-up in the group seeking medical care because of back problems preceding military service: 4 or 25% in the intervention group versus 6 or 25% in the control group, p = 1.000. Worst-case	"It may be possible to reduce the prevalence rate of back problems and the use of health care services during military service, at a low cost, using passive prone extensions of the back motivated by a back school approach, including the theory of the disc as a pain generator and ergonomic instructions."	Many weaknesses. High dropouts. Data suggest exercise may prevent LBP.

								analysis; there was 1 year lower prevalence of back problems in the intervention compared to control group, 45 % compared to 57%, p = 0.025.		
Maastricht Back School										
Keijsers, 1989 (score=4.0)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342].	N = 30 with LBP >6 months in the Netherlands	Mean age: 49.7 years; 12 males, 18 females.	Maastricht Back School (7 1.5 hour sessions, n = 16) vs. WLC (n = 14).	Final follow-up at 8 weeks.	Pre-post test score differences between groups for somatic fixation, internal locus of control, and seeking social support: p <0.05, p <0.01, p <0.01.	"The results suggest that the Back School program for patients with chronic low back pain can have a positive effect."	Small groups. Most variables not significant. Smaller sample than Keijsers 1990 article to address same topic.
Keijsers, 1990 (score=4.0)	Back School	RCT	No mention of industry sponsorship or conflict of interest [342].	N = 77 with LBP ≥2 months in the Netherlands	Mean age: 35.8; 39 males,38 females.	Maastricht Back School Vs No treatment.	Final follow-up at 6 months.	At 6 months, differences in time and condition between groups: p = 0.001, p = 0.001.	"Although bias cannot be excluded from our study results, it does not seem likely that the Maastricht Back School is an effective method of managing LBP."	Data suggest lack of efficacy.
Bio Education – LBP										
Ryan, 2010 (score=4.5)	Back School	RCT	Funded by School of Health and Social Care of Glasgow Caledonian University. No mention of COIs.	N = 38 age 18-65 with non-specific LBP lasting longer than 3 months and no history of back surgery.	Mean age: 45.3; Sex: 13 males, 25 females	Pain biology education (ED) (n = 18) vs. Pain biology education with physical exercise (EDEX) (n = 20).	3 months	Pain rating (0-100) and pain efficacy (0-60) improved significantly in the ED group compared to EDEX (p=.025 and p=0.024). Groups were not significantly	"[P]ain biology education was more effective for pain and pain self-efficacy than a combination of pain biology education and	High dropout rate. Baseline differences.

								different in function, pain related fear, 5 minute walk, or free-living step count.	group exercise classes…"	
Chok, 1999 (score=4.5)	Back School	RCT	No mention of industry sponsorship or COI.	N = 66 with acute and subacute LBP.	Mean age: 36.03; Sex: 41 males, 13 females.	Endurance training of the trunk extensor muscles (n = 30) vs, Control (n = 24).	6 weeks	Improvements at 3 weeks for VAS (p <0.05), and disability score (p <0.05). No differences at 6 weeks.	"Endurance exercise is considered to expedite the recovery process for patients with an acute episode of low back pain."	Significant baseline differences present. Many weaknesses in methods preclude strong conclusions.
Meng, 2011 (score=4.0)	Back School	RCT	Funded by Deutsche Rentenversicherung Bund (German Statutory Pension Insurance Scheme), Berlin, Germany. No mention of COIs.	N = 382 with LBP	Mean age: 49.8; Sex: 129 males, 231 females.	Biopsychosocial back school program (manual based and interdisciplinary) (n = 197) vs. Traditional back school program (usual care) (n = 185).	6 & 12 months	Biopsychosocial back school group improved significantly in knowledge of back exercises (p = 0.021), cognitive restructuring (p = 0.007), counter-activities (p = 0.007), and relaxation (p = 0.007) compared to the traditional school.	"…Results showed a significant medium treatment effect in patients' knowledge about chronic back pain and its treatment at discharge of rehabilitation as well as 6 and 12 months after the program."	High dropout rate in both groups. Results suggest that intervention more efficacious at 6 months compared to traditional back school program
Other										
Loisel, 2002 (score=4.0)	Back School	RCT	Grant sponsor: Institut de Recherche en Santé et Sécurité au Travail du Québec (IRSST). No mention of COIs.	N = 104 workers with LBP absent from work ≥4 weeks in Canada	Mean age: 40.7; Sex: 62 males, 42 females.	Standard care (n = 26) vs. occupational intervention (n = 22) vs. clinical intervention (n = 31) vs. occupational+ clinical arm (n =	Mean follow up 6.5 years.	Differences between groups for number of subjects exceeding total cost of $65,000, p = 0.0201.	"A fully integrated disability prevention model for occupational back pain appeared to be cost beneficial for the workers' compensation board and to save	Large number of days on full benefit (DFB) saved in partial interventions arms and larger numbers of DFB saved in Sherbrooke model, with

						25). Clinical arm and occupational plus clinical arm: back school 8 weeks after work absence. Reassurance through OM physician, back pain specialist, and/or health care professionals in rehab interventions. Early return to normal activity encouraged, early workplace support promoted by ergonomic intervention and/or therapeutic RTW program.			more days on benefits than usual care or partial interventions."	lesser consequence of disease costs. Effective mix of interventions to reduce total costs is unclear.
van Poppel, 1998 (score=4.0)	Back School	RCT	Grant 28.2672.6 from the Praeventiefonds, the Hague, the Netherlands. No mention of COIs.	N = 312 airline cargo workers in the Netherlands	Mean age: 35.1; No mention of Sex.	Lifting instructions (3 sessions for groups of 10-15; 1st session 2 hours at start of intervention, other sessions 1.5 hours given at 6 weeks and	Follow-up for 6 months.	Despite choice of support in pilot testing, compliance with wearing supports at least half time low (43%). No differences in LBP incidence or lost-time injuries. In workers who never had LBP, incidence	"[L]umbar supports or education did not lead to a reduction in low back pain incidence or sick leave.	Considering objects likely large sized, lift with knees not back requirement almost completely infeasible due to human strength considerations

						12 weeks) and lumbar support (n = 70) Vs Lifting instruction (n = 82) vs Lumbar support (n = 83) vs No intervention (n = 77).		higher among those using support. IF LBP at baseline, lost-time injuries were reduced with support (median 1.2 days/month vs. 6.5 days/month). Among workers compliant with supports, LBP reporting not statistically increased.		(potentially substantiated by statement that 11% stated they lifted as taught all the time, 73% some of the time, 11% never).

Evidence for Interdisciplinary Work Rehabilitation Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Staal 2004 (score=8.5)	Interdisciplinary work Rehabilitation program	RCT	Supported by Dutch Health Insurance Executive Council. No COIs.	N = 105 with subacute LBP (median 8 to 8.5 weeks duration, range 6 to 14 weeks) among airline employees	Mean age: 38; Sex: 126 males, 8 females.	Behavioral-oriented, graded exercise therapy (n = 67) vs. Highly heterogeneous group of usual care methods (n = 38 physiotherapy, n = 6 manual therapy, n = 6 Mensendieck exercise therapy, n = 3 chiropractor, n = 1 back school, n = 7 unknown). Intervention group with 2x a week-1 hour exercise sessions with physiotherapists emphasizing operant conditioning, focusing on achieving goals to improve function. Sessions until RTW or 3 months.	6 months	At 6 months, pain ratings not different, but improved more in graded exercise group (3 months/6 months: 2.8 2.4/2.9±3.1 vs. 2.5±2.8/2.7±2.8, p >0.2). Over 6 months of follow-up, median lost time 58 vs. 87 days.	"Graded activity was more effective than usual care in reducing the number of days of absence from work because of low back pain."	Despite high-quality score on grading, due to inclusion of multiple research study design techniques, study so heterogeneous that firm conclusions are not warranted for any single intervention.
Hlobil 2005 (score=6.5)	Interdisciplinary work Rehabilitation program	RCT	Supported by Dutch Health Insurance Executive Council. No COIs were mentioned.	N = 134 workers for KLM airline workers onsite at Schiphol Airport	Mean age: 38; Sex: 126 males, 8 females.	Usual treatment (n = 67) vs. graded exercise program (n = 67). Intervention 60-minute exercise sessions 2 times a week for up to 3 months.	6 months	Median lost time after intervention in interventional group was 54 vs. 67 days usual care group. Hazard ratio for period from 50 days after randomization onwards favored graded exercise group, p = 0.01. Hazard ratio from 50	"Graded activity intervention is a valuable strategy to enhance short-term return to work outcomes."	Program had less exercise time than typical U.S.-based program, thus benefits may be an underestimate. It is also noteworthy that at this time, "completing 365 sick leave days

								days onwards favored graded exercise group, p <0.01. NS between groups for total days sick leave due to recurrent episodes of LBP during 12 month follow-up period.		entitled the worker to receive disability benefits," thus providing governmental, advocagenic policy bias against success of this program.
Moffett 1999 (score=6.0)	Interdisciplinary work Rehabilitation program	RCT	Supported by grant from Arthritis Research Campaign, Northern and Yorkshire Regional Health Authority, and National Back Pain Association. No COIs.	N = 187 with subacute and chronic LBP	Mean age: 41.8; Sex: 81 males, 106 females	Graded exercise (n = 85, program of 8 exercise classes) vs. Routine general practitioner management (n = 98).	6 & 12 months	Roland Disability scores in controls and exercise groups reduced at 6 months (-1.64 and -2.99 respectively, p = 0.03) and 1 year (-1.77 and -3.19, respectively, p = 0.02) compared to baseline. There were 378 lost workdays in intervention group vs. 607 in controls.	"Our exercise programme did not seem to influence the intensity of pain but did affect the participants' ability to cope with the pain in the short term and even more so in the longer term. It used a cognitive-behavioral model…and with minimal extra training a physiotherapist can run it. Patients' preferences did not seem to influence the outcome."	Trial uses usual care as control, which may be biased against that arm. Treatments in usual care also not standardized and may not represent modern practice. Total costs 50% greater in controls, with cost differences mostly due to lost time. Data suggest graded exercise program superior to usual care.
Li 2006 (score=6.5)	Interdisciplinary work Rehabilitation program	RCT	No mention of COIs or industry sponsorship.	N = 64 with musculoskeletal injury and long-term sick leave	Mean age: 43.9; Sex: 63 males, 40 females.	3-week training on work readiness (n = 34) vs. Advice on employment placement (n = 30).	3 weeks	Subjects in training group showed significant improvement in work readiness (p <0.05), level of anxiety (p <0.05) and self-perception of health status measured by SF-36 (p <0.02) vs. control group.	"[T]raining on work readiness program appeared to be effective in reducing the anxiety and stress levels of the injured workers, improving their self perception of health conditions, thus gradually creating	Small sample size.

								Control of chronic pain, negative motivation, anxiety level some of key behavioral changes found from study.	behavioral changes on their work readiness."	
Johnson 2007 (score=6.0)	Interdisciplinary work Rehabilitation program	RCT	No COIs or industry sponsorship	N = 234 with persistent disabling LBP of over 3 months duration at enrollment	Mean age: 47.9; Sex: 94 males, 140 females.	Active exercise, education and CBT 2-hour group sessions over 6-week period (n = 116) vs. Control treatment (n = 118).	Follow at 3, 9, 15 months	Patients who preferred intervention and assigned to it experienced significant reductions in pain and disability scores. Those preferring controls had worse outcomes. Those with no preference, little intervention effects. No differences between groups over 15 months of follow-up.	"This intervention program produces only modest effects in reducing LBP and disability over a 1-year period. The observation that patient preference for treatment influences outcome warrants further investigation."	Study reviewed in psychological section as it does not appear to rely primarily on exercise for treatment. Compliance 63% intervention group. No significant effect found. Other co-interventions not well described.
Van Der Maas, 2015 (Score=4.0)	Interdisciplinary Work Rehabilitation Programs	RCT	No mention of sponsorship. No COI.	N=94 patients with chronic pain.	Mean age: 41.86 years; 17 males, 77 females.	Treatment as Usual (TAU) group: relaxation (6 X 1.5 h), aerobic fitness (33 X 1 h), rational-emotive therapy (9 X 1h, 6 X 1.5h) occupational therapy (6 X 1.5), chronic pain education (3 X 1.5h), sports (in the swimming pool [5 x 1 h] and in the sports hall [5 X 1 h]), partner education (3 X 1.5 h), and coaching (4 X 1 h), a total of 94 hours (n = 45) vs	3, 6, and 12 months	TAU vs PMT Pain intensity; 5.78 vs 5.51 (p = 0.459). PDI overall time effect -1.58 vs -1.83 RAND-36 PCS .25 vs 0.96 RAND_36, MCS 1.49 vs 1.04 BDI -1.04 vs -1.54 SBCBA .04 vs 0.11 PSEQ 1.20 vs 1.27. PMT differed from TAU on depression (RC=-5.01, 95% CI -8.81 to -1.21), body	"No clinical meaningful differences were found between treatment conditions in the primary outcome measures health related, quality of life and disability."	Difference in contact time between groups. High dropout rate at 12 months. Data suggest similar efficacy in clinical outcomes PMT group had significantly less depression and catastrophizing as well as improvement in BA.

						Treatment as usual with Psychomotor Therapy (PMT): (10 X 1.5) body experience and interaction and communication focus. (n = 49)		awareness [RC=0.23, 95% CI 0.04 to 0.42), and catastrophizing (RC=-4.76, 95% CI -8.03 to -1.48).		
Rothman, 2012 (score=4.0)	Interdisciplinary Work Rehabilitation Programs	RCT	No mention of sponsorship. No COI	N=182 Patients with chronic musculoskeletal pain	Mean age: 40 years; 43 males, 139 females,.	Multimodal assessment (MM): Multidisciplinary group therapy, individual multidisciplinary therapy, referral back for conventional treatment. (n=91) vs Conventional multidisciplinary and unimodal assessment (CMUA): conventional multidisciplinary pain management or unidisciplinary treatment (n=91)	15 months	MM baseline vs 15mo Pain vas 69.5 vs 60 (p = 0.002) stress 60 vs 56 (p = 0.067) ODI 40 vs 36 (p = 0.017) Control baseline vs 15mo pain VAS 74.5 vs 65.5 (p = 0.008) stress 54.5 vs 51 (p = 0.673) ODI 38 vs 38 (p = 0.686).	"The patients receiving the MM assessment improved their QOL and working ability, and were also significantly more satisfied with the assessment they received. However, there were no differences between groups regarding a patient's pain intensity, depression, stress symptoms, or disability levels at the 15-month follow-up. Pretreatment MM assessment is, therefore, an option to be used to select and prepare patients for the most suitable subsequent rehabilitation treatment and could be used in a primary care setting. A pretreatment MM assessment for patients with mixed CMP is, thus, recommended."	80% of patients female. Routine care control bias. Data suggest improved satisfaction in MM assessment group.

Evidence for Interdisciplinary Pain Rehabilitation Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Staal 2004 (score = 8.5)	Interdisciplinary Pain Rehabilitation	RCT	By the Dutch Health Insurance Executive Council (CVZ). No COI.	N = 105 with subacute LBP (median 8 to 8.5 weeks duration, range 6-14 weeks) among airline employees	126 males, 8 females; Mean age graded activity 39±9, Usual Care 37±8.	Behavioral-oriented, graded exercise therapy vs. heterogeneous usual care. Intervention bi-weekly 1-hour exercise with physiotherapists who emphasized operant conditioning principles, focusing on achieving goals to improve function. Specific exercises (aerobic, abdominal, back, leg, individually tailored) to "simulate and practice problematic tasks at work or problematic activities of daily living." Sessions continued until subjects RTW or 3 months passed.	Baseline, 3 and 6 months.	At 6 months, pain ratings not significantly different, but improved more in graded exercise. Functional status at 6 months: graded activity (7.8±6.6) vs. usual care (6.4+6.6), p = 0.11. Pain at 6 months: graded activity (2.9±3.1) vs. usual care (2.7±2.8), p >0.2. Hazard ratio for period up to 50 days after randomization 1.0 and 1.9 for period from 50 days after randomization favored graded activity.	"Graded activity was more effective than usual care in reducing the number of days of absence from work because of low back pain."	Despite high-quality score on grading, due to inclusion of multiple research study design techniques, article was so heterogeneous that firm conclusions are not warranted.

Kool 2005 (score = 8.0)	Interdisciplinary Pain Rehabilitation	RCT	Supported by the Swiss Federal Office of Health. No COI.	N = 174 age 20-55 with non-acute, non-specific LBP	137 males, 37 females; Mean age 42±8.	Pain centered treatment to reduce pain 2.5 hours a day 6 days a week for 3 weeks (n = 87) vs. function-centered treatment to increase work-related capacity 4 hours a day 6 days a week for 3 weeks (n = 87).	Baseline and 3 month follow up	Days at work after 3 months post-treatment: function 25.9±32.2 vs. pain centered 15.8±27.5, p = 0.029. Self efficacy change (PACT) after treatment: function 5.9±32.5 vs. pain centered -7.4±4.4, p = 0.003. Perceived effect after treatment: physical capacity 4.1±2.1 vs. 2.9±1.7, p <0.001; overall improvement 4.4±2.0 vs. 3.6±2.0, p = 0.009. Pain change: post-treatment: 0.25±2.1 vs. 0.55±1.9, p = 0.23.	"Function-centered rehabilitation increases the number of work days, self efficacy, and lifting capacity in patients with nonacute nonspecific LBP."	Study in Switzerland. Not clear how applicable to U.S.
Fairbank 2005 (score = 6.5)	Interdisciplinary Pain Rehabilitation	RCT	The Medical Research Council supported the trial financially and was represented on the steering committee. Authors have received funding from Synthes for a spinal fellow.	N = 349 with chronic LBP at least 1 year duration), considered to be a surgical candidate, and thought to not have exclusions such as psychiatric issues	162 males, 177 females; Age range 18-55.	Lumbar spine fusion (n = 176) vs. intensive rehabilitation (n = 173): intensive rehabilitation program consisted of education and exercise full time for 3 consecutive weeks, followed by 1 full day of follow-up at 1, 3, 6, and 12 months. Exercises were	Baseline, 6, 12, and 24 months.	The 48 patients randomized to conservative care later opted for surgery; 7 surgery patients opted for conservative care; 55.1% fusion patient's required further treatment after allocated treatment vs. 39.3% rehab group, 19 surgical cases incurred complications; 11 required additional surgery. Both	"No clear evidence emerged that primary spinal fusion surgery was any more beneficial than intensive rehabilitation."	A weakness of this study is the lack of well-defined patient criteria on entry and lack of control over surgical interventions, which limits strength of some conclusions and generalizability.

						individualized, graded, and consisted of endurance, stretching, flexibility, strengthening and aerobics.		groups reported reductions in disability during 2 years of follow-up, "possibly unrelated to the interventions." Oswestry disability index at 24 months: surgery (34.0±21.1) vs. rehab (36.1±20.6), p = 0.045. NS between groups all other outcome measures.		
Haldorsen 2002 (score = 5.5)	Interdisciplinary Pain Rehabilitation	RCT	This work was financed by a grant from the Royal Norwegian Department of Health and Social Affairs to Department of Health and Social Welfare. No mention of COI.	N = 654 with musculoskeletal pain	Majority female (Not specified); Mean age of 43.	Ordinary (n = 263): referred backed to GP vs. light multi-disciplinary treatment (n = 222): 1-hour lecture on exercise, lifestyle, fear avoidance; given individual feedback and information by team; vs. extensive multi-disciplinary treatment (n = 169): 4 weeks of 6-hour sessions 5 days a week with cognitive behavioral modification (in group sessions 2 hours a week), education,	Baseline, 14 month follow-up.	Return-to-work rates 48% vs. 63% vs. 62%, thus light program non-statistically better. Extensive program outperformed other two arms for those patients "with a poor prognosis." Patients that gave poor results return to work rate was significant both between light multidisciplinary treatment and ordinary treatment (p <0.02) and between extensive multidisciplinary treatment and ordinary treatment, p <0.05.	"Multidisciplinary treatment is effective concerning return to work, when given to patients who are most likely to benefit from that treatment. The cost-benefit analysis of the economic returns of the light multidisciplinary and the extensive multidisciplinary treatment programs yields a positive net present social value of the treatment."	Involved disciplines were general practitioner, neurologist, psychologist, nurse, and physiotherapy.

						exercise (physiotherapy daily for 1.5-3.5 hours a day), and workplace interventions.				
Anema 2007 (score = 5.5)	Interdisciplinary Pain Rehabilitation	RCT	Supported by federal funds. No COI.	N = 196 sick listed 2 to 6 weeks due to nonspecific LBP	129 males,	Workplace intervention: worksite assessments and work adjustments (n = 96) vs. usual care: Dutch occupational guidelines for LBP, education, coping with LBP (n = 100) for 8 weeks, followed by a second randomized trial of a graded exercise protocol among patients who did not return to work based on the workplace intervention (n = 112) start of therapy median 69 days after lost time began with follow-up up to 1 year.	Follow-Up at baseline, 12. 26, and 52 weeks.	Graded activity had negative effect on return to work.	"Workplace intervention is advised for multidisciplinary rehabilitation of subacute LBP. Graded activity or combined intervention is not advised."	Workplace intervention performed first, removing 43% of subject population prior to 2nd randomization, time to onset of exercise approximately 2 months after lost time began, compliance poor (65%), exercise program structure highly variable based on wide range in number of sessions indicating that robust conclusions on graded exercise components of study not warranted.

Amris 2014 (score=5.5)	Interdisciplinary Pain Rehabilitation	RCT	Sponsored by grants from The Oak Foundation, Schioldanns Fond, and The Danish Rheumatism Association. No COI.	N= 191 patients diagnosed with Chronic Widespread Pain (CWP) accord to the 1990 American College of Rheumatology criteria.	0 males, 191 females; Mean age for intervention group 44.4±10.9 and control group 44.2±10.8.	Intervention group (N =96) received 2 weeks of multicomponent treatment, every day for 3-5 hours. vs Control Group (N =95) A controlled wait list group.	Baseline and 6 months.	Assessment of Motor and Process Skills [380] ADL motor logits, baseline to 6 mo change, rehab group (95% CI) vs control group (95% CI) & group difference (p-value): 0.23 (0.15-0.31) vs 0.02 (-0.05-0.10) & .20 ((0.09-0.31) (p=0.0003)). AMPS ADL Process logits, baseline to 6 mo change, rehab group (95% CI) vs control group (95% CI) & group difference (p-value): 0.07 (0.02-0.12) vs -0.13 (-0.18 - -0.08) & .20 ((0.12-0.27) (p<0.0001)).	"We conclude that even in fibromyalgia patients presenting with a longstanding, substantial disability, the 2-week group-based multicomponent treatment course resulted in observable improvements of functional ability in a subgroup of patients at 6-month follow-up. This improvement, however, was not reflected in patient-reported outcomes, including self-reported functional ability on standardized questionnaires."	Waitlist control bias. At 6 months, a subgroup of the intervention group reported functional improvement. Unblinded study. Data suggest there was an observed functional improvement in interdisciplinary rehab group but this was not reported by the patients themselves.
Jensen 2005 (score = 5.0)	Interdisciplinary Pain Rehabilitation	RCT	Sponsord by AFA Insurance and Alecta Insurance. No mention of COI.	N = 214 with non-specific chronic spinal pain	97 males, 117 females; males mean age 97±11, females mean age 42±10.	Behavior-oriented physiotherapy (PT, n = 54): 20 hours a week; individual training program had goal setting, improved muscular endurance, aerobic training, pool training,	Baseline, and 3 years	Behavior-oriented physiotherapy (PT), cognitive behavioral therapy (CBT), physiotherapy and cognitive behavioral therapy (PT/CBT), and treatment-as-usual (TU) control in Sweden. Required to be sick-listed 1-6 months. Interventions lasted 4 weeks, groups of	"[A] full-time behavioral medicine programme (PT and CBT) is a cost-effective method for improving health and increasing return to work in women working in blue-collar or service/care occupations and	Involved were physicians, physiotherapists, and psychologists.

						relaxation techniques, and body awareness therapy vs. cognitive-behavioral therapy (CBT, n = 49): 13-14 hours a week of activity planning and goal setting, problem solving, applied relaxation, cognitive coping techniques, distracting imagery, etc. vs. physiotherapy and cognitive-behavioral therapy full time (BM, n = 63) vs. treatment-as-usual (TU, n = 48) control of routine health-care, no intervention; 5 assessments over 3 years.		4-8 patients. All showed marked reductions in sick leave. Total absences reduced more in PT and CBT, followed by CBT, followed by PT. Total costs lower in PT and CBT. BM group used physiotherapists less than others (p = 0.05). Control group used social services less than intervention groups, p = 0.05.	suffering from back/neck pain."	
Lindström, 1992 (score=4.5)	Interdisciplinary Pain Rehabilitation	RCT	No mention of industry sponsorship or COI.	N = 103 with subacute LBP off work for 6 weeks	71 males, 32 females; mean age in activity group 39.4±10.7 and control group 42.4±10.9	Graded activity group (n = 51) vs. controls: no treatment (n = 52) for 1 year. Graded activity group with measured functional capacity (mobility,	Follow up at one year.	Increases in arm strength, abdominal muscle strength, back muscles, and many other outcome measures preserved at 1 year in activity group. Activity group RTW 5.1 weeks earlier, p = 0.03.	"The patients with subacute, nonspecific, mechanical LBP who participated in the graded activity program regained occupational function faster than did the	Involved orthopedic surgery and physiotherapy. GPs administered routine care, but not otherwise involved. Social worker

						strength and fitness), workplace visit, back school education, and an individual, submaximal gradually increased exercise program with operant conditioning.			patients in the control group, who were given traditional care."	performed psychosocial screening. Graded activity program reduced long-term sick leave especially in males. Intensive exercises, work-hardening exercises, or expensive equipment not necessary to regain occupational function.
Loisel 1997 (score = 4.0)	Interdisciplinary Pain Rehabilitation	RCT	Supported by a grant from the Institut de la Recherche en Sante at Securite du Travail du Quebec, Canada. No mention of COI.	N = 130 with back pain	69 males, 32 females; Mean age usual care 41.7±10.0, clinical 40.2±8.5, occupational 44.5±5.7, full 37.4±8.1.	Usual care (n = 26) vs. clinical intervention (after 8 weeks absence): visit to "back pain specialist," back care school after 12 weeks absence, multi-disciplinary work rehab (n = 31) vs. occupational intervention after 6 weeks absence, occupational therapist visit, ergonomic	Baseline and 1 year follow up.	Return-to-work rate 2.23 times greater in occupational intervention group vs. usual care, p = 0.04. Median duration of work absence was 60 days for full intervention, 67 for occupational intervention, 131 for clinical intervention, and 120.5 days for usual care, p = 0.01 for occupational effect groups vs. 2 groups without intervention.	"Close association of occupational intervention with clinical care is of primary importance in impeding progression toward chronicity of low back pain."	Involved disciplines were OM physicians, ergonomists, "back specialists," and apparently physiotherapists.

						evaluation (n = 22) vs. full intervention (combination of last two) (n = 25); follow-up 12 and 24 weeks and 1 year.				
Becker 2000 (score = 4.0)	Interdisciplinary Pain Rehabilitation	RCT	No mention of sponsorship or COI.	N = 189 with chronic non-malignant pain	59 males, 108 females; Mean age in group MPT 57.7±15.8, in group GP 55.1±14.6, in group WL 57.2±15.5.	Outpatient multi-disciplinary pain centre treatment: cognitive behavioral based, included education on psychology and physiology of pain, teaching of pain management strategies, analgesic treatment, socio-economic counseling, physiotherapy (MPT, n = 56), treatment by a general practitioner (GP, n = 58) vs. a group waiting 6 months before treatment initiated (WL-group, n = 53) follow-up 3 and 6 months.	Baseline, 3, and 6 months.	At six months: MPT vs. WL-group, pain VAS (52±24 vs. 67±19, p ≤0.05), HAD (1.64 vs. 2.31, p ≤0.05), PGWB (62±17 vs. 51±20, p ≤0.05), SF-36-SFA (65±30 vs 57±32, p ≤0.05), SF-36-GH (44±23 vs. 32±20, p ≤0.05), no other significance in variables. MPT vs. GP, Pain VAS (52±24 vs. 65±25, p ≤0.05), PGWB (62±17 vs. 53±19, p ≤0.05), no other significance in variables.	"[I]n the MPT-group there was a significant reduction in pain intensity and improvement of HRQL [health related quality of life] compared to the WL-group, and the mere establishment of a pain diagnosis and a pain management play by a pain specialist was not sufficient to enable the referring GP to manage severely chronic pain patients."	No significance in WL group vs. GP.

Evidence for Multidisciplinary Rehabilitation Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Hellum, 2011 (score=7.5)	Multidisciplinary Rehabilitation Program	RCT	Study funded by South Eastern Norway Regional Health Authority and EXTRA funds from Norwegian Back Pain Association. No COI.	N = 179 age 25-55 with LBP and degenerative discs for at least 1 year having tried physiotherapy or chiropractic treatment for at least 6 months without relief and score of at least 30 on Oswestry disability index (ODI)	88 males, 91 females; Mean age for surgery group 41.1±7.1 and Rehab group 40.8±7.1.	Surgery: replace degenerative intervertebral lumbar disc with artificial lumbar disc (ProDisc II), patients not referred for post-op physiotherapy (n = 86) vs. rehab consisting of cognitive approach and supervised physical exercise for 60 hours 3-5 weeks that included lectures and individual discussions about anatomy, diagnostics, imaging, pain medicine, normal reactions, coping strategies, family, social life, work conditions, daily workouts to increase physical activity (endurance, strength,	Follow-up 6 weeks, 3and 6 months, 1 year after treatment	Primary outcome mean±SD baseline/1 year/2 years. ODI: surgery (41.8±9.1/22.3± 17.0/21.2±17.1) vs. rehab (42.8±9.3/33.0±16.6/30.0±16.0), p <0.001 at 1 year and p = 0.001 at 2 years. Secondary outcomes mean±SD (baseline/1 year/2 years). Back pain score: surgery (64.9±15.3/35.6±28.6/35.4±29.1) vs. rehab (73.6±13.9/53.2± 28.4/49.7±28.4), p = 0.003 at 1 year and p = 0.009 at 2 years. SF-36 physical component summary: surgery (30.5±7.1/42.8±12.2/43.3±11.7) vs. rehab (30.8±6.5/37.3± 11.0/37.7±10.1), p = 0.003 at 1 year and p = 0.001 at 2 years. Euro QoL (EQ-5D): surgery (0.30±0.27/0.68± 0.34/0.69±0.33) vs. rehab (0.27±0.31/0.55±0.32/0.63±0.28), p = 0.04 at 1 year, NS at 2 years. Self-efficacy: surgery (3.4±1.5/6.3±3.3/6.1±	"This randomised trial comparing disc prosthesis with multidisciplinary rehabilitation showed a significant difference in the primary outcome variable (Oswestry disability index after 2 years) in favour of surgery."	Most results not different. 2 year follow up.34% complications over 2 years.

						coordination, etc. n = 87).		2.9) vs. rehab (3.6±1.6/5.2±2.4/ 5.3±2.5), p = 0.01 at 1 year and p = 0.02 at 2 years.		
Kool, 2005 (score=8.0)	Multidisciplinary Rehabilitation Program	RCT	No industry sponsorship or COI.	N = = 174 age 20-55 with non-acute, non-specific LBP.	137 males, 37 females; Mean age 42±8.	Pain-centered (PC) treatment to reduce pain 2.5 hours a day, 6 days a week for 3 weeks (n = 87) vs. Function-centered (FC) treatment to increase work related capacity 4 hours a day, 6 days a week for 3 weeks (n = 87).	Follow-up to 3 months.	Days at work after 3 months post-treatment: FC 25.9±32.2 vs. PC 15.8±27.5, p = 0.029. Lifting capacity change after treatment: floor-waist 2.3±5.4 vs. 0.2±3.9, p = 0.004. Perceived effect after treatment: physical capacity 4.1±2.1 vs. 2.9±1.7, p <0.001; general well-being 4.0±2.1 vs. 3.1±1.9, p = 0.005; overall improvement 4.4±2.0 vs. 3.6±2.0, p = 0.009. Pain change: post treatment -0.25±2.1 vs. 0.55±1.9, p = 0.23; 3 months NS.	"Function-centered rehabilitation increases the number of work days, self efficacy, and lifting capacity in patients with nonacute nonspecific LBP."	Data suggest pain-centered treatment inferior to function-centered over 3 months. No long-term follow-ups. Study in Switzerland and not clear how applicable elsewhere.
Morone, 2012 (score=6.5)	Multidisciplinary Rehabilitation Program	RCT	No sponsorship. No mention of COI.	N = 75 with chronic, non-specific LBP age 18-75	70 males, 64 females; Mean age for Surface perceptive group 52.72±17.58, back school group 55.4413.73, and for control group	Surface for Perceptive Rehabilitation: deformable cone with small tops fixed to rigid surface that patients lie on to perform perceptive tasks to rehabilitate perception of trunk and midline 45 minute sessions	Follow-up 12 and 24 weeks.	VAS scale scores: baseline – surface group 6 vs. Back School 7 vs. control 7 (NS); end of treatment – surface group 4 vs. Back School 6 vs. control (p <0.001); 12 weeks – surface group 5 vs. Back School 5 vs. control 8 (p <0.001); 24 weeks – surface group 5 vs. Back School 4 vs. control 7 (p = 0.009).	"[S]urface Perceptive rehabilitation is a promising approach for pain relief in the short and long term in chronic nonspecific low back pain, whereas the Back School programme results in	Secondary analysis of Morone 2011. Three experimental groups. Baseline data sparse. Perceptive treatment not widely available. Control group not well described, esp. re. physical therapy or

					57.88±12.81.	3x a week 4 weeks (n = 25) vs. Back School exercise program consisting of spine anatomy and educational intervention, exercise 10 sessions for 4 weeks (n = 25) vs. control: medical and pharmacological assistance, no rehabilitative exercise program (n = 25).			primarily long-term benefits."	exercise. At 3 mo and 6mo, the perceptive treatment reported more pain reduction.
Rossignol, 2000 (score=6.5)	Multidisciplinary Rehabilitation Program	RCT	Study funded by the Quebec Research Institute in Occupational Health and Safety. No mention of COI.	N = 110 workers compensated for any work-related injury to thoracic, lumbar and/or sacral portions of vertebral column, absent work for no less than 4 weeks but not more	79 males, 31 females; mean age for CORE group 36.8±9.7 and for Usual care group 38.3±10.5.	Coordination of primary health care (CORE): assisting treating physicians in finding and scheduling diagnostic and therapeutic procedures and helping coordinate health care and rehab needs between worker and Quebec Workers' Compensation Board (QWCB); nurses contacted workers weekly by phone until	Baseline, 3, and 6 months.	No significant differences between groups for return to work rates. Outcomes at 6 months (mean±SD): Quebec Back Pain Disability Scale (QBPDS) – CORE (20.9±22.8) vs. usual (9.1±21.4), p=0.01; Oswestry – CORE (17.2±19.7) vs. usual (7.8±17.9), p=0.02; Dallas – CORE (25.9±25.9) vs. usual (11.7±22.6), p = 0.01. Exercises in last 4 weeks (% use) at 6 months: CORE 38.6 vs. usual 20.0, p <0.05.	"The therapeutic results for workers with low-back pain could be improved by implementing the clinical practice guidelines with primary-care physicians in a large community, without delaying return to work."	Data suggest CORE program is superior

						they returned to work to talk about back pain, functional recovery, diagnostic procedures, medical and nonmedical therapy, relations with QWCB agent, and personal problems (n = 54) vs. control – continue with treating physician, fill out 3 and 6 month questionnaires (n = 56).				
Fairbank, 2005 (score=6.5)	Multidisciplinary Rehabilitation Program	RCT	No mention of industry sponsorship or COI.	N = 349 age 18-55 with more than 1 year of chronic LBP	172 males, 177 females; Age range of 18-55.	Spinal stabilization surgery (allowed surgeon to pick surgery) (n = 176) vs. Intensive rehab program: (outpatient daily education and exercise tailored to patients' baseline ability and included stretching of major muscle groups, spinal flexibility exercises, general muscle strengthening,	Follow-up 6, 12, and 24 months.	Oswestry Disability Index at 24 months: surgery (34.0±21.1) vs. rehab (36.1±20.6), p = 0.045. NS between groups at 24 months for shuttle walking test, SF-36 physical component score, SF-36 mental component score, domains of SF-36 (general health perception, physical function, role limitation physical and emotional), pain, social function, mental health, and energy and vitality.	"The statistical difference between treatment groups in one of the two primary outcome measures was marginal and only just reached the predefined minimal clinical difference, and the potential risk and additional cost of surgery also need to be considered. No clear evidence	Lack of well-defined patient criteria on entry and lack of control over surgical interventions, limiting strength of some conclusions. Data suggest no long-term differences.

						spine stabilisation exercises, and cardio endurance exercise using any mode of aerobic exercise) 5 days a week for 3 weeks (n = 173).			emerged that primary spinal fusion surgery was any more beneficial than intensive rehabilitation."	
Monticone, 2013 (score=6.5)	Multidisciplinary Rehabilitation Program	RCT	No COI. No mention of industry sponsorship.	N = 90 diagnosed with nonspecific chronic LBP (>3 months), able to understand Italian, no cognitive impairments, no previous spinal surgery, deformity, infection fracture or systemic diseases, no reception of compensation for work-related disabilities, and age 18 and older.	38 males, 52 females; mean age for CBT 48.96±7.97 and 49.71±7.01 .	Multidisciplinary program consisting of Cognitive Behavioral Therapy (CBT) focused on modifying fear of movement beliefs, catastrophizing thinking, and negative feelings, ensuring gradual reactions to illness behaviors, 60 minute sessions individually 1x a week for 5 weeks followed by 1 hour sessions once a month for 1 year to verify growth and reinforce self-management of dysfunctional thoughts and	Assessments at baseline, 5 weeks, 12 months, and 24 months.	Outcomes (baseline/5 weeks/12 months/24 months), mean±SD. RMDQ: multi-disciplinary (15.27± 2.94/5.04±2.04/1.31± 1.59/1.40±1.19) vs. control (15.00±2.85/11.04±2.27/ 11.00±2.00/11.07±2.22), p <0.001. Tampa Scale for Kinesiophobia (TSK): multi-disciplinary (41.67±4.60/ 24.67±4.47/7.29±1.53 /17.67±1.62) vs. control (41.78±5.06/ 40.36±5.07/ 40.33±4.55/0.96±5.17) , p <0.001. Numeric rating scale (NRS): multi-disciplinary (7.02±1.07/2.69±0.97/ 1.38±1.07/1.47±1.10) vs. control (7.02±1.30/ 4.96±1.27/5.33±1.22/ 6.24±0.85) SF-36. Physical Functions (PF): multi-disciplinary	"[O]ur findings suggest that long-lasting multidisciplinary rehabilitation is useful in changing the course of disability, fear-avoidance beliefs, pain, and QoL of patients with CLBP."	Poor control over exact makeup of interventions.

						wrong behaviors and exercise training, multimodal motor program consisting of active and passive (manual therapy and physiological movements to improve ROM) mobilizations of spine and exercises aimed at stretching (involved groups of lower limb and back muscles) and strengthening muscles and improving postural control (motor control of the spine and pelvis), 10-60 minute sessions 2x a week 5 weeks and twice weekly for 60 minute sessions for 1 year during which they received phone reminders (n = 45) vs. control group given only exercise (n = 45). Both programs 5 weeks		(47.22±27.25/ 78.44±19.93/ 85.67±19.64/87.56± 18.35) vs. control (48.33±24.65/57.44 ±19.87/62.11±19.43/ 65.00±17.74), p <0.001. Physical Role (PR): (29.44± 35.47/72.22±28.31/86 .11±19.24/88.00±17.9 7) vs. (31.11± 32.48/50.56± 28.94/60.33±19.14/2. 67±17.30), p <0.001. Physical Pain (PP): (38.24± 15.36/68.36±13.97/78 .98± 14.65/ 80.42±13.20) vs. (41.36±17.93/ 44.00±16./71 52.02±16.25/ 61.78± 13.93), p <0.001. General Health (GH): (34.00±17.72/73.22±1 8.19/ 85.00±13.81/86.33±13 .24) vs. (36.67±14.10/44.22±1 6.51/56.44±15.90/63. 11±15.01), p <0.001. Vitality (VT): (52.00± 16.93/77.22±14.71/ 90.00±11.67/91.33±10 .35) vs. (52.56± 15.36/51.89±15.85/55 .33±11.04/56.22±10.5 0), p <0.001. Social Functioning (SF): (50.83±18.34/85.83±1 5.21/		

						(instructive phase) plus 1 year (reinforcement phase).		91.00±10.47/92.33±9.20) vs. (51.56± 17.66/63.06±17.66/54.44±11.35/52.50±10.18), p <0.001. Emotional Role (ER): (39.26±35.02/76.89±28.90/ 91.11±14.90/93.11±13.45) vs. (39.26± 37.79/55.56±28.42/58.52±14.48/60.74±12.88), p <0.001. Mental Health (MH): (50.13±11.55/81.78±13.79/ 89.78±13.00/91.02±11.28) vs. (52.09± 12.69/55.47±12.66/54.13±11.89/58.84±11.80), p <0.001.		
Dufour, 2010 (score=6.0)	Multidisciplinary Rehabilitation Program	RCT	Study funded by Apotekerfondenaf 1999, Sygekassernes Helsefond, and the Danish National Board of Health. No COI.	N = 286 with LBP >12 weeks with or without radiating pain into legs, age 18-60.	119 males, 153 females; mean age for group A 41.2±10.0 and group B 40.6±9.1.	Group based multidisciplinary biopsychosocial rehabilitation program: treatment in groups of 6, program consisted of exercise, education, and pain management for 12 weeks and divided into 3 periods of 4 weeks (group A, n = 142) vs. intensive individual therapy assisted	Follow-up at 6, 12, and 24 months.	VAS pain scores: NS between groups through study period. Roland Morris Disability Questionnaire mean±SD (3 months/6 months/12 months/24 months): Group A (3.3±5.5/3.4±6.0/ 4.0±5.8/3.9±6.9) vs. Group B (1.6±4.5/1.3±4.7/0.8±5.1/1.5±5.4), p = 0.001. SF-36 mean±SD (3 months/6 months/12 months/24 months): Physical functioning – Group A (12.2±21.2/10.6±22.0/ 12.1±24.0/ 11.2±23.3)	"Both groups showed long-term improvements in pain and disability scores, with only minor statistically significant differences between the 2 groups."	High dropout over time. Data suggest comparable results although trends favoring multidisciplinary program.

						back muscle strengthening exercise 1 hour twice a week for 12 weeks (group B, n = 144). Assessments at baseline and 3 months after treatment.		vs. Group B (6.0±17.7/ 4.4±18.0/ 2.0±19.0/1.6±20.4), p = 0.000; Physical component summary – Group A (5.0± 7.7/4.2±7.9/5.1±8.3/ 5.0±8.2) vs. Group B (2.8±7.3/2.2±7.7/ 1.9±7.4/1.7±7.8), p = 0.001.		
Vollenbroek-Hutten, 2004 (score=6.0)	Multidisciplinary Rehabilitation Program	RCT	No mention of sponsorship or COI.	N = 163 with chronic nonspecific LBP with no back surgery in last 3 months,	No mention of sex; mean age for treatment group 38.5±9.8 and control group 39.5±9.9	Roessingh Back Rehabilitation program (RRP): influence patient health, perceived disabilities by improving physical condition, activity level, knowledge of back problems and reducing fear of movement, 8 patients per group for 3 hours of conditional training/sport, 0.5 hours of swimming, 1.5 hours of occupational therapy, and 4 hours of physiotherapy a week for 7 weeks (n = 79) vs. usual care:	Follow-up for 6 months.	No significant differences between groups for primary outcomes of EuroQOL and the Roland Disability Questionnaire.	"The present study shows that the overall effects of a multidisciplinary treatment programme over usual care are disappointing. Only 30-50% of the patients improve as a result of such treatment and this number is not significantly different from a usual care group."	At 6mo, both groups had improved with no significant differences suggesting equal (in)efficacy. Intervention group was "Roessingh Back Rehabilitation Programme." Controls had unstructured care. Generalizability of results beyond the Netherlands is unclear.

						no rehab treatment, control group (n = 84).				
Castel 2014 (score=5.5)	Multidisciplinary Rehabilitation Program	RCT	No COI. Supported by the Foundation Marató TV3 Grant Number 070910.	N=130 patients with fibromyalgia.	130 females, 0 males. Mean age control group 49.3 years. Multidisciplinary group 47.8 years.	Conventional pharmacologic treatment (included analgesics, antidepressant, benzodiazepine and nonbenzodiazepine hypnotics) (N=61) vs. multidisciplinary treatment (CBT, and physical therapy, 24 sessions twice a week) (N=69).	3-, 6- and 12-month follow-up.	Baseline vs. 12 month follow up outcome measures control vs. multidisciplinary group of participants with BMI: ≥ 30 kg/m2: *Catastrophizing* 18.6±12.4 vs. 10.0±11.0, p<0.05. *Sleep quantity* 5.8±1.3 vs. 6.2±1.9, p<0.05.	"[T]here are not differences among normal weight, overweight and obese patients with FM regarding their response to a multidisciplinary treatment programme for FM which combines pharmacological treatment, education, physical therapy and CBT."	Significant dropout rate. Data suggest comparable efficacy between all groups in response to a multidisciplinary treatment for IM regardless of BMI.
Mangels, 2009 (score=5.5)	Multidisciplinary Rehabilitation Program	RCT	Sponsored in part by Deutsche Rentenversicherung Bund (German Annuity Insurance Association). COI, Worringen is from German Annuity Insurance Association.	N = 363 inpatients with chronic LBP and no surgeries in previous 3 months.	81 males, 282 females; Mean age traditional rehab 48.7±14.7 years, behavioral rehab 49.5±9.0 years, behavioral rehab plus booster 48.3±15.8 years.	Traditional orthopedic rehabilitation: medical care, physiotherapy, back school, and occupational therapy intended for 3 weeks, TOR, (n = 131) vs. behavioral-medical rehabilitation: traditional orthopedic treatment with psychologic	Follow-Up at 1 year.	Beck Depression Inventory, pre-post, df: TOR vs. BMR 8.03 (p <0.01); TOR vs. BMR+B 7.54 (p <0.01). Action-oriented coping, pre-post, df: TOR vs. BMR 13.03 (p <0.001); TOR vs. BMR+B 8.82 (p<0.01) – pre-follow-up: TOR vs. BMR 8.25 (p <0.01); TOR vs. BMR+B 10.27 (p <0.01). Cognitive restructuring, pre-post, df: TOR vs. BMR 8.15 (p <0.01) – pre-	"Overall, we found both traditional and multidisciplinary inpatient pain treatment to be effective for core outcome measures."	Study of inpatient treatment that may not have generalizability outside of Germany. Data suggest similar efficacy between 3 groups, but inerventions not standardized.

						treatment elements, 9 group sessions for 90 minutes to enhance pain management skills, progressive muscle relaxation training intended for 4 weeks, BMR, (n = 113) vs. behavioral-medical rehabilitation plus booster sessions:7 additional booster sessions by phone within 12 months of discharge, BMR+B, (n = 119). Assessments at admission and discharge.		follow-up: TOR vs. BMR 6.22 (p <0.01). Mental distraction, pre-post, df: TOR vs. BMR 8.86 (p<0.01); TOR vs. BMR+B 7.16 (p<0.01) – pre-follow-up: TOR vs. BMR 6.17 (p <0.05). Relaxation, pre-post, df: TOR vs. BMR 12.87 (p<0.001); TOR vs. MBR+B 19.26 (p<0.001) – pre-follow-up: TOR vs. BMR 10.18 (p <0.01); TOR vs. BMR+B 13.57 (p <0.001).		
Anema, 2007 (score=5.5)	Multidisciplinary Rehabilitation Program	RCT	No industry sponsorship or COI.	N = 196 sick listed 2-6 weeks due to non-specific LBP	116 males, 156 females; Mean age for group A 41.2±10.0 and Group B 40.6±9.1.	Workplace intervention: worksite assessments and work adjustments (n = 96) vs. usual care: Dutch occupational guidelines for LBP, education, coping with LBP (n = 100) for 8	Follow-up up to 1 year.	Time till full and lasting return to work in the graded activity group was 144 days vs. 111 days in the usual care group, p = 0.030. Total number of sick leave days during 12 month follow-up for graded activity 145 vs. 111 for usual care group, p <0.001.	"Workplace intervention is advised for multidisciplinary rehabilitation of subacute LBP. Graded activity or combined intervention is not advised."	Workplace intervention removed 43% before 2nd randomization. Time to onset of exercise 2 months after lost time began, compliance poor (65%), and

						weeks, followed by 2nd randomized trial of graded exercise for those not returning to work (n = 112) start of therapy median 69 days after lost time began.				exercise program structure appears variable based on wide range in number of sessions indicating robust conclusions on graded exercise components not warranted. Applicability outside Netherlands unclear.
Nazzal, 2013 (score=5.5)	Multidisciplinary Rehabilitation Program	RCT	No industry sponsorship and no COI.	N = 100 age 18-65 with LBP at least 12 weeks with or without pain radiating to legs.	35 males, 65 females: Mean age group A 49.8±6.2 for group B 49.4±5.2.	Multidisciplinary biopsychosocial (Group A, n = 50) consisting of ultrasound therapy, TENS, aerobic, resistive, stretching, flexibility and postural exercises, massage, education (anatomy and pain management), and occupational therapy for 6 weeks, divided	Assessments at baseline and 6 weeks. Follow-up for 12 weeks and 24 weeks.	VAS after treatment (mean± SD): Group A 4.5±1.2 vs. Group B 5.6±1.5, p = 0.0001. McGill pain scores after treatment: Group A 25.2±11 vs. 36±12.2, p = 0.0001. Oswestry disability scores after treatment: Group A 20±11.5 vs. Group B 31+ 12.8, p = 0.0001. Extension after treatment: Group A 3.9±0.6 vs. Group B 3.5±0.3, p = 0.0001. Flexion: Group A 15.2±1.2 vs. Group B 14.1±09, p = 0.0001. Right lateral bending after treatment:	"[O]ur results indicate that the combined comprehensive, and intensive multidisciplinary biopsychosocial rehabilitation management program improved spinal function and mobility measures and reduced pain scale scores."	Poor control over interventions.

						into 3 periods of 2 weeks each vs. assisted therapist exercise (Group B, N=50) focused on back and gluteus muscle strengthening exercises for 2 hours, 5 times a week for 6 weeks.		Group A 45.2±3.7 vs. Group B 47.9±3.0, p = 0.0001. Left lateral bending after treatment: Group A 45±4.6 vs. Group B 48.2±3.4, p = 0.0001. Ability to work after treatment (n): Group A 25 vs. Group B 14, p = 0.04; after 12 weeks – Group A 27 vs. Group B 15, p = 0.02; after 24 weeks – Group A 30 vs. Group B 17, p = 0.04.		
Monticone, 2016 (score=5.5)	Multidisciplinary Rehabilitation	RCT	No COI or sponsorship.	N = 170 with non-specific chronic neck pain lasting longer than 3 months	Mean age: 53 years; 49 males, 121 females.	General exercise group (muscle strengthening, regional stretching and spinal mobilization) - one hour session of physical training each week for ten weeks, asked patients to repeat exercises at home (N = 85) vs. Multidisciplinary group (involved in group-based cognitive-behavioural therapy as well as exercises) - met with psychologist	12 months	Neck Disability Index (0-100) changes over time within and between multidisciplinary group and exercise group, respectfully: pretraining 41.9, 41.1 (time effect, group effect, and interaction effect for linear mixed model all p<0.001), posttraining 24.3, 36.7 (time effect, group effect, and interaction effect for linear mixed model all p<0.001), follow-up 21.7, 37.3 (time effect, group effect, and interaction effect for linear mixed model all p<0.001)	"A group-based multidisciplinary rehabilitation programme including cognitive-behavioural therapy was superior to group-based general physiotherapy in improving disability, pain and quality of life of subjects with chronic neck pain. The effects lasted for at least one year."	Predominantly female subjects. Data suggest group base multidisciplinary rehab which includes CBT and exercise is superior for improving disability, quality of life and pain at one year post intervention.

						once a week for one hour session for ten weeks (N = 85)				
Jay, 2016 (score=5.5)	Multidisciplinary Rehabilitation	RCT	No sponsorship and no COI.	N = 112 with chronic musculoskeletal pain.	Mean age 45.5 ± 9.0 / 476 ± 8.2 years for experimental / control groups; 0 males, 112 females.	PCMT – physical and mindfulness group-based training: supervised physical training sessions for 20 minutes four days a week, mindfulness sessions one each week for 50 minutes (N = 56) vs. REF - encouragements to follow on-going company health initiatives (N = 56)	10 weeks	Least square means difference from baseline to follow: Pain Intensity - Within group PCMT -1.5, Within group REF -0.3, Between group difference at follow-up (PCMT vs. REF) -1.0 (p<0.0001)	"A higher dose of physical-cognitive training appears to facilitate pain reduction, whereas a higher dose of mindfulness appears to increase pain."	Data suggest combining physical training with CBT and mindfulness training can significantly reduce pain.
Wong, 2011 (score=5.5)	Multidisciplinary Rehabilitation	RCT	Sponsored by a granted by the Food and Health Bureau, Hong Kong SAR Government, Hong Kong. No COI.	N = 99 with chronic pain for at least 3 months.	Aged 24 – 64 years; gender not specified, majority participants are females.	Mindfulness-Based Stress Reduction (MBSR) program consisting of a 7-hour "retreat" session (N = 51) vs Multidisciplinary pain intervention (MPI) program, educational instructions on management of chronic pain	8 weeks	Within both the MBSR and MPI groups, there was an increases in the PCS12 at 3 months (Wald statistic = 4.62, p = 0.032) and 6 months (Wald statistic = 10.503, p = 0.001) vs baseline scores. MPI group had a statistically significant reduction in the pain related distress with a mean (SD) of 5.67 (1.88) vs. 6.12 (1.94) in	"This randomized, clinical trial showed that both MBSR and MPI programs reduced pain intensity and pain related distress although no statistically significant differences were observed between the 2 groups and the	Data suggest comparable efficacy between groups and overall improvements were small.

						based on a self-help book, "Managing Pain Before It Manages You" (N = 48).		MBSR (Wald statistic = 3.98, p = 0.046).	improvements were small."	
Haldorsen, 2002 (score=5.5)	Multidisciplinary Rehabilitation Program	RCT	No mention of industry sponsorship or COI.	N = 654 with musculoskeletal pain	Typical participant in the study in a married woman (60%) and mean age is 43 years old.	Ordinary treatment (n = 263): referrals back to GP vs. light multi-disciplinary treatment (n = 222): 1 hour lecture (exercise, lifestyle, and fear avoidance); given individual information and feedback by team; gradually improve exercise levels despite pain vs. extensive multidisciplinary treatment (n = 169): 4 weeks of 6 hour sessions 5 days a week with CBT (group sessions 2 hours a week), education, exercise (physiotherapy daily for 1.5-3.5 hours day), and workplace interventions.	Baseline, 3, 6 and 10 months.	RTW rates 48% vs. 63% vs. 62%. Light program non-statistically better. Extensive program outperformed both arms for those patients "with a poor prognosis." Return-to-work rates were significant between light multi-disciplinary treatment vs. ordinary treatment (63% vs. 48%, p <0.02) as well as extensive multidisciplinary treatment vs. ordinary treatment (62% vs. 48%, p <0.05).	"[M]ultidisciplinary treatment is effective concerning return to work, when given to patients who are most likely to benefit from that treatment. The cost-benefit analysis of the economic returns of the light multidisciplinary and the extensive multidisciplinary treatment programs yields a positive net present social value of the treatment."	Involved disciplines were general practitioners, neurologist, psychologist, nurses and physiotherapy. Ordinary treatment/usual care provides biased comparison group ('more of same'). Data suggest either active treatment superior to usual care.

Lemstra, 2005 (5.5)	Multidisciplinary Rehabilitation Program	RCT	No mention of sponsorship or COI.	N = 79 with fibromyalgia and chronic widespread pain	Mean age for intervention group 49.7±9.57 years, control group 49.11±13.38 years; 12 males, 67 females.	Intervention group – 18 group supervised exercise therapy sessions, 2 group pain and stress management lectures, 1 group education lecture, 1 group dietary lecture, 2 message therapy sessions and rheumatologist and physical therapyist intake and discharge, all over 6 weeks (n = 43) vs control group (n = 36)	6 week post-intervention, 15 months	Reported change in health outcomes between intervention and control groups, respectively: Change in average pain intensity –1.02±0.25, 0.22±0.20 (absolute difference between groups 0.8, p=0.019). At 15 month follow-up – (absolute difference between groups -0.21, p=0.479)	"Positive health-related outcomes in this mostly unresponsive condition can be obtained with a low-cost, group multidisciplinary intervention in a community-based nonclinical setting."	Standard care control bias. Data suggest improved perceived health status, pain intensity, disability, mood and time in both hours and minutes in pain but these interventions did not result in decreases in either prescription nor non-prescription drug use or improved work status.
Jensen, 2011 (score=5.0)	Multidisciplinary Rehabilitation Program	RCT	Study supported by Danish Working Environment Research Fund. No COI.	N = 351 age 16-60 partly or fully sick-listed from work for 4 to 12 weeks due to LBP.	168 males, 183 females; Mean age for brief intervention group 41.9±10.4 and fro multidisciplinary intervention group 42.1±10.5.	Brief intervention: seek advice about RTW; physiotherapy, increase physical activity/exercise, education, follow-up after 2 weeks (group 1, n = 175) vs. brief intervention plus multidisciplinary	Follow-up for 1 year.	Mental Health (SF-36) mean±SD after 1 year: brief intervention (70.0±20.3) vs. multidisciplinary intervention (75.0±19.8), p = 0.046. There were no other significant differences between groups.	"[A] rather limited brief intervention had the same effects on RTW, pain, disability, and self-rated health as a more comprehensive multidisciplinary intervention."	Secondary analyses of Jensen C, Jensen OK, Christiansen DH, Nielsen CV:

						intervention: coordinated action plan for RTW; interview with case manager 1-2 hours to discuss work history, private life, and pain and disability perception; created tailored rehab program together for partial or full RTW (n = 176).				
Skouen, 2002 (score=5.0)	Multidisciplinary Rehabilitation Program	RCT	No mention of industry sponsorship. COI category stated as 14. Interpretation not included.	N = 195 with LBP age 21-66 years.	69 males, 126 females; Mean age of 44.0±11.7.	Control: (n = 86) treatment as usual with 31 men, and 55 women. vs. Light Multidisciplinary (LMT): (n = 52) 21 men, and 31 women Vs. Extensive Multidisciplinary (n = 57) 17 men, and 40 women.	Follow-up at 12, 18 and 24 months.	Significant results in men for Light Multidisciplinary vs. control group. At 12-months; mean = 5.1, SD = 4.7 for control, and mean = 7.9, SD = 4.7 for LMT with p = 0.03. At 18-months; mean=8.1, SD = 7.0 for control, and mean = 12.5, SD = 5.9 for LMT with p = 0.02. At 24-months; mean = 11.1, SD = 9.6 for control, and mean = 16.9, SD = 7.5 for LMT with p = 0.02 for men. Women had no significant results between groups.	"The challenge of the future may be to offer at risk patients, at approximately 8 weeks absence from work, a light multidisciplinary treatment program at a multidisciplinary spine clinic. Our light multidisciplinary treatment model seems appropriate for men. In women, however, the emphasis on illness behavior, family situation, and job factors,	Post-hoc sub-analysis of larger RCT.

									such as control over work and job satisfaction, may be important elements in future LBP programs, but this should be further evaluated."	
Von Korff, 2005 (score=5.0)	Multidisciplinary Rehabilitation Program	RCT	Sponsored by a grant from the National Institutes of Health. No mention of COI.	N = 317 with back pain (mainly chronic) and 7+ activity limitation on 23-item Roland Disability Questionnaire (RDQ).	90 males, 150 females; Mean age for intervention group 49.7±9.0 and for the control group 49.8±9.8.	Intervention group: 4 in person visits with psychologist and physical therapist focusing on back pain fear, exercise plans and goals, relaxation and pain management (n = 119) vs. control group: usual care consisting of pain medications, primary care visits, and ancillary services such as physical therapy (n = 121).	Follow-up at 2, 6, 12, and 24 months after randomization.	Mean±SD RDQ baseline/24 months, intervention vs. control: 12.3±5.5/ 8.1±6.5 vs. 11.4±5.7/9.1±7.2 (p = 0.0078). Mean±SD worrying rate baseline/24 months, intervention vs. control: 6.7±2.6/3.5±3.0 vs. 6.2±2.7 /4.5±3.2 (p <0.0001). Mean±SD fear avoidance baseline/24 months, intervention vs. control: 41.1±8.8/ 34.3±9.7 vs. 41.3±8.2/ 38.4±9.9 (p = 0.0001). Mean±SD pain intensity baseline/24 months, intervention vs. control: 5.7±1.8/ 4.3±2.1 vs. 5.8±1.8/ 4.6±2.5 (NS). Percent with clinically meaningful reduction in RDQ intervention vs. control: 2 mo 27.7 vs. 13.2 (p = 0.0007); 6	"[A]n intervention integrating fear reducing and activating interventions into care for chronic back pain patients produced sustained reductions in patient fears, commonly activity limitations related to back pain, and days missed from usual activities due to back pain."	Baseline differences in pain/limitations (e.g., 43.6% vs. 28.9% severe activity limitations) raising question of randomization failure. At 2 yrs, the interventional group had less fear, less pain and less activity limitations. High dropout rate at 2yrs.

								months 42.2 vs. 23.7 (p = 0.0005); 12 months 44.6 vs. 22.7 (p = 0.03); 24 months 49.4 vs. 37.0 (p = 0.08).		
Monticone, 2016 (score=5.0)	Multidisciplinary Rehabilitation	RCT	No mention of industry sponsorship or COI.	N = 150 with chronic low back pain (CLBP).	Mean age 53.2 (11.1) / 53.8 (10.4) for experimental / control groups; 58 males and 91 females.	Experimental group: 2 physiatrists, a psychologist, and 4 physiotherapists, plus exercise (N = 75) vs Control group: task oriented exercise, group based CBT (N = 75).	5-weeks, 12 and 24 months	Oswestry Disability Questionnaire (ODI): baseline vs post-treatment score for both groups favoring experimental group, ($p < 0.001$). Effect of time / group / and time by group: $p < 0.001$ / $p < 0.001$ / and $p < 0.001$.	"This light group-based multidisciplinary cognitive behavioural rehabilitation programme was superior to traditional exercises in reducing disability, kinesiophobia, catastrophizing, and enhancing the quality of life of subjects with CLBP."	Usual care control bias. Data suggest disability decreased in group based multidisciplinary CBT rehab group as well as improved kinesiophobia, quality of life, and less catastrophizing.
Tavafian, 2011 (score=5.0)	Multidisciplinary Rehabilitation Program	RCT	No industry sponsorship or COI.	N = 197 with chronic LBP	43 males, 154 females; Mean age of intervention group 44.6±10.2 and control group 45.9±11.3.	Intervention Group receiving group based multidisciplinary rehabilitation program plus oral medication (n = 97) vs. Control group receiving oral medication (n =100).	Follow-Up of 6 months.	Significant difference on all SF-36 subscales within each group by time ($p < 0.01$), except mental health ($p = 0.7$). Mean±SD for QDS scores at baseline comparing intervention group vs. control group at baseline: 35.45±20.19 vs. 33.08±19.69; and 6 months follow-up: 18.65±16.14 vs. 27.19±17.85 ($p = 0.01$). Mean±SD RDQ scores comparing intervention group vs.	"This study revealed that the multidisciplinary rehabilitation program added to a typical oral medication regimen can improve QOL and disability of patients with CLBP in a 6-month period of follow-up."	Unclear how blinding occurred. Contact time bias. Data suggest possible modest efficacy.

								control group at baseline: 9.80±5.07 vs. 10.04±5.28; and at 6 months follow-up: 7.03±5.49 vs. 8.80±5.68.		
Jensen, 2012 (score=5.0)	Multidisciplinary Rehabilitation Program	RCT	Study supported by Danish Working Environment Research Fund. No COI.	N = 351 age 16-60 partly or fully sick-listed from work for 3 to 16 weeks due to LBP	168 males, 183 females; Mean age for brief intervention group 41.9±10.4 and fro multidisciplinary intervention group 42.1±10.	Brief intervention: seek advice about RTW; physiotherapy, increase physical activity and exercise, and education, follow-up after 2 weeks (group 1, n = 175) vs. brief intervention plus multidisciplinary intervention: coordinated action plan to facilitate RTW; interview with case manager for 1-2 hours to discuss work history, private life, and pain and disability perception; created tailored rehab program together for partial or full RTW (n = 176).	Follow-up for 2 years.	No significant differences between groups.	"The effects of the brief and multidisciplinary interventions at the two-year follow-up were similar to the effects reported at the one-year follow-up."	Secondary analyses of Jensen C, Jensen OK, Christiansen DH, Nielsen CV:
van Eijk-Hustings,	Multidisciplinary	RCT	No COI. Sponsored by Maastricht	N = 203 with fibromyalgia	Mean age for those in MD who	Multidisciplinary intervention with aftercare,	21-24 months	Intention-to-treat analyses among the MD group showed	"MD seemed to yield positive effects, but firm	Usual care bias. Conclusions are limited due to

2013 (score=4.5)	Rehabilitation Program		University Medical Centre and by Care Renewal Grants of medical insurance companies in region.	based on the American College of Rheumatology criteria	started program 41.6±8.8, MD who did not start 41.3±11.0, those in AE who started 43.9±7.6, AE who did not start 39.1±9.6, UC 42.9±11.0; 55 males, 148 females.	two phase program with 12-week course consisting of 3 half days each week, focusing on sociotherapy, physiotherapy, psychotherapy and creative arts therapy with group interaction (MD) (n = 108) vs. Aerobic exercise (AE), twice per week (n = 47) vs. Usual care (UC) (n = 48)		improvements within and small differences between groups at follow-up. Between MD and UC group a not statistically significant difference as follow-up was found (difference between groups 0.22, 95% CI -0.12-0.56).	conclusions with regard to effectiveness cannot be formulated due to small between-group differences and limitations of the study."	unequal participation and completion rates between groups (AE group had significant dropout).
Lindström, 1992 (score=4.5)	Multidisciplinary Rehabilitation Program	RCT	No mention of industry sponsorship or COI.	N = 103 with subacute LBP off work for 6 weeks	71 males, 32 females; mean age in activity group 39.4±10.7 and control group 42.4±10.9	Graded activity group (n = 51) vs. controls: no treatment (n = 52) for 1 year. Graded activity group with measured functional capacity (mobility, strength and fitness), workplace visit, back school education, and an individual, submaximal gradually increased exercise program with	Follow up at one year.	Increases in arm strength, abdominal muscle strength, back muscles, and many other outcome measures preserved at 1 year in activity group. Activity group RTW 5.1 weeks earlier, p = 0.03.	"The patients with subacute, nonspecific, mechanical LBP who participated in the graded activity program regained occupational function faster than did the patients in the control group, who were given traditional care."	Involved orthopedic surgery and physiotherapy. GPs administered routine care, but not otherwise involved. Social worker performed psychosocial screening. Graded activity program reduced long-term sick leave especially in males. Intensive exercises, work-hardening exercises, or expensive equipment not

						operant conditioning.				necessary to regain occupational function.
Haldorsen, 1998 (score=4.5)	Multidisciplinary Rehabilitation Program	RCT	Study funded by Royal Norwegian Department of Health and Social Affairs. COI: Skouen.	N = 573 (223 with back pain) sick-listed 8 weeks due to muscle pain and currently employed	171 males, 298 females; Mean age of 43±10.6.	Multi-disciplinary rehabilitation program 6 hour sessions 5 days a week for 4 weeks – physical treatment, cognitive behavioral modification, education, and workplace-based interventions (Treatment group, n = 312; n = 142 with back pain) vs. follow-up by GP without feedback or advice on therapy (Control group, n = 157; n = 81 with back pain) Treatment for 4 weeks, Patients given pre and post-test.	Follow-up at 2 months, 6 months, and 10 months.	No significant differences between groups for RTW rate. Outcomes at post-test (mean±SD): regular physical training – treatment 3.1±0.9 vs. control 2.5±1.1, risk ratio 2.02; work satisfaction – treatment 3.1±1.1 vs. control 2.71.1, risk ratio 1.54; attribution style – treatment 17.1±5.3 vs. control 18.0±6.4, risk ratio 1.66; psychological distress – treatment 35.4±10.3 vs. 36.9±9.9, risk ratio 1.61; subjective health complaints – treatment 16.7±10.7 vs. control 17.4±10.4, risk ratio 1.22; Pain (VAS, afternoon) – treatment 48.2±27.4 vs. control 52.1±28.9, risk ratio 1.31.	"[T]he patients did not return to work at a higher rate than those receiving ordinary treatment available through the general practitioners at one year follow-up."	Significant change in contact time between groups.
Henchoz, 2010 (score=4.5)	Multidisciplinary Rehabilitation Program	RCT	No industry sponsorship or COI.	N = 105 with subacute to chronic LBP, phases 2 to 6	64 males, 41 females; Mean age for Multidisciplinary group 41.09±10.6	Functional multi-disciplinary rehab (FMR, n = 49) for 5-7 hours per day, 5 days a week, for	Follow up of 1-year.	Beginning of FMR/End of FMR mean (SD) for Shirado test (s) for exercise program 54.46 (47.51)/66.13 (45.95), p <0.01; for routine follow-up	"A favorable long-term outcome was observed after functional multidisciplinary rehabilitation in	Data suggest no meaningful differences in outcome measures between groups

				of Krause classification.	and fro routine group 39.25±9.05 .	3-weeks vs. Exercise program (n = 56) sessions lasted 90 min.		42.79 (30.34)/65.45 (41.86), p <0.001. Sörensen tests (s) for exercise program 46.44 (40.97)/64.82 (49.83), p <0.001; for routine follow-up 38.09 (36.65)/67.12 (50.63), p <0.001, MMS test, extension (cm) for exercise program -1.4 (0.89)/-1.63 (0.78), p<0.05; for routine follow-up -1.33 (0.73)/-1.46 (0.7), p=0.127. Fingertip-floor distance (cm) for exercise program 17.56 (15.91)/11.32 (13.13), p <0.001; for routine follow-up 21.6 (18.59)/17.31 (18.44), p<0.001. Modified Bruce test (min) for exercise program 9.81 (2.31)/11.23 (2.20), p <0.001; for routine follow-up 53.24 (18.27)/37.45 (21.73), p <0.001. Back pain VAS (%) 53.24 (18.27)/37.45 (21.73), p <0.001; for routine follow-up 51.56 (21.54)/35.93 (23.67), p <0.001. SFS (0-200) for exercise program 114.16 (40.8)/126.53 (32.08), p <0.01; for routine follow-up 109.69 (37.36)/129.12 (37.85), p <0.001.	both patient groups. Patients who participated in an exercise program obtained some additional benefits."	at same time point. Both groups improved over time.

Monticone, 2014 (score=4.5)	Multidisciplinary Rehabilitation	RCT	No sponsorship and no COI.	N = 20 with chronic low back pain (CLBP).	Mean age 58.9 ± 16.4 / 56.6 ± 14.4 for experimental / control groups; 9 males and 11 females.	Experimental group included stabilizing exercises plus usual-care rehabilitation (N = 10) vs Control group, 60 minutes cognitive-behavioral sessions once a week (N = 10).	8 – weeks	Disability improvement by 61 % in the experimental vs 25 % in the control group, a significant effect of time ($p < 0.001$), group ($p = 0.027$), and time-by-group interaction ($p = 0.001$) in favor of the experimental group.	"The multidisciplinary rehabilitation programme including cognitive–behavioural therapy was superior to the exercise programme in reducing disability, kinesiophobia, catastrophizing, and enhancing the quality of life and gait cadence of patients with CLBP."	Pilot study. Small sample, usual care control bias. Data suggest multidisciplinary rehab group which included CBT was better for improving disability, kinesiophobia, gait cadence, castrophizing, and quality of life.
Jellema, 2005 (score=4.5)	Multidisciplinary Rehabilitation Program	RCT	No industry sponsorship or COI.	N = 62 with non-specific LBP of less than 12 weeks	42 males, 18 females; Mean age for minimal intervention group 43.0±7.2 and usual care group 45.7±7.4.	Minimal intervention strategy (n = 30) vs. Usual care (n = 32).	Follow up at 6, 13, 26, and 52 weeks.	No significant difference between groups.	"This study provides no evidence that (Dutch) general practitioners should adopt our new treatment strategy aimed at psychosocial prognostic factors in patients with (sub)acute low back pain."	Cluster randomization results in significant differences in numbers or participants in each treatment arm.
Kääpä 2006 (score=4.0)	Multidisciplinary Rehabilitation Program	RCT	No COIs or industry sponsorship.	N = 120 females age 22-57 years old, employed as health care	Mean age: 46.25 Sex: 0 males, 120 females.	Multi-disciplinary restoration group or MR; 8-week intervention, 70 hours rehab	6, 12, and 24 months	No significant differences between groups with respect to LBP intensity, sciatic pain intensity, back specific disability, subjective working	"The results of this study indicate that semilight outpatient multidisciplinary rehabilitation	Data suggest comparable efficacy between treatment groups and

				and social care professionals with nonspecific chronic LBP		program, including intensive period of 5 days (6 hours per day), home-training of 2 weeks, and semi-intensive period of 5 weeks. (n = 59) vs. Individual Physiotherapy group or IP, 10 1-hour treatment sessions of 6-8 weeks. Sessions included 30- to 40-minute passive pain treatment and 15-20-minute light active exercise (n = 61).		capacity, sick leave due to back pain, beliefs of working ability about 2 years, and symptoms of depression at any time during study. Significant difference between groups with respect to General Well Being after rehabilitation (MR: 7.74 ± 5.45 vs. IP: 9.83 ± 5.4, p = 0.02)	program for female chronic low back pain patients does not offer incremental benefits when compared with rehabilitation carried out by a physiotherapist having a cognitive-behavioral way of administering the treatment."	positive effect maintained at 2 years. Primary reliance on passive methods in individualized physiotherapy group may have resulted in these findings.
Campello, 2012 (score=4.0)	Multidisciplinary Rehabilitation Program	RCT	Study sponsored by Navy & Marine Corps Public Health Center (NMCPHC), funded by Office of Assistant Secretary of the Army for Installations and Environment – OASA (I&E), and managed by Battele. No mention of COI.	N = 33 active duty service members for all US military branches seeking care for non-specific LBP interfering with normal work or life for 4-12 weeks.	30 males, 3 females; Mean age for BTW 33.1±6.6 and for usual care 32.0±7.2.	Multidisciplinary program – Backs to Work (BTW): coordinated multi-disciplinary, reconditioning program 3 hours a day, 3 days a week 4 weeks. BTW goal-oriented program of aerobic conditioning, strength training,	Follow-up at 12 weeks.	Oswestry score (baseline/4 weeks) mean±SD: control (24.3±10.5/21.0±8.3) vs. BTW (24.5±7.7/10.7±6.5, p = 0.014.	"This feasibility study was successful in demonstrating the implementation and execution of an early intervention multidisciplinary program for Navy personnel with NSLBP."	Small sample size (N=33). Pilot Study.

						flexibility exercises. Cognitive behavioral treatment included education on psychosocial variables that affect pain, relaxation training, modification of maladaptive beliefs, and problem solving (n = 16) vs. standard of care at a US Navy Military Treatment Facility (MTF) – treatment at the discretion of their doctor 2-3x a week up to 1 hour and included any of following: ultrasound, heat, ice, and electrical stimulation, traction, exercises, back class, and spinal manipulation (n = 17).				
Loisel, 1997 (score=4.0)	Multidisciplinary	RCT	No mention of industry sponsorship or COI.	N= 130 with back pain.	62 males, 42 females; Mean age for usual	Usual care (n = 26) vs. Clinical intervention: involved after 8	Follow-up at 12, 24 and 52 weeks.	RTW rate 2.23 times greater in occupational intervention group vs.	"Close association of occupational intervention	Involved disciplines were occupational

	Rehabilitation Program				care 41.7±10.0, clinical care 40.2±8.5, Occupational care 44.5±5.7, and Full care 37.4±8.1.	weeks absence visit to "back pain specialist," back care school, after 12 weeks absence, multidisciplinary work rehab intervention (n = 31) vs. Occupational intervention: after 6 weeks absence, visit to OT, ergonomics evaluation (n = 22) vs. Full intervention (combination of last two, n = 25).		usual care, p = 0.04. Median duration of work absence was 60 days for full intervention, 67 for occupational intervention, 131 for clinical intervention, and 120.5 days for usual care group, p = 0.01 for occupational effect groups vs. 2 groups without intervention.	with clinical care is of primary importance in impeding progression toward chronicity of low back pain."	physicians, ergonomists, "back specialists," and apparently physiotherapists . Long times off work atypical for U.S. and unclear if results generalizable outside the Netherlands.
Henchoz, 2010 (score=4.0)	Multidisciplinary Rehabilitation Program	RCT	No mention of industry sponsorship or COI.	N = 105 with subacute or chronic LBP without irritative neurological deficit and Krause classification phases 2-6.	64 males, 41 females; Mean age for EP group 41.1±10.6 and UC group 39.3±9.1.	Exercise program (EP, n = 56): 24 group training sessions 12 weeks 90 minute submaximal exercises under supervision vs. usual care (UC, n = 49): advised to exercise regularly and written description of exercises used during FMR continued at home after both groups received functional multi-disciplinary	Assessments at end of FMR and 1 year after end of EP/UC.	No significant differences between groups.	"[A]dding an exercise programme after FMR compared with usual care does not offer significant long-term benefits in terms of quality of life and direct and indirect costs."	Much missing data, especially OP group. Baseline differences including better fitness in MDRP group, possible moderate randomization failure. As all of work <6mo, likely had PT, which would bias in favor of other treatment. Data favor MDRP.

						rehab (FMR): 3-week outpatient program, groups of 5 patients treated Monday-Friday for 5-7 houra day with exercises, ergonomics, 1-to-1 and group psychosocial interventions, relaxation therapy and information, individually tailored pharmacotherapy and regular follow-up.				
Eisenberg, 2012 (score=4.0)	Multidisciplinary Rehabilitation Program	RCT	Study supported in part by grants from National Center for Complementary and Alternative Medicine and Bernard Osher Foundation. No COI.	N = 20 age 18-70 undergoing evaluation for work or non-work related LBP for 21-84 days (subacute) and >3 on 0-10 scale in past week	9 males, 11 females; Mean age of integratred care 47.2±9.1 and for usual care 48.0±8.0.	Integrative care plus usual care: acupuncture, chiropractic, internal medicine consultation and referral, massage therapy, occupational therapy, physical therapy, mind-body techniques, neurology consultation, nutritional counseling, orthopedics	Follow-up by phone at 2, 5, 12, and 26 weeks.	Bothersomeness at week 12 (mean±SD): IC (1.4±2.8) vs. UC (5.7±3.6), p = 0.02. Pain at week 12: IC (0.6±1.2) vs. (5.0±3.7), p=0.005. Pain at week 26: IC (1.0±1.6) vs. US (4.7±3.9), p = 0.04. Worst activity at week 12: IC (3.1±3.4) vs. US (6.7±3.7), p=0.03. SF-12 Physical at week 26: IC (51.0±8.9) vs. UC (43.8±13.1), p = 0.03.	"It is feasible for a multidisciplinary, outpatient IC team to deliver coordinated, individualized intervention to patients with subacute LBP. Results showed a promising trend for benefit of treating patients with persistent LBP with this IC model, and warrant evaluation in a full-scale study."	Small sample size. Alternative and usual care are ill defined.

						consultation, and psychiatry and rheumatology consultation and referrals up to 2 times a week up to 12 weeks (IC, n = 14) vs. usual care only: consisting of NSAIDs, muscle relaxants, as-needed referral to physical therapy, limited bed rest, education, and activity alterations. (UC, n = 6)				
Keller, 1997 (score=4.0)	Multidisciplinary Rehabilitation	RCT	No mention of industry sponsorship or COI.	N = 64 with chronic LBP (Quebec Task Force), no prior pain management program, able to attend, and fluent in German.	Mean age 46.89 (12.25) and 49.10 (12.75) for treatment and control groups; 18 males and 45 females.	Treatment program, included group meetings and 18 individualized sessions supervised by physicians, physiotherapists, and pain psychologist, education and relaxation exercises included (N = 35) vs Wait-list controls (N = 29).	6 months	Pain frequency, typical pain intensity and disability were reduced. Strength and endurance not affected. Most changes maintained at follow-up.	"These changes corresponded with improvements in well-being, whereas depression scores remained unchanged as before."	Wait-listed controls biases in favor of intervention. Baseline characteristics sparse and suggest trends towards differences. Co-interventions not well described. Data suggest physical activity improves outcomes in

										chronic LBP. Exercise components are not well described, but appear to emphasize posture.

Evidence for Chronic Pain Management Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Nicholas, 2014 (score=7.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsored by the Australian Health Ministers Advisory Council. No COI.	N = 141 patients with chronic pain.	Mean age: 73.90 years; 52 males, 89 females.	Pain Self-Management Group (PSM) (n= 49) – Patients received intervention based on cognitive behavioral pain management skills. Vs. Exercise-Attention Control Group (EAC) (n= 53) – Participants were able to choose at home exercise performance. Vs. Waiting List Control Group (n=39) - performed measures at baseline and at 12 weeks, without any intervention.	1 month.	For RMDQ, the adjusted mean (95% CI) value of PSM vs EAC is 2.68 (p=0.004), PSM vs WL is -2.65 (p=0.001), EAC vs WL is 0.03 (p=0.90).	"In the short term at least, cognitive-behavioral therapy based PSM was more effective than exercises and usual care."	Waitlist control bias. Data suggest cognitive behavioral therapy self-management is better than usual care or exercise alone for chronic pain in older adults at 1 month.

Dear, 2015 (score=6.5)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsored by the Motor Accidents Authority of New South Wales and the National Health and Medical Research Council (NHMRC) to B. F. Dear through an Australian Public Health Fellowship. No COI.	N=490 patients with chronic pain conditions.	Mean age: 50 years; 96 males, 375 females.	Regular Contact (n=143) – Participants participating in the Pain Course were assigned to a clinician who provided weekly contact to patients for 10-15 mins per contact. Vs. Optional Contact (n=141) – Patient participating in the Pain Course were given the option to contact the clinician. Vs. No Contact (n=131) – Patients were informed they would not revive contact during the Pain course. Vs. Control (n=75) – Treatment as	Baseline, 8 weeks, 3 month follow up.	The between-group Cohen's d effect sizes at posttreatment RMDQ score for regular contact and the following groups: -0.02 optional contact, 0.06 no contact, 0.53 waitlist control; for optional contact and the following groups: 0.07 no contact, 0.54 waitlist contact; for no contact and the following groups: 0.50 waitlist control. PHQ-9 d effect sizes at posttreatment were 0.18 regular contact and optional contact, 0.15 regular contact and no contact, 0.98 regular contact and waitlist control, -0.05 optional control and no contact, 0.73 optional contact and waitlist control, 0.87 no contact and waitlist control. GAD-7 d effect sizes at posttreatment were	"…[T]he present study replicates and extends the findings of an earlier trial. Significant improvements in levels of disability, anxiety, depression, and pain were observed and no consistent or marked differences were found across the levels of clinician support provided."	Waitlist control bias data suggest an internet-delivered pain management program can improve anxiety depression pain and disability in lieu of varying levels of clinical support.

						usual waitlist group.		0.16 regular contact and optional contact, 0.06 regular contact and no contact, 0.63 regular contact and waitlist control, -0.11 optional contact and no contact, 0.44 optional contact and waitlist control, 0.61 no contact and waitlist control.		
Bair, 2015 (score=5.5)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsorship by Merit Review grant from VA Rehabilitation Research and Development. Dr. Kroenken received honoraria from Eli Lilly and company outside the submitted work no other COI.	242 patients with chronic and disabling musculoskeletal pain.	Mean age 37.3; 213 males, 28 females.	Stepped-care intervention optimization of analgesic treatment, self-management strategies, and CBT. (N = 121) vs Usual Care (N = 120)	9 months	Change from baseline stepped-care vs Usual care RMDS s -1.9 (p = .002) BPI pain interference -.8 (p = .003) GCPS severity -6.6 (p = .001)	"Stepped-care intervention that combined analgesics, self-management strategies, and brief cognitive behavioral therapy resulted in statistically significant reductions in pain-related disability, pain interference, and pain severity in veterans with chronic musculoskeletal pain."	Usual care bias. No information on medication pre-trial. Data suggest stepped care plan significantly improved pain and disability.
Hutting, 2015 (score=5.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsored by ZonMw, the Netherlands Organization for Health Research and Development. No COI.	N= 123 patients with chronic pain.	Mean age: 46.2 years; 28 males, 89 females.	Self-Management Group (SG) (n= 64) – Patients set goals and made action plans and were given information in	Baseline, 3 months, 6 months, 12 months.	DASH scores at baseline, 3 months, 6 months , and 12 months for SG group were 22.28, 17.76, 14.04, 14.32, p=0.10; for UCG group were 22.27,	"The self-management intervention improved the participants' perceived disability during work. Since no significant	Usual care bias. High dropout rate in control group. Medication use missing from baseline data table. Data suggest

						self-management Vs. Usual Care Group (UCG) (n= 53) – Patients were able to use all usual care information within and outside the organization of the participant.		19.55, 17.39, 15.05, respectively.	between-group differences were found on most outcome measures, the results of this study should be interpreted with caution."	perceived disability improvement in SG group.
Oldenmenger, 2011 (score=4.5)	Pain Education Programs	RCT	Sponsored by the Erasmus MC Health Care Research and the Erasmus MC Revolving Fund. No COI.	N = 72 patients with cancer and chronic pain.	Mean Age: 59 years; 25 males, 47 females.	Standard Care (n=37) – Patients received standard treatment. Vs. Pain Consult and PEP (n=35) – Consisted of patient-tailored pain education and weekly monitoring of pain and side effects.	8 weeks.	Pain treatment during the study: Patients with pain consultation: SC 13, PC-PEP 35, p<0.001; CT/MRI: SC 15, PC-PEP 26, p=0.004; Hospital Admissions: SC 8, PC-PEP 11, p=0.25; Radiotherapy: SC 10, PC-PEP 9 p=0.556.	"In conclusion, PC-PEP improves pain, daily interference, and patient adherence in oncology outpatients."	Standard care bias. Data suggest PC-PEP improves pain intensity and pain knowledge in oncology patients.
Kell, 2009 (score=4.5)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsored by the Saskatchewan Health Research Foundation (New Investigator Grant) and the University of Alberta,	N = 27 patients with non-specific low back pain.	The mean age of the RT group is 40.1 years. 5 males, 4 females. The mean age of the	Resistance Training (RT) (n=9) - Patients performed upper- and lower-body RT exercises that consisted of free	Baseline, week 8 and week 16.	The data of significance for muscular strength, endurance, flexibility and power is the following: Bench Press – RT group: at baseline	"This study indicates that whole-body periodized RT can be used by training and conditioning personnel in the rehabilitation of	Relatively high dropout rate with unknown differences between groups.

			Augustana Campus (travel grant).		AT group is 36.7 years. 5 males, 4 females. The mean age of the Control group is 35.3 years. 5 females, 4 males.	weights and machine use. Vs. Aerobic Training (AT) (n=9) – Patients performed any aerobic exercise in which the subject was interested, with the most commonly selected modes being the elliptical trainer and treadmill walking or jogging. Vs. Control (n=9)		44.4 kg ((p ≤ 0.05) between RT and C at week 16 and (p ≤0.05) within group between baseline and week 16). At week 8 54.3 kg ((p ≤0.05) within group between week 8 and week 16). At week 16 56.9 kg ((p ≤0.05) between RT and C at week 16). Sit-and-Reach flexibility (cm) at baseline: RT group 31.7 ((p ≤0.05) within group between baseline and week 8 and (p ≤0.05) within group between baseline and week 16). AT group 24.9 ((p ≤0.05) within group between baseline and week 8).	those clients suffering with CLBP."	
Jousset, 2004 (score=4.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsored by Union Re´gionale des Caisses d'Assurance Maladie des Pays de Loire. No COI.	N = 86 patients with low back pain.	The mean age of the Functional Restoration group is 41.4 years. 30 males, 13 females. The mean age of the active individual therapy group is 39.5 years.	Functional Restoration (n=43) – For 6 hours a day, 5 days a week, for 5 weeks, patients participated in the following activities: warm-up, strengthening exercises, aerobic activities,	Baseline and 6 months.	The main outcome measure is was the number of self-reported sick-leave days between the end of the program and the 6-month follow-up appointment. Number of sick-leave days for Functional Restoration group and Active Individual Therapy	"This study demonstrates the effectiveness of a functional restoration program on important outcome measures, such as sick leave, in a country that has a social system that protects people facing difficulties at work."	Data suggest the functional restoration group had a significantly lower number of sick day s than the active individualized therapy group.

					26 males, 15 females.	occupational therapy, endurance training, and individual interventions vs. Active Individual Therapy (n=41) – Patients received 1-hour treatment sessions, three times a week during 5 weeks. Patients were to perform exercise at home for 50 minutes.		group is 42 and 41, respectively. (p=0.12).		
Friedrich, 1998 (score=4.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	No mention of sponsorship. No COI.	N = 93	Mean age is 44.08; 46 males, 47 females.	Standard Exercise Program (N = 49) vs. Combined Exercise and Motivation Program (N = 44)	12 months	Pain intensity decreased in both treatment groups. Significant effects of both the time of assessment (p=.000) and treatment (p=.037) but significant time X group inter action (p = .609). Significant differences in pain ratings in favor of the motivation group (1st follow up p=.011; 4-month follow up p=.026; 12-month follow up p=.006).	"A program combining conventional exercise therapy with motivation-enhancing intervention strategy significantly reduced the level of disability and pain in low back pain patients."	Compliance higher in motivational groups. High 5 year dropout rate (>40%). Data suggest combined motivational and exercise program better at reducing disability and pain and increases work ability in patients with chronic pain.

Roche, G 2007 (score=4.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Supported by the Union Regionale de Caisses d'Assurance Maladie des Pays de Loire. No COI.	N = 132	Mean age is 39.8 years; 46 females, 86 males.	FRP Group (N = 68) vs. AIT Group (N = 64)	5 weeks	No significant between the two comparison groups at baseline in regards to sex, age, depression, and lower back pain. Greater improvement for patients with lower t0 Sorensen scores. Change in score between t0 and t5 correlated with significant with the t0 score (ANCOVA, p<.001) and treatment (P<.001).	"Low-cost ambulatory AIT is effective. The main advantage of FRP is improved endurance. We speculate that this may be linked to better self-reported work ability and more frequent resumption of sports and leisure activities."	Data suggest all outcome measures improved in both the AIT and FRP groups with the exception of endurance in the AIT group. However, greater improvements were seen in ERP groups.
Roche-Leboucher, 2011 (score=4.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsored by Institut National de veille sanitaire, Paris, France. No COI.	N=132 patients with low back pain	Mean age: 39.8 years; 86 males, 46 females.	Functional Restoration Program (n=68) – Patients performed muscle strengthening, endurance training, balneotherapy, and attended psychologist meetings. Vs. Active Individual Therapy (n= 64) – Patients focused on flexibility training and	1 year.	The reduction in number of sick-leave days (posttreatment year – pretreatment year) for functional restoration is 64 (p<0.001) and for Active Individual Therapy is 49 (p<0.001).	"Both programs are efficient in reducing disability and sick-leave days. The FRP is significantly more effective in reducing sick-leave days. Further analysis is required to determine if this overweighs the difference in costs of both programs."	Data suggest FRP effective with less sick leave, increased fitness, and trends towards greater return to work and full time work (the latter 2 are underpowered).

						pain management.				
Dowd, 2015 (score=4.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	No COI. No mention of sponsorship.	N = 124 with chronic pain for more than 6 months	Mean age: 44.53 years; 12 males, 112 females.	Mindfulness in Action (MIA) (N = 62) vs. online version of pain management psychoeducation program (PE) (N = 62). Each group received 12 sessions twice a week for 6 weeks	6 months	Least Squares Mean for Pain interference at times T1 (baseline), T2 (pre-intervention), and T3 (6 month follow-up), respectfully: MIA 39.55±1.96, 24.83±2.90, 30.71±3.00. PE 44.83±2.02, 31.50±2.42, 35.47±2.69. Multilevel Model Results for Group Effects on Changes in Pain interference over time: Intercept 48.89±2.97, Group -5.20±4.22, Time -5.78±1.44 ($p<0.0001$), Time x Group 0.34±2.16.	"The results of the study provide evidence that although there were equivalent changes across outcomes of interest for participants in both conditions over time, the MIA program showed a number of unique benefits."	High dropout rate.
Guetin, 2012 (score=4.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsored by the Foundation CNP Assurances. No COI.	N= 87 patients with lumbar pain, fibromyalgia, inflammatory disease, or neurological disease.	Mean age: 48.8 years; 19 males, 68 females.	Music Intervention (n=44) – Patients received standard therapy and individual music therapy sessions.	3 months.	Pain VAS score at D0 was -1.6 and at D60 was -3.4 in the music intervention group. $p<0.001$. At D90 the mean score is 3.4 in the music intervention group and 4.7 in control group. $P<0.001$.	"These results confirm the value of music intervention to the management of chronic pain and anxiety/depression. This music intervention method appears to	Data suggest short term benefit of music therapy for decreasing anxiolytics, depression, pain perception and overall medication consumption.

						Vs. Control (n=43) – Patients received standard treatment only.			be useful in managing chronic pain as it enables a significant reduction in the consumption of medication.”	

Evidence for Other Functional Restoration Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Smeets, 2005 (7.0)	Functional restoration	RCT	No mention of sponsorship. No COI.	N = 223 with chronic low back pain.	Mean age 41.43; 117 males, 106 females.	Active physical treatment, (APT) 5-minute warming up, 20 minutes performing at 65 to 80% of the maximum heart rate (HRmax) followed by a 5-minute cooling down. (N = 53) vs Cognitive-Behavioral treatment, (CBT) two introductory group meetings followed by 18 individual sessions. No physical exercise (N =58) vs Combined Treatment, CT consisted of APT in combination with PST 10 sessions of 1 1/2 hours (CT) (N = 61) vs Waiting List (WL) (N = 51)	1 year	Outcomes compared to WL RDQ 13.88 vs APT -2.40, vs CBT -3.05, vs CT -2.56. Main complaints 74.25 vs APT -11.19, vs CBT -16.36, vs CT -17.84. APT & CBT vs CT RDQ 0.16, -0.49 vs 11.40 Main complaints, 6.65, 1.48 vs 54.68 Current pain -0.45, 1.48 vs 42.31.	"All three active treatments were effective in comparison to no treatment, but no clinically relevant differences between the combined and the single component treatments were found."	Waitlist control bias. Data suggest all 3 of the treatment arms showed improvement compared to control group but no one treatment group was superior to another.

Pires D 2015 (6.5)	Functional restoration	RCT	No COI. No sponsorship	N= 62 chronic low back pain patients	Mean age: 50.0 years 40 females, 22 males	Education group (n=20) vs Control group (n=32) Twelve sessions of a 6-week aquatic exercise programme preceded by 2 sessions of pain neurophysiology education. Controls received only 12 sessions of the 6-week aquatic exercise programme.	Post 6-weeks intervention, post 3-months follow-up	55 participants completed the study. Analysis using mixed-model ANOVA revealed a significant treatment condition interaction on pain intensity at the 3 months follow-up, favoring the education group (mean SD change: –25.4± 26.7 vs –6.6 ± 30.7, $P < 0.005$). Although participants in the education group were more likely to report perceived functional benefits from treatment at 3 months follow-up (RR=1.63, 95%CI: 1.01–2.63), no significant differences were found in functional disability and kinesiophobia between groups at any time.	"[T]his study indicates that the provision of pain neurophysiology education is a clinically effective addition to aquatic exercise. Further studies are necessary to better understand how pain neurophysiology education influences pain intensity and disability and to evaluate the long terms effects of this intervention on pain and disability."	Data suggest the combination group (aquatic exercise plus pain education) improved pain intensity but no other differences between groups.
Ris, 2016 (6.0)	Functional restoration	RCT	No COI. No sponsorship.	N= 200 traumatic/non-traumatic neck pain patients	Mean age: 45 years; 149 females, 51 males	Pain education combined with exercises/ training Exercise group (n=101) Vs. Pain education Control group (n=99)	At baseline, after 4 months	The exercise group showed statistically significant improvement in physical HR-QoL, mental HRQoL, depression, cervical pressure pain threshold, cervical extension	"A 4-month intervention containing pain education, specific exercises and graded activity training showed significant effect on improved HR-QoL, as well as on	Data suggest combination physical training, specific exercises and pain education is superior to pain education alone for improving QoL.

								movement, muscle function, and oculomotion. Per protocol analyses confirmed these results with additional significant improvements in the exercise group compared with controls	psychological factors, cervical extension, muscle function and some oculomotor functions. Good adherence increased the effect in favour of the exercise group. This may be an effective intervention for chronic neck pain patients	
Archer, 2016 (score=6.0)	Functional restoration	RCT	Sponsorship by the national institute of Arthritis and Musculoskeletal and Skin Diseases of the National Institutes of Health.	N = 86 patients post lower lumbar surgery	Mean age 57.6; 38 males 48 females.	Education (N = 43) vs Cognitive-behavioral-based rehabilitation therapy(CBPT) weekly sessions with a study physical therapist for 6 weeks (N = 43)	3 months	CBPT vs Education post treatment .22 (p = .52) 3 months -.88 (p = .007) Leg pain Post treatment -.53 (p = .07) 3 mo -1.2 (p = .007)	"This randomized trial demonstrates that screening patients for fear of movement and using a targeted CBPT program results in significant and clinically meaningful improvement in pain, disability, general health, and physical performance after spine surgery for degenerative conditions"	Data suggest CBPT may improve chronic pain and other post-operative outcomes after spinal surgery as 3 month outcome follow-ups were statistically significant for pain improvement in CBPT groups.
Monrone, 2016 (score=5.5)	Functional restoration	RCT	Sponsored by national institutes of health no COI.	N = 282 patients with chronic lower back pain.	Mean age 74.5; 134 males and 148 females	Intervention 8 week mindfulness based stress reduction program. (N = 140)	6 months	Roland and Morris Disability Questionnaire; intervention group improved −1.1 points on the at 8 weeks and −0.4	"A mind-body program for chronic LBP improved short-term function and long-term current and most severe	Data suggest there were short term functional improvements from the mind-body group and

						vs Control (N = 142)		points at 6 months (overall group × time interaction, P = .01). Mean overall change in pain scores. 30% improvement immediately after completion. Intervention group vs control group achieved a 30% improvement on the current (54 of 132 [40.9%] vs 34 of 138 [24.6%]; P = .004) and most severe (48 of 132 [36.4%] vs 30 of 138 [21.7%]; P = .008). 6 months (52 of 117 [44.4%] vs 34 of 135 [25.2%]; P = .001) and most severe (42 of 117 [35.9%] vs 30 of 135 [22.2%]; P = .02). Evaluation at 50% improvement at trial end. (21 of 132 [15.9%]vs 14of 138 [10.1%]; P = .16), current (43 of 132 [32.6%]vs22of 138 [15.9%];P = .001), Most severe (21 of 132 [15.9%] vs 12 of 138 [8.7%]; P = .07)	pain. The functional improvement was not sustained, suggesting that future development of the intervention could focus on durability."	pain improvement for severe and current long term pain in older adults. Medication u se not described.

								6 months; (29 of 117 [24.8%] vs 18 of 135 [13.3%];P = .02) and current (41of 117 [35.0%]vs 28 of 135 [20.7%]; P = .01) not most severe (25 of 117 [21.4%] vs 17 of 135 [12.6%]; P = .06) NRS pain measures.		
Izquierdo, 2016 (5.5)	Functional restoration	RCT	No mention of Sponsorship or COI.	28 patients with chronic neck pain	Mean age 29.2; 10 males, 18 females.	(Cranio-cervical flexion test) CCF training (N = 14) Vs Proprioception training (N = 14)	2 months	NDI post month 2 CCF 4.46 vs Proprioception 4.14 Vas maximum median CCF.20 vs Proprioception 1.25 VAS minimum CCF 2.17 vs proprioception 2.05	"Training protocols of CCF and proprioception training produced an improvement in activation and endurance of the deep cervical flexors, as assessed via the CCFT, on pain measured by triple VAS and on the level of disability evaluated with NDI, with similar results in both groups. However, pressure pain sensitivity was not affected in either group. Proprioception training may provide an additional benefit of facilitating the deep cervical flexor muscles."	Small sample. Data suggest comparable efficacy.

Bendix, 1996 (score=5.5)	Interdisciplinary work Rehabilitation program	RCT	Supported by grant from Danish Rheumatism Association, and Research Foundation of the Copenhagen University. No mention of COIs.	N = 106 with chronic LBP in Denmark	Median age: 41 for treated group, 40 for control group; 28 male, 66 females.	Multidisciplinary functional restoration (n = 55) vs. Control (n = 51). Multi-disciplinary program: aerobics, weight training, work stimulation/work hardening, relaxation, psychological group, stretching, theoretical class, recreation. Intervention full-time program with 135 hours for 6 weeks. Controls sent for treatment elsewhere.	4 months	Intervention group returned to work at much higher rate (64% vs. 29%). Median contacts with health care system were median 1.6 for treatment group vs. 5.3 for control, p <0.001. Sick leave days were median of 10 for treatment group vs. 122 for control, p = 0.02. Back pain ratings 5.7 for treatment group vs. 6.9 for control group, p = 0.05.	"Although such programs are expensive, they can reduce pension expenditures, sick leave days, health care contacts, and pain."	Large differences in contact time and untreated controls bias in favor of intervention. Program with many co-interventions and was intensive. Data suggest effective to reduce lost time in Denmark and applicability elsewhere uncertain.
Bendix, 1998 (score=5.5)	Functional Restoration	RCT	Sponsored by Danish Rheumatism Association, Danish Ministry of Health, National health Fund for Research and Development, Danish Society for Manual Medicine, Minister Erna Hamilton's Foundation, Foundation of Gerda and Aage	N = 185 participants with chronic low back pain.	Mean age: 42.2 years; 54 males, 131 females.	Two parallel groups: Group A1 (N = 46) functional restoration (FR, 8h/day X 3 weeks, then 6h/day X 3 weeks FR) and A2 control group (no treatment, N = 42) vs Group B1 FR (N = 37), B2 physical training only (N = 29), and B3 psychological	Follow-up at baseline and 5 years.	Comparing baseline to 5 year follow-up, statistically significant results were seen in being able to do more work in B1 (p=0.0006), decreased difficulties in ADLs due to LBP in both FR groups (p=0.001 for A1, p=0.0008 for B1), reduction in back pain for both A groups (p=0.01 for both), decreased pain medication for	"The overall result shows a positive long-term effect of the FR program, but it also shows the necessity of testing a given treatment in different projects and designs, among other things due to statistical variations."	Data suggest at 5 years the FR group showed a positive long term effect.

			Haensch, Research Foundation of Copenhagen University, Rockwool Foundation and more. No mention of COI.			support and physical training (N = 31, 2x/w for 6 weeks, total of 24 hours for B2 and B3).		back pain in group B1 (p=0.009), and increased sport activity for every group (p≤0.001). For increase in subjective quality of life, B1 was significantly higher compared to B2 (p=0.007) and B3 (p=0.003).		
Jessep 2009 (score=5.5)	Functional Restoration	RCT	Sponsored by Physiotherapy Research Foundation Project Number PRF/03/3. No COI.	N = 64 over age 50 with mild, moderate, or severe non-specific knee pain lasting more than 6 months, diagnosed with knee OA	Mean (range) age outptatient group 67 (51 to 76), ESCAPE group 66 (53 to 81). Females only.	Outpatient physiotherapy vs. ESCAPE-knee pain for knee osteoarthritis for maximum of 10 sessions.	Follow-up at baseline and 12 months.	Exercise beliefs and self-efficacy score, mean (SD): outpatient physiotherapy 68.2 (60) post intervention, 66.2 (6.9) 12 month follow-up compared to ESCAPE-knee pain 71.5(8.4) and 70.8 (8.2), p = 0.035.	"The hypothesis that ESCAPE-knee pain would sustain greater benefits than outpatient physiotherapy was not supported as both interventions produced similar sustained improvements in physical function and other clinical outcomes. Lower intervention costs and reduced healthcare utilisation did support the hypothesis that ESCAPE-knee pain would be less costly and more cost-effective than outpatient physiotherapy."	High dropouts. Multiple co-interventions. Data suggest comparable results at 1 year.
Hahne 2016 (score=5.5)	Functional Restoration	RCT	Supported by LifeCare Health. COI of authors Grant: LifeCare	N=54 with clinical features of	Mean (SD) age advice group 46.9 (12.8), 44.5	Individualized functional restoration incorporating	Follow-up 52 weeks.	Mean (SD) Activity limitation (Oswestry 0–100): Adjusted	"[I]ndividualized functional restoration	Medication use missing in baseline

			Health (Paid directly to institution/employer), pertaining to the submitted work; Consulting: LifeCare Health (D), outside the submitted work	radiculopathy (6-week to 6-month duration) and imaging showing a lumbar disc herniation.	(11.5) IFR group.	advice (10 sessions) (N=28) vs. guideline-based advice alone (2 sessions) (N=26) over a 10-week period.		between-group difference (95% CI) was 8.2 (0.7–15.6), p=0.03.	incorporating advice was more effective than guideline-based advice alone for achieving faster improvement in back pain (10-week follow-up) and faster (10 weeks) and sustained (52 weeks) improvement in activity limitation, but not for improvement in leg pain"	comparison table. Data suggest individualized functional restoration experienced greater improved back pain and activity vs advice group at 52 weeks.
Masharawi 2013 (score=5.0)	Functional Restoration	RCT	No mention of sponsorship or COIs.	N=40 with non specific chronic low back pain (NSCLBP).	Mean age exercise group 52.45 (10.6), control group 53.6 (9.53). Females only.	NWB bi-weekly group exercise class aimed at improving lumbar mobility/flexibility and stability (N=20) vs. control group (N=20).	Follow-up at 4 weeks of intervention and 8 weeks later.	VAS score significantly reduced following intervention and at follow up vs. control group (mean difference = 2.32 (−58%), $p < 0.001$.	"A functional program of NWB group exercising improves functional, painful status, lumbar flexion and extension ranges of motion in women suffering from NSCLBP."	Waitlist control bias. Data suggest NWB group had better pain relief vs controls.
Hurley 2015 (score=5.0)	Functional Restoration	RCT	The Health Research Board Project Grant 2007/79 funded this research. No COI.	N=246 with chronic low back pain.	Mean age±SD: 45.4±11.4 years. 79 males, 167 females.	Individualized walking program (WP) (N=82) vs. group exercise class (EC) (N=83) vs. usual physiotherapy (UP, control) (N=81)	Follow-up 12 months.	Mean Oswestry Disability Index (0-100): Baseline vs. 12 months EC Group 33.52 vs. 26.93. WP Group 33.52 vs. 26.67.	"Supervised walking provides an effective alternative to current forms of CLBP management."	Usual care bias. Data suggest equal outcomes in all 3 groups but the WP group had largest adherence.

Rudolfsson T 2014 (4.5)	Functional restoration	RCT	Sponsored by Alfta Research Foundation, grants from the Swedish Council for Working Life and Social Research (2006-1162) and Länsförsäkringar Forskning och Framtid (51-1010/06). No mention of COI.	N= 128 women with chronic non-specific neck pain	Mean age: 51.2 years; all females	Neck coordination exercise NCE with novel training device (n=36) Vs. Strength Training ST for the neck and shoulders (n=36) Vs. Massage (n=36)	Six month follow up	No significant treatment effects in favor of neck coordination exercise were found for short-term or 6-month evaluations.	"Neck coordination exercise is no better than strength training and massage in improving sensorimotor function. Further research should investigate the use of cutoffs for sensorimotor dysfunctions prior to proprioceptive or coordinative training.	Data suggest comparable in efficacy between groups.
Roche-Leboucher, 2011 (score=4.0)	Chronic Pain Management Programs/Functional Restoration Programs	RCT	Sponsored by Institut National de veille sanitaire, Paris, France. No COI.	N=132 patients with low back pain	Mean age: 39.8 years; 86 males, 46 females.	Functional Restoration Program (n=68) – Patients performed muscle strengthening, endurance training, balneotherapy, and attended psychologist meetings. Vs. Active Individual Therapy (n= 64) – Patients focused on flexibility training and pain management.	1 year.	The reduction in number of sick-leave days (posttreatment year – pretreatment year) for functional restoration is 64 ($p<0.001$) and for Active Individual Therapy is 49 ($p<0.001$).	"Both programs are efficient in reducing disability and sick-leave days. The FRP is significantly more effective in reducing sick-leave days. Further analysis is required to determine if this overweighs the difference in costs of both programs."	Data suggest FRP effective with less sick leave, increased fitness, and trends towards greater return to work and full time work (the latter 2 are underpowered).

Bendix, 2000 (score=4.0)	Functional Restoration	RCT	Sponsored by Danish Rheumatism Association, Gerda and Aage Hensch Foundation, Director Ib Henriksen's Fund, Insurance Company for Industrial Injuries, Lilly Benthine Lunds Fund, DANICA Pension, Municipal Pension Insurance Company Ltd., and Danish Society for Manual Medicine. COI, category 14.	N = 99 participants with chronic low back pain.	Mean age: 42 years; 31 males, 68 females.	Functional Restoration Program (FR, N = 48) for 39 hrs/week for 3 weeks, vs Outpatient Intensive Physical Training (OIT, N = 51) for 1.5 hrs 3x/week for 8 weeks.	Follow-up at baseline and 1 year.	The only statistically significant difference between groups at the one year follow-up favored FR (p=0.03) in the overall assessment (subjective improvement of quality of life on a 5-point scale).	"Functional restoration (FR) was superior to an outpatient intensive training program in overall assessment, whereas all other tested clinical or work-related variables did not differ between the two programs."	Data suggest FR better than outpatient PT program but only in overall assessment and more costly. Medication use not described.
Engbert 2011 (score=4.0)	Functional Restoration	RCT	No funds were received in support of this work. No COI reported.	N = 23 patients with chronic low back pain.	Mean age 48.7 (SD=9.7) years). 11 males, 12 females.	Therapeutic Climbing (TC) group received 4 weeks of training 4 times a week on an indoor training wall (4 m x 2.5 m) (n = 14) vs. Standard exercise regime (SRE) group also received 4 training sessions	Follow-ups were at baseline and after 4 weeks of treatment.	After 4 weeks of training, there was a significant difference in SF-36: Physical Health subscales of physical functioning (TC: 86.50 ± 15.1 vs. SRE: 75.50 ± 16.7, p = 0.01) and general health (TC: 71.10 ± 13.6 vs. SRE: 62.85 ± 12.4, p = 0.01).	"This study demonstrates that therapeutic climbing may be suitable for patients with chronic low back pain. The therapeutic climbing regime especially improved the perceived health and physical functioning of patients, possibly through changes in	Small sample size. Methodological details sparse.

						a week for 4 weeks (n = 14).			attentional focus and new learning experiences regarding movement and pain."	
Frih 2009 (score=4.0)	Functional Restoration	RCT	No mention of sponsorship or COIs.	N = 107 with chronic low back pain or CLBP, eighty-two women.	Mean age 35.7. 82 females, 25 males.	Group A or home-based rehabilitation program received 4 sessions, 2-hours each with a total of 18 exercises (N = 54) vs. Group B or a standard rehabilitation program with 90 minutes of treatment a day, three times a week (N = 53).	Follow-up at baseline and four weeks and three, six and 12 months later.	Between time0 and time4 time points: pain intensity / FTF distance / and TL angle: in Gr A, -25.1, $p < 0.001$ and Gr B -13.9, $p < 0.001$ / 7.3 cm compared to 5 cm, $p < 0.001$ / and, 8.4º compared to 9.9º in group B, $p < 0.001$. Pain intensity between months 3 and 6, $p < 0.05$ and 6 and 12, $p = 0.199$. Quebec functional index between 6 months and one year, for Gr A -0.5 and Gr B 3.9, $p = 0.018$.	"[A] home-based rehabilitation program is as effective as standard physical therapy."	Multiple outcomes measured at timepoints. Comparable efficacy between programs.
Jeitler 2015 (score=4.0)	Functional Restoration	RCT	Supported by grants from the Else Kroner-Fresenius-Stiftung and the Karl and Veronica Carstens Stiftung, Germany. No COI.	N=89 with chronic neck pain.	Mean age 49.7±10.5 years. 73 females, 16 males.	8-week meditation program (jyoti meditation) with weekly 90-minute classes (n=45) vs. home-based exercise program (n=44).	Follow-up 8 weeks.	Reduction of 45.5±23.3 mm to 21.6±17.2 mm in the meditation Group vs. 43.8±22.0 mm to 37.7±21.5 mm in the exercise group; mean difference: 13.2 mm; p=0.02.	"[M]editation may support chronic pain patients in pain reduction and pain coping. Further well-designed studies including more active control comparisons and longer-term	Waitlist control bias. Data suggest meditation reduced pain at rest but not disability in neck pain patients.

									followup are warranted."	
Bearne 2011 (score=4.0)	Functional Restoration	RCT	Funded by the Physiotherapy Research Foundation, administered by the Chartered Society of Physiotherapy. M.H. and N.W. are funded by the Arthritis Research UK.	N=48 with chronic hip pain.	Mean (range) age usual care: 67 (53-78), rehabilitation 65 (52-76). 34 females, 14 males.	Five week exercise and self-management program (N= vs. continue under the management of their general practitioner (GP).	Follow-up at baseline, post-intervention (or after six weeks) and six months post-intervention.	No differences between the groups (all p > 0.05).	"The moderate effects in all outcomes immediately following rehabilitation suggested that it warrants further investigation. Issues with diagnosis and adaptations to the programme were identified and will be addressed in a randomized controlled trial."	Usual care control bias. Data suggest moderate improvement in rehabilitation group. Attrition rate (25%) comprised of worst functioning in treatment group and best functioning in control group may have under or overestimated effect.

Evidence for the Use of Cognitive Therapy

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Smeets, 2006 (score = 8.0)	Cognitive Behavioral Therapy	RCT	Supported by Zorgonderzoek Nederland/Medische Wetenschappen (ZonMw) Grant No. 014-32-007. No mention of COI.	N = 309 with chronic LBP of >3 months	Mean age: 41.91±9.65; 93 males, and 79 females.	Compared effectiveness of active physical treatment (APT, n = 53), CBT (CBT, n = 58), combination of both (CT, n = 61) with waiting list (WL, n = 51) for 10 weeks. Interventions: 1) APT, aerobic training and 3 dynamic static strengthening exercises; 2) CBT of operant behavioral graded activity training and problem solving training; 3) CT of APT in combination with problem-solving training, both in same frequency and duration. Wait-list control group (WL) after which were offered regular individual rehab treatment.	One year	Roland Disability Questionnaire: WL mean±SD (13.88±4.78); mean difference between WL and APT (-2.40, p <0.01); mean difference WL and CBT (-3.05, p <0.01); mean difference WL and CT (-2.56, p <0.01). Current pain: WL mean±SD (53.35±22.6); mean difference WL and APT (-8.68, p <0.05); mean difference WL and CBT (-14.76, p <0.01); mean difference WL and CT (-8.23, p <0.05). Beck Depression Inventory (BDI): WL (9.42±7.81); mean difference WL and APT (-2.09, p <0.05); NS between WL and CBT and WL and CT. Global Improvement: WL (3.78±0.91); NS between WL and APT; difference WL and CBT (0.90, p <0.01); difference WL and CT (0.70, p <0.05.	"[T]he combination treatment integrating physical, graded activity with problem solving training is not a better treatment option for patients with chronic low back pain."	Wait list control bias. Disability/pension status trended to be greater in active PT and combined therapy groups. Duration with limitations greater in cognitive behavioral therapy group. Active interventions appear to be effective.

Wicksell, 2008 (Score=4.5)	Cognitive Behavioral Therapy	RCT	No mention of Sponsorship or COI.	N = 22 with Whiplash-Associated Disorders (WAD)	Mean age 49.15 years: 6 males, 16 females.	Treatment 10 sessions over 8 weeks. Preformed tasks that exposed them with increased frequency to behaviors that triggered pain related avoidance. (N = 11) vs Control Standard care (N = 10)	4 and 7 months	PDI difference between groups (P = 0.003). Treatment group improvement over time, (p = 0.017). SWLS treatment vs control (p = 0.006) improvement between groups at 7 months (P<0.001)	"These results support findings from previous studies in which a behavior therapy-oriented approach improved functioning in people with chronic pain and WAD."	Waitlist control bias. Data suggest CBT (exposure and acceptance strategies) may improve pain disability, flexibility, depression and life satisfactions up to 7 months post-treatment.
Linton, 2005 (score = 6.5)	Cognitive Behavioral Therapy	RCT	No mention of sponsorship or COI.	N = 185 with non-specific back or neck pain thought at risk for long-term disability	Mean age: 48.3; Sex: 30 males and 155 females.	Minimal treatment (n = 47) vs. CBT (n = 69) vs. CBT plus PT (n = 69), Minimal treatment consisted of physical exam, information that pain not harmful and resume usual activities, and an information booklet. CBT received minimal treatment plus 6x2-hour CBT sessions including problem solving, coping skills and	12 month follow-up.	Central tendency and 95% CI for 3 groups. Pre-test vs. follow-up minimal treatment, average pain last week: 5.0 (4.4-5.7) vs. 4.1 (3.3-5.0). CBT group: 4.2 (3.6-4.8) vs. 3.4 (2.8-4.1). CBT+PT: 4.4 (3.9-4.9) vs. 2.9 (2.4- 3.5). Average pain last 3 months; minimal treatment: 4.7 (4.3-5.2) vs. 4.1 (3.3-4.8). CBT: 4.5 (4.0-5.0) vs. 3.2 (2.5- 3.8). CBT+PT: 4.5 (4.0-4.9) vs. 3.0 (2.6-3.5).	"Adding cognitive-behavioral intervention and cognitive-behavioral intervention and preventive physical therapy can enhance the prevention of long-term disability. There was no substantial difference in the results between the cognitive-behavioral	All participants currently employed. CPT plus PT appeared effective in preventing sick leave and chronic disability in patients with non-specific low back pain compared to minimal treatment.

						relaxation aimed at preventing problems. CBT plus PT group got additional PT advice on cause of problem and maintaining or resuming activities. Personalized exercise programs included, but don't appear a major component.			intervention group and the CBT plus PT group."	
Kashikar-Zuck, 2012 (Score = 6.0)	Cognitive Behavioral Therapy	RCT	Sponsorship by grant from National Institute of Arthritis and Musculoskeletal and Skin Diseases grant. Dr. Passo has received consulting fees, speaking fees, and/or honoraria from Pfizer (less than $10,000). No other COI.	N = 114 adolescents with juvenile FMS.	Mean age; 15 years; 9 males, 105 females.	FM education group; 8-session supportive FM education program. education and discussion about FM, pain medications, general lifestyle issues such as diet, sleep, and exercise, and impact of juvenile (N = 57) vs CBT group; 8-session, individually delivered cognitive-behavioral therapy (CBT)	8 weeks and 6-month follow-up.	CBT and FM education groups reduction functional disability (main effect for time F = 10.85; P < 0.0001) CBT improvement vs FM education group (group-by-time interaction F = 5.15; P = 0.007)	"…CBT was found to be a safe and effective treatment for reducing functional disability and symptoms of depression in adolescents with juvenile FMS."	Data suggest CBT may be useful for reducing depression and increasing function in chronic musculoskeletal pain in juveniles.

						intervention (N = 57)				
Cherkin, 2016 (Score = 6)	Cognitive Behavioral Therapy	RCT	Sponsorship by National Center for Complementary and Integrative Health of the National Institutes of Health. No COI.	N = 343 patients with chronic lower back pain.	Mean age: 49.3; 118 males, 224 females.	CBT: training to change pain-related thoughts and behaviors 8 weekly 2-hour groups. (N = 113) vs MBSR: Training in mindfulness meditation and yoga delivered in 8 weekly 2-hour groups. (N = 116) vs Usual care: (N = 113)	4, 8, 26, 52 weeks.	Improvement in bothersomeness at 26 weeks 43.6% MBSR vs 44.9% CBT group, vs 26.6% usual care group (P = .01). Meaningful improvement on the RDQ MBSR (60.5%) vs CBT (57.7%) vs usual care (44.1%) (overall P = .04)	"Treatment with MBSR or CBT, compared with usual care, resulted in greater improvement in back pain and functional limitations at 26 weeks, with no significant differences in outcomes between MBSR and CBT. These findings suggest that MBSR may be an effective treatment option for patients with chronic low back pain."	Usual care Bias Data suggest comparable efficacy between CBT and MBSR for improved back pain and function at 26 weeks compared to usual care.
Magnussen, 2007 (score = 6.0)	Cognitive Behavioral Therapy	RCT	Funded by Norwegian Foundation for Health and Rehabilitation. No mention of COI.	N = 89 receiving disability pension in Norway	Mean age: 49.1; Sex: 33 males	Intervention had 2 group sessions of 3 hours each separated by 2 to 3 days focusing on spinal problems,	One year.	No change in Roland-Morris scores from baseline to 1 year follow-up in either group. No differences in return to work status at 1-year	"The effort of returning disability pensioners to work by a brief vocational-	Study of those on disability in Norway. While they called for a larger sample size, results

					and 56 females.	mechanisms and reductions in fear avoidance beliefs and 3 additional hours of motivational interviewing (n = 45) vs. control group (n = 44).		follow-up, but 22% vs. 11% had "entered a return to work process." NS between groups for Norwegian Functional Scale, Fear Avoidance Beliefs Questionnaire-physical activity or work. Life satisfaction (baseline/1 year follow-up): intervention (5.3±1.9/5.3±1.7) vs. control (4.5±1.6/5.4±2.0), p = <0.05.	oriented intervention may be of clinical relevance."	essentially negative. It appears the proportion interested in possibly returning to work is not exactly large and applicability of this intervention to U.S. is questionable.
Linton, 2000 (score = 6.0)	Cognitive Behavioral Therapy	RCT	Supported by theO¨ rebro County Council and the Swedish Council for Work Life Research. COI category: 14.	N =243 with acute and mostly subacute LBP self-identified that felt their problems at risk of becoming a chronic	Mean age: 44.28; Sex: 69males and 173 females.	Pamphlet on back pain; advice on best way to cope with back pain (remain active, think positively); aimed to prevent fear-avoidance, promote coping (n = 70) vs. information package once a week for 6 weeks; based on back school approach (n = 66) vs. CBT of 6 small group sessions for 2 hours once a week for 6 weeks; short reviews to cover	12 months.	A 5-year follow-up evaluation of 97% of the participants found that CBT produced "long-term health and economic benefits. Usual medical care might be improved considerably by implementing these psychologic methods." More sick leave over 5 years in information group (40 vs. 13 days, graphic data interpreted). Risk of long-term disability at the 5-year follow-up was 2.61 times lower in the CBT group. Risk of being on long-term sick	"[A] cognitive-behavior group intervention can lower the risk of a long-term disability developing. These findings underscore the significance of early interventions that specifically aim to prevent chronic problems. This	Number declining intervention at outset 11.9%. Data suggest tendency of subacute LBP to improve over time regardless of treatment, although greater effect among CBT group. Sick leave rates and long-term sick leave risks much better in CBT group.

						homework; structured exercises; new skill development, (n = 107). Intervention 6 group sessions.		disability leave for any illness was 3 times lower. CBT group had significantly less lost productivity, p <0.02. No differences between groups for pain experience or activity level.	approach might be applied to primary care settings."	
Johnson, 2007 (score = 6.0)	Cognitive Behavioral Therapy	RCT	Supported by the Arthritis Research Campaign, Chesterfield, UK and the Epidemiology Unit at the University of Manchester, UK. No COI.	N = 196 with persistent disabling LBP (>3 months duration)	Mean age: 47.9; Sex: 94 males and 140 females.	Active exercise, education, CBT (n = 116) vs. control (n = 118). Both groups: education booklet and audio-cassette on advice for LBP. Active treatment had group sessions over 6 weeks to develop awareness, focus on resumption of activity, physical exercise, psychological self-help techniques, encourage return to normal activities/work.	Follow ups at 3, 9, 15 months	Structured exercises appear to have not been included in homework. Patients who preferred intervention and assigned to it experienced significant reductions in pain and disability scores. Those with preference for controls had worse outcomes. For those with no preference, little effect of intervention. No significant differences between groups across 15 months of follow-up.	"This intervention program produces only modest effects in reducing LBP and disability over a 1-year period. The observation that patient preference for treatment influences outcome warrants further investigation. "	Magnitude of exercise as described relatively minor and may be a reason for lack of results. Compliance 63% in intervention. Patients had mild LBP at entry. No significant effect found. Co-interventions not well described.
Karlsson, 2015 (Score = 6.0)	Cognitive Behavioral Therapy	RCT	Supported by grants from the Söderström-KönigFoundation (2003-139), the Swedish Rheumatism Association	N = 48 with fibromyalgia syndrome (FMS).	Aged 18 – 64 years; 0 males and 48 females.	Group 1, cognitive behavior therapy treatment (CBT) group (N = 24) vs	6-months	For the psychosocial dimension MPI-1 dimension 'life control" scale score: increased in group 1 from 3.15 to 3.62 and decreased to 2.86 in group 2 /	"Cognitive behaviour therapy improved the life control in a female population with FMS."	Waitlist control bias. Data suggest CBT improved coping behavior and overall control over life which

			(51/04), the Swedish Social Insurance Agency (11124), Uppsala County Council (K2003-0036) and Uppsala University (UFV2003/39). No COI.			Group 2, wait-list control group (N = 24).		'Pain severity' score: increased from 3.61 to 4.20 in group 1 and decreased to 3.37 in group 2 / and 'Interference' score increased from 3.37 to 4.07 in group 2 decreased to 3.45 in group 2 with a significance of p = 0.01 / 0.02 / and p = 0.04.		were maintained at 6 months.
Turner, 2006 (Score = 5.5)	Cognitive Behavioral Therapy	RCT	Supported by the National Institute of Dental and Craniofacial Research Grant. No mention of COI.	N = 158 with chronic temporomandibular pain.	Mean age 38.9 (11.6) and 35.7 (10.9) for PMT and SCM groups; 128 males and 30 females.	Pain management training or PMT assigned to CBT (N = 79) vs Self-care management or (SCM) (N = 79).	3, 6, and 12 months	At 12 months, improvement in pain intensity / masticatory jaw function / and depression: p = 0.01 / < 0.001 / and 0.016 favoring CBT group.	"A brief CBT intervention improves one-year clinical outcomes of TMD clinic patients and these effects appear to result from specific ingredients of the CBT."	Data suggest the one term post intervention clinical outcome of chronic temporomandibular pain are improved with CBT.
Luciano, 2014 (Score = 5.5)	Cognitive Behavioral Therapy	RCT	No sponsorship or COI.	N = 156 with fibromyalgia syndrome (FMS).	Aged 18 – 65 years: 0 males and 156 females.	Acceptance and commitment therapy (ACT/GACT) group, based on one psychotherapy and one pharmacotherapy treatment (N = 51) vs Recommended	6-months	At baseline / After treatment / and at 6-months mean scores comparison for GACT vs RPT vs WL groups on Fibromyalgia impact questionnaire (FIQ): 68.2 (8.96) vs 68.96 (10.93) vs 65.87 (7.63), (p = 0.22) /	"[A] group ACT intervention produces a greater increase in global functional status than recommended medications	Data suggest CBT less costly than either RPT or TAU for treating chronic pain and CBT patients recorded enhanced Q of L.

						pharmacological treatment (RPT) group (N = 52) vs Wait-list or WL group offered preferred therapy (N = 53).		48.70 (6.91) vs 63.37 (9.10) vs 67.68 (9.23) / and 49.49 (8.77) vs 65.11 (8.87) vs 67.45 (9.15).	and no treatment."	
Jensen, 2012 (Score = 5.0)	Cognitive Behavioral Therapy	RCT	Supported by the Swedish Society for Medical Research (SSMF) and the Swedish Council for Working Life and Social Research (KJ), Swedish research council, and Stockholm County Council (EK), and the Swedish Rheumatism Association (EK and GO). No COI.	N = 43 with fibromyalgia syndrome (FMS).	Mean age 45.6 (6.4) years: 0 males and 43 females.	Cognitive behavioral therapy or CBT group (N = 25) vs Control group (N = 18).	12-weeks	Patient Global Impression of Change (PGIC) questionnaire in CBT group vs control, ($p < 0.01$). Pre- to posttreatment correlated with the PGIC responses for the CBT, $r = - 0.60$, ($p < 0.05$) and for controls, $r = - 0.30$, ($p = 0.265$).	"CBT in patients with FM was associated with increased activity of the vlPFC and OBFC during evoked pain, brain regions implicated in executive cognitive control."	Waitlist control bias. Data suggest CBT changes the processing of chronic brain pain suggesting cortical control theory in response to treatment.
Fersum, 2013 (Score = 5.0)	Cognitive Behavioral Therapy	RCT	Supported by the Norwegian Fund for Post-Graduate Training in Phuysiotherapy and, No COI.	N = 121 with non-specific chronic low back pain for >3 months.	Aged between 18 – 65 years: 73 males and 48 females.	Classification based cognitive functional therapy group (CB-CFT), 1 hour for 30-45 minute, every 2-3 weeks of a cognitive component, specific movement	3 and 12 months	8 out of 59 (13.5%) of the MT-EX group and 1 out of 62 (1.6%) of the CB-CFT group were unsuccessful after treatment. CB-CFT group had ODI score of 13.7 points [95% (CI): 11.4–16.1; $p < 0.001$]	"The classification-based cognitive functional therapy produced superior outcomes for non-specific chronic low	High dropout in both groups. Statistically significant differences at 12 months in favor of cognitive function therapy.

						exercises, daily activities and a physical activity program (N = 62) vs Manual therapy and exercise group (MT-EX), general exercise or motor control exercise of 1 hour for 30 minutes (N = 59).		and for PINRS scores 3.2 (95% CI: 2.5–3.9; p < 0.001) vs MT-EX group, the mean improvement for ODI score was 5.5 points (95% CI: 2.8–8.3; p < 0.001) and 1.5 for PINRS (95% CI: 0.7–2.2; p < 0.001).	back pain compared with traditional manual therapy and exercise."	
Kristjánsdóttir, 2013 (Score = 5.0)	Cognitive Behavioral Therapy	RCT	Supported by the Research Council of Norway (grant number 182014) (OBK, HE, EE and TLS). No mention of COI.	N = 140 with chronic widespread pain.	Mean age for intervention group 44.59 (11.13) and control group 43.80 (11.20): 0 males and 140 females.	Smartphone intervention, 1 face-to-face session and 4 weeks of written communication via a smartphone (N = 69) vs Control group without a smartphone intervention after the rehabilitation (N = 66).	4-weeks	At 5-month between-group effect sizes for catastrophizing, (p = 0.003) / acceptance of pain, (p = 0.02) / and functioning and symptom levels, (p = 0.001).	"[A] smartphone-delivered intervention with diaries and personalized feedback can reduce catastrophizing and prevent increases in functional impairment and symptom levels in women with chronic widespread pain following inpatient rehabilitation."	Interventional group had significant drop-outs. Data suggest preliminary evidence support use of smartphone based intervention with diaries and feedback to decrease catastrophizing.

Wetherell, 2011 (Score = 5.0)	Cognitive Behavioral Therapy	RCT	Supported by Grant F4306I from VA Rehabilitation Research and Development Service (J.L.W.). No COI.	N = 114 with chronic nonmalignant pain of any type for at least 6 months.	Mean age 54.9 (12.5) years: 56 males and 58 females.	Acceptance and commitment or ACT with exercise + cognitive fusion + mindfulness + committed actions (N = 57) vs CBT relaxation training + activity pacing + challenging negative thoughts (N = 57).	8-weeks	Pain interference / Depression / and Pain-related anxiety: (b = -0.09, SE = 0.02, p < 0.001 in CBT vs b = -0.06, se = 0.02, p = 0.02) / (Δm = 3.18, t (56) = 3.73, p < 0.001 in CBT vs Δm = -2.32, t (56) = -2.98, p = 0.04) / and (Δm = 5.63, t (56) = 3.02, p = 0.004 in CBT vs Δm = -4.51, t (56) = -3.54, p < 0.001). r = 0.43, p = 0.001, and correlation with pain acceptance r = 0.12, p = 0.39. vs CBT correlation between changes in interference vs control was r = 0.35, p = 0.008, and correlation with acceptance was, r = 0.103, (p = 0.45).	"In conclusion, this randomized, controlled trial comparing ACT and CBT interventions in an adult sample with chronic nonmalignant pain found evidence of benefits on measures of pain interference and mood in both conditions compared to treatment as usual."	Data suggest improved pain interference and mood from both ACT and CBT compared to usual care.
Monticone, 2013 (Score=5.0)	Cognitive Behavioral Therapy	RCT	No sponsorship or COI	N = 130 Patients after lumbar fusion for degenerative spondylolisthesis and/or lumbar spinal stenosis	Mean age 57.33 years: 51 males, 79 females.	Experimental group: programme consisting of exercises and cognitive-behavioural therapy (N=65) vs Control group: exercise alone (N=65)	Before treatment, 4 weeks after treatment, and 12 months after treatment	ODI linear mixed model. Significant effects of group (F(1,122.8) = 95.78, p < 0.001) and time (F(2,120.1) = 432.02, p < 0.001) in favor of the experimental group. Significant group X time interaction effect (F(2,120.1) = 20.37, p < 0.001)	“The rehabilitation programme, including the management of catastrophising and kinesiophobia, was superior to the exercise programme	Data suggest a combination program to manage catastrophizing and kinesiophobia with exercise is better than exercise alone for lumbar spondylolisthesis and

									in reducing disability, dysfunctional thoughts, and pain, and enhancing the quality of life of patients after lumbar fusion for degenerative spondylolisthesis and/or LSS. The effects lasted for at least 1 year after the intervention ended."	stenosis patients post lumbar fusion
Thieme, 2007 (Score=4.5)	Cognitive Behavioral Therapy	RCT	Sponsored by the Deutsche Forschungsgemeinschaft and the National Institute of Arthritis and Musculoskeletal and Skin Diseases.	N = 125 with Fibromyalgia using ACR criteria	Mean age: 46.55 years; Gender not specified.	CBT (n=42) – Patients received Cognitive-behavioral treatment of 15 weekly 2-hour sessions. Focused on the patients thinking and involved problem solving. vs. OBT (n=43) – Patients received operant-behavioral treatment based on changing	12 months.	At follow-up, 53.5% vs. 45.2% vs. 5% reported clinically meaningful improvements in pain intensity ratings. Significant improvements in physical impairments: 58.1% vs. 38.1% vs. 7.5%. Low physical impairment predicted significant decrease in pain intensity. Duration of pain, psychological factors and behavioral factors did not predict reductions in pain.	"Pretreatment patient characteristics are important predictors of treatment response and may serve as a basis for matching treatments to patient characteristics."	Dropout rate in the attention controls (50%) suggests it was not a credible control.

						observable pain behaviors for 2 hours a week for 15 weeks. vs. Attention placebo (n=40) – Patients participated in general, therapist guided discussion for 2 hours for 15 weeks.				
Alaranta, 1994 (score = 5.0)	Cognitive Behavioral Therapy	RCT	No mention of sponsorship or COI.	N = 293 with back disease without inflammation, pain duration at least 6 months, age 30-47, no compensation or claim of pension, 1 back surgery at most	Mean age: 40.45; Sex: 133 males and 160 females.	Conventional inpatient rehab (n = 152) vs. program thought to be more active (AKSELI) in Finland (n = 141), 1 year follow-up. AKSELI program 37 hours of guided or self-controlled physical exercises, without passive PT, 5 hours of discussion groups, included cardiovascular endurance exercises. Conventional program included "large amount" of passive PT, including	3 and 12 months	After 3 months of follow-up, Million disability index decreased more in AKSELI group (17.1 vs. 9.1, p <0.001); 12 months (15.9 vs. 8.9, p = 0.011). Number of annual physician visits also favored AKSELI group (decrease 74% vs. 67%), NS. Mean sick leave days decreased from 57.8 to 33.9 vs. 58.5 to 36.9 in controls, NS.	"The intervention program could improve physical disability, but to improve occupational handicap, activities of the whole society (social legislation, labor market policy) are needed."	Applicability to U.S. is unclear. Baseline characteristics minimal. Intensive rehab appears beneficial for chronic LBP patients.

						massage, electrical therapies, traction, etc.				
Altmaier, 1992 (score = 4.5)	Cognitive Behavioral Therapy	RCT	Supported by a grant from the National Institute for Handicapped Research, No mention COI.	N = 47 age 18-63, admitted over 18-month period to low back rehab program; inclusion criteria disabled/not working due to pain of 3 to 30 months; not candidate for lumbar surgery or involved in personal injury litigation; pain not due to pregnancy or severe vertebral fracture; no significant levels of depression or anger	Mean age: 39.91; Sex: 33 males, and 12 females.	Standard inpatient rehab for chronic LBP (n = 21) vs. psychological program plus standard program (n = 24); 3 week and 6 month follow-up. Standard program consisting of twice daily PT exercise sessions, daily aerobic fitness training, daily education classes, and vocational rehab. Psych program included charting of exercise behaviors, contingent verbal praise, relaxation training, biofeedback, and group and individual cognitive-behavioral coping training.	6 months	Return-to-work rate non-statistically significantly lower in psychological group (47.6% vs. 67%). Data revealed that patients improved their overall functioning at discharge and maintained these gains at follow-up assessment; similar pattern of findings was engaged in active job retraining by follow-up. Patient improvement not differentially affected by treatment group assignment.	"[T]he psychological treatment failed to add to the effectiveness obtained by the standard rehabilitation program."	As inpatient rehab for LBP, applicability to current US care unclear. Study suggest no additional benefit from providing training in relaxation and coping skills when added to education, support, and exercise programs for chronic low back pain.
Goossens, 1998 (score = 4.5)	Cognitive Behavioral Therapy	RCT	Supported by a grant from the investigative medicine	N = 148 with chronic LBP (>6 months) age 18-65,	Mean age: 39.8;	An economic analysis over 3 years to compare treatment with	1 year	Estimated annual costs for these programs were	"Adding a cognitive component to an	As study conducted in the Netherlands,

			programme of the Health Insurance Executive Board. No mention of COI.	observable pain behavior, discrepancy between objective clinical findings and pain complaints; partner willing to participate in parallel partner program	Sex: 53 males and 95 females.	usual care (n = 31) vs. a cognitive program with relaxation 12 sessions of 90 minutes (n = 58) vs. an operant treatment program (n = 59)with a group discussion.		$2,293 vs. $2,119 vs. $3,404 respectively.	operant treatment did not lead to significant differences in costs and improvement in quality of life when compared with the operant treatment alone."	applicability of economic analysis elsewhere somewhat unclear.
Palermo, 2016 (Score = 4.5)	Cognitive Behavioral Therapy	RCT	Supported by the Eunice Kennedy Shriver National Institute of Child Health & Human Development of the National Institutes of Health. No COI.	N = 273 with chronic idiopathic pain present over the previous 3 months.	Aged 11-17 years: 68 males and 205 females.	Internet-delivered cognitive-behavioral therapy (CBT) group (N = 138) vs Internet education included modules with information about pediatric chronic pain, plus diary and assessments (N = 135).	6-months	From baseline to follow-up, daily activity limitations CBT achieved greater reductions in daily activity limitations vs Internet education group, (b = - 1.13, p = 0.03, d = - 0.25). After treatment CBT vs internet group for daily activity, b = -0.43, p = 0.39.	"In conclusion, Internet interventions address barriers to access and could ultimately lead to wide dissemination of evidence based psychological pain treatment for youth and their families."	Data suggest a trend towards a benefit from internet delivered CBT for chronic pain adolescents in terms of activities.
Martínez, 2013 (score = 4.5)	Cognitive Behavioral Therapy	RCT	Supported by the Spanish Ministry of Science and Innovation. Author Días-Pierdra supported by grant from the	N = 59 who met the 1990 American College of Rheumatology fibromyalgia criteria	59 female, 0 male. Mean age 47.58 years	Both groups participated in 90 minute group sessions (5-6 participants) once each week for 6 weeks. CBT-I program (n = 30) vs Sleep	3 and 6 months	CBT-I vs SH changes in sleep quality at pre-treatment, post-treatment, 3 months, and 6 months, respectively. .44, -2.22 (p<0.05), -2.02 (p<0.05), 1.27.	"Patients in the CBT-I group showed significantly greater changes than those in the SH group in	Data suggest better improvement in CBT-I group for fatigue, anxiety, depression, pain catastrophizin

			Spanish Ministry of Education. Author Buela-Casal supported by the Spanish Ministry of Science and Innovation and by Spanish Ministry of Education grants.			hygiene education (SH) group (n = 29)			most outcome measures. The findings underscore the usefulness of CBT-I in the multidisciplinary management of FM."	g and daily function.
Kerns, 2014 (Score = 4.5)	Cognitive Behavioral Therapy	RCT	Supported by Department of Veterans Affairs, Veterans Health Administration, Office of Research and Development, Clinical Science Research and Development Service Merit Grant, and by the Health Services Research and Development Research Enhancement Award Program. No mention of COI.	N = 128 with chronic back pain.	Mean age 55.5 (13.1) and 55.0 (10.0) for TCMT and SCBT groups: 106 males and 22 females.	Tailored cognitive–behavioral therapy (TCBT) group had 10 weekly sessions, 60-minutes (N = 68) vs Standard CBT (SCBT) group had 10 weekly sessions, 60-minutes (N = 60).	15-weeks	Perception of treatment credibility at end of the first week / after 3 weeks: 8.3 (1.5) vs 8.3 (1.2) / and 8.3 (1.5) vs 8.2 (1.4), $F < 1$. Treatment engagement and adherence: at 3 sessions completed reported difference between TCBT vs SCBT was $x^2 = 0.10$, $p > 0.10$ / and number of cancellations difference between groups, $F = 23$, ($p > 0.10$).	"Participants in this study evidenced a high degree of participation and adherence, but treatment tailored to take into account participant preferences, and that employed motivational enhancement strategies, failed to increase treatment participation over and above SCBT for chronic back pain."	"Modified Randomization" used. Data suggest similar adherence to treatment between groups.

Castel, 2012 (Score = 4.0)	Cognitive Behavioral Therapy	RCT	No mention of sponsorship. No COI.	N = 93 with fibromyalgia.	Mean age for Control / CBT / CBT + hypnosis ; 48.7 (6.5) / 50.0 (7.6) / and 6.2): 3 males and 90 females.	Cognitive behavior-therapy (CBT) group (N = 34) vs CBT + hypnosis group (N = 29) vs Control group (N = 30).	3- and 6-months	Post-treatment CBT vs control group at post-treatment on catastrophizing ($p < 0.05$) and sleep index problems ($p < .0001$). At 3-month CTT vs control on psychological distress ($p < 0.05$) / sleep quantity ($p < 0.05$) / and sleep index problems ($p < 0.0001$). Post-treatment CBT + hypnosis vs control on catastrophizing ($p < 0.0001$) / psychological distress ($p < 0.0001$) / and sleep index problems ($p < 0.0001$). At 3-month CBT + hypnosis vs control on catastrophizing ($p < 0.05$) / psychological distress ($p < 0.01$) / sleep quantity ($p < 0.05$) / and sleep index problems ($p < 0.0001$).	"This article highlights the beneficial effects of adding hypnosis in a multicomponent cognitive-behavioral group treatment of fibromyalgia patients."	Standard/usual care control bias. Data suggest CBT or CBT plus hypnosis improved symptoms associated with FM.
Glombiewski, 2010 (Score = 4.0)	Cognitive Behavioral Therapy	RCT	Supported by a doctoral thesis scholarship from the University of Marburg. No mention of COI.	N = 128 with chronic back pain.	Mean age 48.8 (11.7): 39 males and 77 females.	Cognitive–behavioral therapy (CBT) group (N = 35) vs Cognitive-behavioral therapy including	6-months	CBT-B and CBT equally effective for pain intensity (using, Pain Intensity Questionnaire or PIQ): CBT-B, $\mu = 0.66$ (95% CI 0.39–0.95) vs CBT,	"In conclusion, biofeedback ingredients did not lead to improved outcome of a psychological	Waitlist control bias. Data suggest CBT intervention decreased LBP and addition of

						biofeedback tools (CBT-B) group (N = 31) vs Wait-list control (WLC) group (N = 51).		μ = 0.60 (95% CI 0.33–0.87)). CBT+CBT-B, 33.85% clinically significantly improved vs WLC 13.73%. Primary outcome PIQ / Secondary outcome Pain Diary & RLS Scale & CS Scale & Doctor Visits; F (1.57, 177.98) = 3.45, p = 0.043 / (F (1.9, 133.32) = 1.29, p = 0.28, & F (1.96, 221.12) = 58.73, p < 0.001, & F (1.66, 186.64) = 8.8, p < 0.001).	intervention. ”	biofeedback to CBT did not improve clinical outcomes. Not all patients randomized. Not blinded. Pooled CBT arms compared to control had improvements in many subjective measures but clinical significance uncertain. Data suggest no benefit from CBT when biofeedback is added.
Lera, 2009 (Score = 4.0)	Cognitive Behavioral Therapy	RCT	No mention of sponsorship or COI.	N = 83 with fibromyalgia (FM) symptoms.	Mean age 50.2 (9.3) years: 0 males and 83 females.	Multidisciplinary treatment or MT + CBT for 15 group sessions, 90 min per week (N = 43) vs Multidisciplinary treatment (MT) group received education about the central nervous system and the peripheral sensations, different levels	6-months	MT+CBT vs MT at baseline / post-treatment: Fibromyalgia Impact Questionnaire (FIQ) mean score 59.2 (9.6) / 53.2 (13.4) vs 58.4 (10.4) / 57.2 (11.3): Functional Status (FS) means 38.6 (22.1) / 39.5 (20.4) vs 32.3 (17.6) / 30.7 (14.4): Emotional well-being (EW) means:	“In less severe FM patients who also suffer fatigue, the addition of CBT leads to a greater improvement in daily functioning and health status than is achieved through a basic	Data suggest MT improved function and symptom impact in FM patients.

						of pain processing, behavioral techniques (N = 40).		29.1 (12.4) / 33.9 (14.6) vs 27.1 (13.6) / 28.8 (12.9).	multidisciplinary program consisting of education, physical training, and medical management ."	
Thieme, 2016 (Score = 4.0)	Cognitive Behavioral Therapy	RCT	Supported by grants of the Deutsche Forschungsgemeinschaft to KT Th 877/1-2 and the Bundesministerium f€ur Bildung und Forschung to HF. No COI.	N = 145 with fibromyalgia.	Mean age for OBT / CBT / IH / and CON; 43.24 (9.03) / 49.13 (10.03) / 47.46 (9.75) / and 48.22 (9.02): 0 males and 15 females.	Cognitive behavioural treatment (CBT) group 2-h sessions (N = 42) vs Operant behavioural (OBT) group 2-h sessions (N = 43) vs Whole-body infrared heat (IH) group 2 h-sessions (N = 30) vs Pain-free controls (CON) group 2-h sessions (N = 30).	15-weeks	OBT and CBT vs IH reduced pain intensity [OBT: effect size (ES) = 1.21 CI: 0.71–1.71 vs CBT: ES = 1.23, CI: 0.72–1.74]. At 12 months, OBT increased diastolic blood pressure [ES = 1.13, CI: 0.63–1.63 and CBT reduced SCL (ES) = - 0.66, CI: -1.14–0.18]. CBT vs OBT significantly increased EMG levels (OBT: ES = 0.97, CI: 0.48–1.46, CBT: ES = 1.17, CI: 0.67–1.68).	"Increased diastolic blood pressure and decreased pain after OBT suggest a reactivation of baroreflex-mechanisms in fibromyalgia and a normalization of the blood pressure and pain functional relationship."	Data suggest OBT and CBT decreased pain but are different mechanisms.
Ang, 2010 (Score = 4.0)	Cognitive Behavioral Therapy	RCT	No mention of sponsorship or COI.	N = 32 with fibromyalgia (FM) symptoms.	Mean age for CBT / and UC groups, 50.5 ± 9.5 and / 47.0 ± 12.4: 0	Telephone-delivered CBT group, 6 weekly sessions (N = 17) vs Usual care (UC) group (N = 15).	6-months	Pre- to 6 months, nociceptive flexion reflex (NFR) mean scores for UC group (4.4 ± 13.7 mA vs -10.2 ± 9.9 mA for CBT, (p = 0.005). And at week 12 NFR mean scores were:	"Compared with UC, CBT reduced nociceptive responding in fibromyalgia patients."	Pilot study. Usual care bias. Data suggest CBT decreased nociception response in FM patients.

					males and 32 females.			(7.3 ± 9.2 mA for CBT vs -5.4 ± 13.5 mA for UC, (p = 0.01).		
Schweikert, 2006 (score = 4.0)	Cognitive Behavioral Therapy	RCT	Supported by the German Federal Ministry of Education and Research and the Federation of the German Pension Insurance Institutes. No mention of COI.	N = 409 with non-specific LBP of at least 6 months; excluded if severe co-morbidities and indication of sever spinal pathology (e.g., RA, arthritis, osteoporosis, fibromyalgia)	Mean age: 46.7±9.1; Sex: 339 males and 70 females.	Intervention (n = 200) vs. usual care (n = 209). Intervention: cognitive-behavioral pain management of 6 group sessions 1.5 hour each plus 1 individual prep and final session (0.5 hour each). Usual care: standardized conventional 3 week inpatient rehab program of daily physiotherapy in small groups, massage of spinal region, electro-therapeutical measures, 1-hour seminary regarding back training, twice-daily exercise program, seminars on lifestyle and risk factors for back pain and its process of becoming chronic.	6 months	At 6 months follow-up, intervention group (mean: 11.4, sd: 28.9) absent from work average of 5.4 days less than usual treatment (mean: 16.5, sd: 34.1, p = 0.115). No significant differences in quality-adjusted life-years gained or in direct medical or nonmedical costs found between groups.	"The cognitive behavioral treatment showed lower indirect costs."	Use of an inpatient program for LBP may not have generalizability where such treatment is extraordinarily rare (e.g., USA).

Friedrich, 2005 (score = 4.0)	Cognitive Behavioral Therapy	RCT	No sponsorship or COI.	N = 93 with chronic and recurrent LBP	Mean age: 44.12; Sex: 46 males, and 47 females	Standard exercise program (n = 49) vs. a combination of an exercise and motivational program (n = 44) over a 5-year period. Dropout rate over 5 years was 40%. Exercise program consisted of ten 25-minute training sessions of individual submaximal gradually increased exercises focused on spinal mobility, truck and lower limb "muscle length," force, endurance and coordination. Motivational program focused on extensive counseling emphasizing importance of regular exercise, reinforcement of techniques used, treatment contracts, posting of treatment contract in home, and	5 years	Effects of motivational group on disability measure present at 3.5 weeks and 4 months ($p = 0.003$) and persisted for 5 years. Pain ratings also lower in motivational group, $p < 0.001$ vs. control, $p = 0.155$. Still apparent at 5 year follow-up, $p = 0.0011$. LBP episodes requiring therapy lower over 5 years in motivational group. Work ability measures also superior in motivational group, $p = 0.005$.	"Regarding long-term efficacy, the combined exercise and motivation program was superior to the standard exercise program. Five years after the supervised combined exercise and motivational program, patients had significant improvements in disability, pain intensity, and working ability."	Combined motivational and exercise program thought to reduce disability and pain and increase work ability in patients with chronic pain. 40% dropout rate over 5 years. Working ability assessed. Co-interventions not well described. Exercise and motivation reported to increase function in chronic LBP patients without adding additional training time.

						maintenance of an exercise diary. Compliance higher in motivational group.				
Keller, 1997 (score = 4.0)	Cognitive Behavioral Therapy	RCT	No mention of sponsorship or COI.	N = 64 with 1) chronic LBP (Quebec Task Force on Spinal Disorders classification); 2) no previous pain management program; 3) fluent in German; 4) able to attend therapy sessions on a regular basis in an outpatient setting; 5) provided informed consent	Mean age: 47.89; Sex: 18 male, and 45 females	Treatment program (n = 35) vs. wait-list controls (n = 29). Consisted of group meetings and 18 individualized training sessions supervised by physicians, physiotherapists, and pain psychologists. Education and relaxation exercises included.	6 months	Baseline differences NS, but present. Pain frequency, typical pain intensity and disability caused by pain reduced as consequence of treatment. Improvement in daily functioning, although strength and endurance not affected due to strict statistical criteria. Behavioral observations clarify that posture and performance of daily activities improved. At follow-up, most improvements reported maintained. T-tests revealed improved scores compared to pre-treatment scores on both pain frequency and typical pain intensity. Changes were accompanied by better daily functioning, and also in contrast to post-treatment findings, by improved strength and endurance.	"These changes corresponded with improvements in well-being, whereas depression scores remained unchanged as before."	Wait list control bias (quantified as 7 refusals to participate after assignment to control group.) Baseline characteristics comparisons were minimal. Co-interventions not well described. Physical activity appears to improve outcomes in chronic LBP.

								Disability scores unimproved. Observation of posture and behavioral habits confirmed improvements. Ratings of pain related self-efficacy not improved. Patient attitudes towards posture and pain more favorable compared to pre-program value…		
Kole-Snijders, 1999 (score = 4.0)	Cognitive Behavioral Therapy	RCT	Supported by a grant from the Investigative Medicine Fund of the Dutch Insurance Council. No mention of COI.	N = 175 with LBP for at least 6 months, age 18-65, discrepancy between objective findings and pain complaints, and cooperation of spouse	Mean age: 39.8; Sex: 54 males and 94 women.	Complete treatment package (OPCO, n = 59) vs. operant program and group discussion (OPDI, n = 58) vs. waiting-list control (WLC, n = 31). Two measurements before treatment (Pre-treatment 1 and 2, with 2-week interval) and 2 follow-up measurements, at 6 (Follow-Up 1), 12 months (Follow-Up 2) after termination of treatment. Of 148 who started measurements, results available for 133 post-	Follow up at 6months and 1 year post treatment.	Less pain behavior and higher pain coping and pain control $\chi 2$ (2, N =149) >=17.4, p<.001. Calculation of improvement rates revealed that OPCP and OPDI had significantly more improved patients than OPUS on all the dependent variables (p = 0.01)".	"Compared with WLC, both OPCP and OPDI led to less negative affect, higher activity tolerance, less pain behavior and higher pain coping and pain control. At posttreatment, OPCP led to better aim coping and pain control than OPDI. Calculation of improvement rates revealed that OPCP and	Dropout rate for follow-up measurements was high and compliance low. Dropout rate >20% Cognitive behavioral interventions are reported to help in patients with chronic low back pain compared to wait listing.

						treatment and 107 at follow-up. OPCO received operant behavioral treatment and cognitive coping skill training. Cognitive received education that hurt does not necessary mean harm. Electromyography biofeedback used to help patients recognize changes in tension and relaxation. Control waiting-list group received no treatments.			OPDI had significantly more improved patients than OPUS on all the dependent variables."	
Other Psychological Therapies										
Luciano, 2014 (score = 6.5)	Other Psychological Therapies	RCT	No COI. Author Luciano was given a research contract form the Institute of Health Carlos III.	N = 156 who fulfilled the 1990 American College of Rheumatology criteria for fibromyalgia	Mean age: GACT 49, RPT 51, WL 50; 6 males, 150 females.	Group Acceptance and Commitment Therapy (GACT) – 2.5 hour sessions involving ACT and mindfulness practice, 8 sessions total (n = 51) vs Recommended pharmacological treatment (RPT)	3 and 6 months	FIQ total scores (0-100) at baseline, post-treatment, and 6 month follow-up, respectfully: GACT 68.20, 48.70, 49.49, RPT 68.96, 63.37, 65.11, WL 65.87, 67.68, 67.45 (F=3.32, p=0.036).	"Changes in pain acceptance only mediated the relationship between study condition and health-related quality of life. These findings are discussed in relation to previous psychological research on FM treatment."	Data suggest group acceptance and commitment therapy (GACT) statistically superior to recommended pharmacological treatment

						– pregabalin (300-600 mg/day), duloxetine (60-120 mg/day) for those who had major depression (n = 52) vs Waitlist control (WL) (n = 53)				(RPT) and waitlist (WL) both immediately after treatment and at 6 months. Waitlist control bias.
Buhrman, 2013 (Score = 4.5)	Other Psychological Therapies	RCT	Supported by a grant From Linköping University, a grant from Rehsam / Vårdalsstiftelsen, and the Swedish council for working and life research. No COI.	N = 76 with chronic pain.	Mean age 49.1 (10.34) years: 31 males and 45 females.	Acceptance and commitment therapy (ACT) group of 7-sections (N = 38) vs Control group participated in moderated online discussion forum (N = 38).	7-weeks	Chronic Pain Acceptance Questionnaire (CPAQ): at 6-months t (28) = 0.29 – 1.95, (p = 0.77 – 0.06). Means CPAQ pre vs post; 22.84 (11.02) and 21.18 (9.70) for treatment and control vs 28.62 (11.15) and 22.22 (11.17) for treatment and control, (F-u M (SD) = 27.51(11.60).	"[A]n acceptance based internet delivered treatment can be effective for persons with chronic pain."	Medication use not described. Data suggest internet-delivered acceptance and commitment therapy may benefit chronic pain patients.
La Cour, 2015 (Score = 4.0)	Other Psychological Therapies	RCT	Supported by TrygFonden, Axel Muusfeldts Fond, Fabrikant Mads Clausens Fond, and Fonden af 1870. No COI.	N = 109 with nonspecific chronic pain.	Mean age 46.52 (12.42) / 48.84 (12.20) for meditation / WL groups: 16 males and 93 females.	Meditation group included mindfulness program (N = 43) vs Control or wait list (WL) group (N = 47).	6-months	SF36 "vitality" dimension after intervention, ($p \leq 0.05$). Score for the SF36 questions about the impact of pain on everyday life between baseline raw score mean 2.07 (0.89) and after the course mean 2.57 (SD 1.13), p = 0.01 and after 6 months mean 2.71 (1.18), ($p < 0.01$).	"A standardized mindfulness program (MBSR) contributes positively to pain management and can exert clinically relevant effects on several important dimensions in patients with long-lasting chronic pain."	Waitlist control bias. Baseline differences in agreed duration of pain. Significance dropout rate matching conclusions difficult but data suggest MBSR may benefit chronic pain patients.

Fear Avoidance Belief Training (FABT)

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
George, 2003 (score = 7.5)	Fear Avoidance Belief Training	RCT	Support for this study provided by Foundation for Physical Therapy. No mention of COI.	N = 66 with acute LBP within 8 weeks of study.	Mean age: 38.19; Sex: 28 males and 38 females.	Fear avoidance physical therapy (n = 34) vs. Standard physical therapy (n = 32) for duration of 4 weeks. Median number of therapy appointments 6 for both groups.	Final follow-up at 6 months.	Between group differences (95% CI)/p values for fear avoidance beliefs questionnaire at 4 weeks, and 6 months: 4.2(1.3 to 7.1)/p = 0.006, 3.4(0.2 to 6.6)/p = 0.037.	"[D]isability experienced at 4 weeks and 6 months after an episode of low back pain is dependent on an interaction between the type of treatment received and the level of fear-avoidance beliefs."	Most (62%) also had lower extremity pain. Non-significant differences favoring FABT over standard treatment at 4 weeks and 6 months. Treatment found to be beneficial for those with elevated baseline FABs.
Sorensen, 2010 (score = 7.0)	Fear Avoidance Belief Training	RCT	Supported by grants from IMK Foundation, Health Insurance Foundation, Tryg Foundationen, Funen County Research Foundation and Danish Rheumatism Association. Authors declare no competing interests.	N = 207 with LBP at least 4 of prior 12 months, a mean LBP score over last 14 days of ≥4 (scale 0-10), and back pain had to be greater than any associated leg pain.	Mean age: 39; Sex: 99 males and 108 females	Educational group (EDUC, n = 105) had 1-3wk intervals, 1st and 3rd by TB. 2nd visit a group visit, included a relative. 2nd visit led by PT with experience in chronic pain mgt. Also gave PowerPoint to study general biology and cognitive aspects.	Follow-up at 2, 6, and 12 months.	No differences between groups for pain and activity limitations, physical activity, and work ability. FAB Questionnaires differed (2 mos: EDUC = 10.3 ± 5.9 vs. TRAIN = 13.3 ± 6.4, p < .001; 6 mos: EDUC = 10.8 ± 6.2 vs. TRAIN = 13.3±6.0, p = 0.007, 12 mos: EDUC = 10.5 ± 6.1 vs. TRAIN = 13.1±6.5, p = 0.01), and Back Belief	"A cognitive, educational intervention for cLBP resulted in at least as good outcomes as a symptom-based physical training method despite fewer treatment sessions."	Patient contact bias in favor of traditional PT, suggest alternate treatment may be superior. Mostly subacute to chronic pain population.

						Symptom-based physical training program (TRAIN, n = 102) had consultation at 1st visit with PT for possible direction of preference exercises, plus advice on optimal postures.		Questionnaire at 6 mo. (EDUC: 24.3 ± 12.7 vs. TRAIN: 28.5 ± 11.4, p = 0.01)		
Beltran-Alacreu, 2015 (Score=6.0)	Fear Avoidance Belief Training	RCT	No sponsorship or COI	N=45 with nonspecific chronic neck pain.	Mean age 41.4 years: 20 males, 25 females	All received 8 treatments over 1 month (2 per week) Control Manual therapy (MT) (N=15) vs Group 1 Received MT and therapeutic patient education (TPE) (N=15) vs Group 2 Received MT, TPE, and therapeutic exercise protocol. (N=15)	4, 8, 16 weeks.	Nonparametric Kruskal-Wallis test of neck disability index difference of baseline and follow up periods ($p < 0.01$) Difference for Visual Analog Fatigue scale & Neck Flexor Muscle Endurance test at 8 and 16 weeks ($p < 0.05$) Variance for group X time interaction ($P = 0.005$). Fear Avoidance Beliefs Questionnaire ($P = 0.022$).	"Differences between experimental groups and the control group were found in the short and medium term. Multimodal treatment is a good method for reducing disability in patients with nonspecific chronic neck pain in the short and medium term."	Small sample size, all received manual therapy. Multiple co-interventions. Data suggest FABT most important component as little additive benefit from this exercise regimen for improving the disability associated with non-specific CNP. Both groups received education which included FABT.
Jay, 2016 (score=5.5)	Fear avoidance belief training	RCT	No mention of sponsorship. No COI.	N = 112 patients with chronic musculoskeletal pain	Mean age: 46.55 years; 0 males,	Physical-cognitive mindfulness training intervention	Follow-up at baseline and 10 weeks.	Significant results were seen in a group by time interaction in work-related Fear-Avoidance Beliefs for	"[A] 10-week targeted physical-cognitive mindfulness intervention has	Data suggest work-related fear avoidance beliefs may be reduced by 10 weeks with

					112 females.	group, including joint mobility, strength training, and CBT for 20 min 4X/week, and mindfulness group training 1Xweekly (PCMT, N = 56) vs reference group, which followed company initiatives of ergonomic education and 10 minute exercise breaks 3X/week (REF, N = 56)		the PCMT group (P<0.05) at the 10-week follow-up.	significant effects on work-related FAB. As previously reported, the intervention group experienced reduced pain intensity by ~52% across 6 body regions compared to the REF group"	PCMT training in female chronic pain patients.
Pfingsten, 2001 (score = 4.5)	Fear Avoidance Belief Training	RCT	Study was supported by Deutsche Forschungsmeinschaft Grant. No mention of COI.	N = 50 with non-specific CLBP	Mean age: 41.4 ±1.5; Sex: 27males and 23 females.	Anticipating pain (n = 25) vs. Anticipating no pain (n = 25) while being tested for leg flexion movement.	None.	Anticipating pain vs. anticipating no pain intensity of pain mean±SD at time before instruction, time after instruction, and time after behavioral test: 38.2±20.2/38.1±20.7, 45.9±21.8/28.6±18.9, 48.1±23.7/30.2±19.6. Fear: 40.3±21.4/41.8±20.5, 46.5±20.1/27.4±23.3, 43.6±18.5/26.2±21.9.	"Results confirm that pain anticipation and fear-avoidance beliefs significantly influence the behavior of patients with low back pain in that they motivate avoidance behavior."	Controls informed it would not result in pain. Patients anticipating pain performed more poorly than those who did not anticipate pain.
Klaber Moffett, 2004	Fear Avoidance Belief Training	RCT	Other funds received in support of this work. No COIs.	N = 187 with mechanical LBP between 6	Mean age: 41.88;	Exercise (8 1-hour session spread over 4 weeks vs. Usual	Final follow-up at 12 months.	Outcomes compared at 6 weeks, 6 months, and 12 months. High fear-avoiders fared	"Patients with high levels of fear avoidance beliefs could significantly	Attendance suboptimal and averaged 4-5 classes.

(score = 4.5)				weeks and 6 months	Sex: 81 males, and 106 females.	care. Exercise intervention with low impact aerobics, strengthening, and stretching exercises		significantly better in exercise program than usual care at 6 weeks and 1 year; low fear-avoiders did not. Distressed or depressed patients significantly better off at 6 weeks, but benefits not maintained long-term.	benefit from the Back to Fitness program. The benefits of the exercise program for patients with high levels of distress/depression appear to be short-term only."	Comparison group underwent treatment by GP in U.K., thus likely heterogeneous and may have included individuals not optimally treated, thus potentially magnifying results which generally favored exercise, particularly including in high FAB group at up to 12 months.
Linton, 2008 (Score=4.0)	Fear Avoidance Belief Training	RCT	No mention of sponsorship or COI.	N = 46 patients with long-term back pain and reduced function who are fearful according to standardized measures.	Mean age 47.85 years: 16 males, and 18 females	All received usual treatment according to their medical plan. Exposure 13-15 sessions where 8-10 were graded exposure in vivo sessions. (N = 13) vs Waiting list control (N = 21)	3 months	WLC-TAU group (29%) either had no improvement or had deteriorated on the TSK versus (0%) in the EXPOSE-TAU group (p = 0.03) ADL (no improvement: 38% WLC-TAU, 9% Exposure) (p = 0.08)	"Compared to a group receiving usual treatment and waiting for exposure, the exposure in vivo group demonstrated significantly larger improvement on function. Overall exposure had moderate effects on function, fear and pain intensity. We conclude that exposure may be important in treatment, but is not recommended as a ''stand alone" adjunct to usual treatment."	Data suggest exposure group showed improved function but did not improve pain or fear.

Slater, 2009 (score = 4.0)	Fear Avoidance Belief Training	RCT	Supported by Office of Research and Development, Health Services Research and Development Service and Medical Research Service, Department of Veterans Affairs. Dr. Atkinson is on Scientific Advisory Board of Eli Lily which sells antidepressants, an alternative treatment method for LBP.	N = 67 with first-onset back pain (thoracic vertebra 6 or below) present at least 6 but no less than 10 weeks, and not candidate for acute surgical intervention.	Mean age: 30.52; Sex: 58 males, and 9 females.	Behavioral Medicine Group (BMG, n = 34) had 4 weekly, 1 hour individual sessions, let by a master's-level clinician trained in study in behavior pain management and rehabilitation method. Attention Control Group (ACG, n = 33) had 4 weekly, 1 hour individual sessions led by a master's-level clinician with training in psychotherapy, and provided nondirective, supportive care.	6 months	At six months, Pain and Impairment Relationship Scale differed (BMG = 50.00 ± 16.20 vs. ACG = 60.60 ± 12.50, $p \leq 0.05$). For patients who completed 4 sessions, there was significant difference in those who recovered at 6 months (BMG = 54% vs. ACG = 23%, $\chi^2 = 5.12$, df = 1, p = 0.02). Recovery rates in the maximum dose sample (n = 32) of those who recovered was significantly higher in BMG (75%) versus ACG (20%, $\chi^2 = 9.41$, df = 1, p = 0.002).	"A behavioral medicine, rehabilitation intervention applied at the subacute phase for individuals with first-onset LBP and moderate functional work limitations enhanced recovery and reduced chronic pain and disability at 6 months after pain onset, relative to an attention control condition."	Mostly subacute to chronic pain population. Study defined chronic pain at 6 months post initial onset. Data suggest behavioral interventions may be beneficial in reducing progressions to chronic LBP in military population with 1st onset LBP. Compliance <80% and loss to follow up which author excluded non-compliant.
Rolving, 2014 (score=4.0)	Fear avoidance belief training	RCT	Sponsorship by the Danish Working Environment Research Fund. No mention of COI.	N = 83 patients with non-specific neck pain on sick leave	Mean age: 39.3 years; 23 males, 60 females.	General physical activity at home 3-4 h/week or 30 min/day (GPA, N = 40) vs GPA with additional 15-20 min 3x/week of strength training of the neck and shoulder, (SST, N = 43).	Follow-up at baseline and 3 months.	Significant pain reduction and increase in neck flexion strength for GPA group (p=0.046, p=0.014 respectively) and SST (p<0.001, p=0.001 respectively) with no significant difference between groups. Improvement of within group Fear-Avoidance Beliefs	"The overall pain reduction gained by adding specific strength training to a program of general physical activity was not found to be clinically relevant in the present study. Only limited improvements in muscle strength were gained with	Data suggest a trend towards reduced pain in the SST group, both groups improved in neck flexion strength but there was a significant improvement in fear-avoidance beliefs in the SST group. Home-

								were seen in both groups ($p<0.001$ for SST, $p=0.004$ for GPA) with a significant difference between groups ($p=0.046$).	either type of training. Participants of the specific training program did however show an improvement in fear-avoidance belief compared to the participants in the general physical activity program, although a significant within-group improvement was also seen here."	based low supervision training does not appear to increase muscle strength or decrease pain.

Evidence for the Use of Biofeedback

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Kent, 2015 (score=7.0)	Biofeedback	RCT	Sponsored by dorsaVi P/L and the Victorian State Government. COI, authors, clinicians and patients were reimbursed by the Victorian State Government and dorsaVi.	N = 112 patients with chronic back pain.	Mean age: 43.5 years; 51 males, 61 females.	Movement Biofeedback Group (N = 58) vs Guidelines-based Care Group (N = 54). Both groups had 6-8 clinical consultations over 10 wks. Advice was given on management of LBP, importance of staying active. Based on data received from the ViMove system in Biofeedback Group, clinician would identify and offer suggestions to adjust movement dysfunction related to LBP. Other group had sham biofeedback sensor.	Follow-up at baseline, 3 and 12 months.	Results showed significant improvement in biofeedback group vs. controls in Roland Morris Disability Questionnaire (activity limitation, $p<0.014$), Patient Specific Functional Scale ($p=0.001$), and self-reported pain (VAS scale, $p<0.004$).	"Patients in the Movement Biofeedback Group showed significant improvements in the primary outcome measures of activity limitation and pain intensity, compared with those in the Guidelines-based Care Group, as seen by the group effects and group-by-time interaction effects all favouring the Movement Biofeedback Group"	Cluster randomization. Data suggest changing posture and movement patterns with sensor biofeedback may decrease chronic low back pain and improve activity when compared to sham.

Babu, 2007 (score = 6.5)	Biofeedback	RCT	Supported by Ethical Committee of Christian Medical College and Hospital, Vellore, and Fluid Research Grant. All authors are employees of Christian Medical College and Hospital.	N = 30 who met the 1990 American College of Rheumatology fibromyalgia criteria	21 female, 9 male. Mean age 39 years	Biofeedback (n = 15) vs Sham biofeedback (n = 15). Each group received a continuous six-day treatment with each session being 45 minutes long	6 days	Mean changes in baseline scores after 6 days for biofeedback and sham groups, respectively. FIQ -21.9, -12.3 (p=0.05), VAS -4.3, -2.6 (p=0.09), Tender points -8.6, -4.4 (p=0.002), Six-minute walking test distance in meters 69, 16 (p=0.08)	"Biofeedback as a treatment modality reduces pain in patients with FMS, along with improvements in FIQ, SMWT and the number of tender points."	Data suggest biofeedback reduces pain in fibromyalgia patients and positively impacts fibromyalgia impact questionnaires.
Kapitza, 2010 (score = 6.0)	Biofeedback	RCT	Industry sponsorship (Biomental Gesellschaft fűr Mentalsysteme) and no mention of COI.	N = 42 with moderate chronic LBP at least 3 months and 1 week before study, no change in medication.	Mean age: RFB 21, non-contingent RFB 21; 15 males, 27 females.	Non-invasive relaxation breathing technique or RFB with synchronized feedback (n = 21) vs. RFB placebo, no feedback (n = 21).	2 weeks, 3 months	PDI/recreation/social activity/ sexual life/RI/VAS at rest and during activity; p = 0.004/p = 0.006/p = 0.005/ p = 0.027 / increase of 0.22 points for RFB / p=0.12 & p= 0.01 vs. p = 0.27 and p = 0.014.	"…RFB can be used as a useful, safe and effective adjunct in multimodal pain therapy."	Although authors conclude RFB may have benefit, the study's data show no statistical or clinically significant differences between groups.
van Santen, 2002 (score = 5.5)	Biofeedback	RCT	Supported by the Dutch Arthritis Association. No mention of COI.	N = 129 who met the 1990 American College of Rheumatology fibromyalgia criteria	129 female, 0 male. Mean age fitness group 46.2 years, biofeedback group 44.4 years, control group 42.8 years	Fitness group, exercised for 60 min two times a week for 24 weeks (n = 50) vs Biofeedback group, individual sessions for 30 min, two times a week for 8 weeks (n = 50)	12 and 24 weeks	Mean difference in baseline scores at 24 weeks for fitness, biofeedback, and control groups, respectively (ANOVA between-group difference p values): VAS -5.5, -0.6, 1.3 (p=0.3), Tender points -0.6, -1.4, -1.9 (p=0.4), total myalgia score 12.8, 15.5, 25.3 (p=0.6)	"Thus compared to usual care, the fitness training (i.e., low impact) and biofeedback training had no clear beneficial effects on objective or subjective patient outcomes in	Data suggest comparable (in)efficacy between groups as neither fitness training nor biofeedback improved fibromyalgia symptoms better than controls.

						vs control group (n = 29)			patients with FM."	
Mehling 2005 (4.5)	Biodfeedback	RCT	Sponsored by the Mount Zion Health Fund, and Health Resources and Services Administration fellowship of the US department of Health and Human Services. No mention of COI.	N=36, patients with chronic low back pain.	Group 1: mean age 49.7±12.1; 5 males. Group 2: mean age 48.7±12.5; 5 males.	Group 1, 6 to 8 weeks (12 sessions) of breath therapy (n=16) vs. Group 2, 6 to 8 weeks (12 sessions) of Physical therapy. (n=12)	Baseline, 6 weeks, and 6 months.	Group 1 vs group 2, pre-6 week pain VAS score (Mean±SD): -2.71±2.23 vs -2.43±2.05 (p=0.74). Group 1 vs group 2, pre-6 week SF-36 score (Mean±SD): +14.9±1.5 vs +21.0±2.5 (p=0.45). Group 1 vs group 2, relapse of low back pain at 6 months: 5/15 (33%) vs 1/11 (9.1%).	"In summary, this is the first study providing evidence that patients suffering from chronic low back pain can clinically improve with breath therapy. Changes in standard self-reported low back pain measures of pain and disability appear to be comparable to changes measured following high-quality, extended physical therapy."	Possible randomization failure as baseline data worse baseline differences in one group.
Altmaier, 1992 (score = 4.5)	Biofeedback	RCT	Industry sponsorship (National Institute for Handicapped Research) and no mentioned COI.	N = 47 consecutively admitted over 18-month period to low back rehab program	Mean age: 39.91; 33 males, 12 females.	Treatment programs: 1) standard inpatient rehab for chronic LBP (education QD and physical reconditioning, 2x/day PT, QD aerobic	6 months	RTW not significantly lower in psychological group (47.6% vs. 67%). Patients improved in overall functioning at discharge and follow-up, but not different by group assignment.	"[T]he psychological treatment failed to add to the effectiveness obtained by the standard rehabilitation program."	Study suggests no additional benefit from relaxation training and coping skills when added to education, support, and exercise

						training, vocational rehab, n = 21); 2) Psychologically based program added to above (operant conditioning, relaxation, biofeedback, charting of exercise behaviors, contingent verbal praise, chart on patient room wall, group and individual cognitive-behavioral coping training, n = 24). Follow-up at 3 weeks, 6 months.				programs for chronic LBP.
Frih, 2009 (score = 4.5)	4.5	RCT	No mention of industry sponsorship or COI.	N = 107 with symptomatic LBP, sciatica, and psychiatric disorders, and or behavior precluding participation in group therapy.	Mean age: Group A 34.7, Group B 36.9; 27 males, 80 females.	Group A (GpA): Group performs home-based rehabilitation program (n = 54) vs. Group B (GpB): Group received a standard rehabilitation program (n = 53).	3, 6, and 12 months	Significant difference for pain intensity in favor of GpA. VAS pain for GpA 25.1±20.3 and $p<0.001$, and GpB - 13.9±17.3 and $p < 0.001$. A total difference of, $p = 0.003$.	"The results of the present study suggest that a home-based rehabilitation program including exercises that match each individual patient's clinical profile	Both groups improved over time, and most measures were not significantly different between groups, except VSA (ps=0.003) and Schirado ($p<0.008$).

									can reduce chronic pain intensity and perceived disability, improve functional capacity and limit the psychological impact of LBP. However, this type of program requires high levels of motivation and regular supervision and patient evaluation."	
Glombiewski, 2010 (Score = 4.0)	Cognitive Behavioral Therapy	RCT	Supported by a doctoral thesis scholarship from the University of Marburg. No mention of COI.	N = 128 with chronic back pain.	Mean age 48.8 (11.7): 39 males and 77 females.	Cognitive–behavioral therapy (CBT) group (N = 35) vs Cognitive-behavioral therapy including biofeedback tools (CBT-B) group (N = 31) vs Wait-list control (WLC) group (N = 51).	6-months	CBT-B and CBT equally effective for pain intensity (using, Pain Intensity Questionnaire or PIQ): CBT-B, μ = 0.66 (95% CI 0.39–0.95) vs CBT, μ = 0.60 (95% CI 0.33–0.87)). CBT+CBT-B, 33.85% sig. improved vs WLC 13.73%. Primary outcome PIQ / Secondary outcome Pain Diary & RLS Scale & CS Scale & Doctor Visits; F (1.57, 177.98) = 3.45,	"[B]iofeedback ingredients did not lead to improved outcome of a psychological intervention."	Waitlist control bias. Data suggest CBT intervention decreased chronic back pain and addition of biofeedback to CBT did not improve clinical outcomes. Not all patients randomized. Not blinded. Pooled CBT arms compared to control had

								p = 0.043 / (F (1.9, 133.32) = 1.29, p = 0.28, & F (1.96, 221.12) = 58.73, p < 0.001, & F (1.66, 186.64) = 8.8, p < 0.001).		improvements in many subjective measures but clinical significance uncertain. Data suggest no benefit to CBT when biofeedback is added.
De Sousa, 2009 (score=4.0)	Biofeedback	RCT	No mention of sponsorship or COI.	N = 60 patients with low back pain.	Mean age: 46.39 years; 17 males, 43 females.	Treatment group received 16 sessions using biofeedback (visual biofeedback F 1000 system) of muscular relaxation, techniques for cognitive restructuring, and abdominal strengthening exercises for eight weeks (N = 30) vs waitlist control group (N = 30).	Follow-up at baseline and 8 weeks.	No sig. results between treatment and control group in primary outcomes of VAS (p=0.131), Schober index (p=0.184), Roland-Morris Questionnaire (p=0.183), State-Trait Anxiety Inventory (State: p=0.071, Trait: p=0.425), Beck's Depression Inventory (p=0.647), or paraspinal and abdominal muscle electromagnetic levels (p=0.503 - 0.055).	"[O]ur treatment program did not lessen pain, improve quality of life or anxiety in patients with CLBP, or change paraspinal muscle toning during abdominal contraction. May be the biofeedback program is only valuable in a context of a cognitive-behavioral therapy."	Waitlist control bias. Data suggest lack of efficacy for primary treatment outcomes when compared to control.
Hallman 2011 (4.0)	Biofeedback	RCT	No mention of sponsorship or COI.	N=24 patients who sustained stress related chronic neck pain.	Mean age 40.5; 2 men.	Group 1: patients received heart rate variability biofeedback training for 10	Baseline and 10th session.	Group 1, baseline vs post-test for Short form 36 health survey "bodily pain" / Vitality / Social Function (mean±SD):	"The present pilot study showed improvement in perceived health over 10	Pilot study with small sample. Data suggest slight trend in perceived

						weeks. (N=24) vs. Group 2: patients only received breathing protocol at session 1 and 10 (n=10)		46.5±21 vs 71.8±18 (p=0.049) / 37.1±22 vs 57.5±22 (p=0.005) / 76.0±23.0 vs 90.6±12 (p=0.047). above stats tested with ANOVA groupXtme with control group as well and stayed significant.	weeks intervention with HRV-biofeedback in subjects with stress-related chronic neck-shoulder pain. Increased resting HRV as well as enhanced reactivity to HGT and CPT might reflect beneficial effects on ANS regulation, and may further suggest that this intervention protocol is suitable for a larger controlled trial."	health improvement in biofeedback group.
Bush, 1985 (score = 4.0)	Biofeedback	RCT	Industry sponsorship (MRC Studentship and a Gouvernment du Quebec FCAC Bourse Scholaire) and no mentioned COI.	N = 72 with chronic LBP	No mean age given. Age range 20-65; 38 males, 34 females.	Paraspinal EMG for ≥8 sessions (n = 23) vs. placebo (n = 24) vs. waiting list control (n = 25). Monitored self pain for 4 weeks. Assessments post-treatment and 3 months.	3 months	All groups with small but significant decreases in pain, depression and anxiety.	"[P]araspinal EMG biofeedback is not a specific treatment for chronic low back pain in a nonhospitalized population."	Correlation found at pre-treatment, but not present at post-treatment and follow-up.

Donaldson, 1994 (score = 4.0)	4.0	RCT	No mention of industry sponsorship or COI.	N = 36 with chronic LBP	Mean age 38.0 years; 17 males, 21 females.	Single motor unit biofeedback training (SMUBT, n = 11) vs. Relaxation training (n = 8) vs. educational program (n = 7). All groups received 10 sessions. Final follow-up at 4 years.	90 days, 4 years	McGill pain questionnaire average pain measure score (SD) biofeedback for pre/post/follow-up: 28.75 (15.11)/16.08 (14.98)/15.33 (15.66), p <0.05; for relaxation: 31.08 (12.39)/27.67 (12.63)/32.33 (11.31), p <0.05; for education: 34.50 (14.43)/28.58 (16.07)/20.08 (20.28), p <0.05. No significant differences for global VAS.	"The EMG results showed decreased amplitude and bilateral differences for the SMUBT and education groups. A 4-year follow-up revealed the SMUBT group remained symptom free."	Baseline trends favored biofeedback group as they are somewhat less severely affected. Data suggest biofeedback effective.
Asfour, 1990 (score = 4.0)	4.0	RCT	No mention of industry sponsorship or COI.	N = 30 with chronic LBP	Mean age: control group 46.53, experimental group 43.27; 13 males, 17 females.	EMG biofeedback as add-on therapy to exercise in increasing strength of trunk extensors (n = 15) vs. control (n = 15). Intervention administered 2 weeks of 4 week study.	2 weeks at post-intervention	Mean increase in strength (SD) for control vs. experimental group at final assessment: 284.22 (141.82) vs. 224.86 (209.19), p <0.01.	"[T]he proposed methodology was an effective tool to achieve a significant improvement in the strength of lumbar paraspinal muscles of chronic low-back pain patients."	Many details sparse. Data suggest biofeedback effective.

Appendix 6 : Systematic and Non-Systematic Reviews, Low Quality RCTs and Non-Randomized Studies

Aerobic Exercise

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Topcuoglu 2015 (3.5)	CRPS	RCT	No COI or sponsorship.	N = 40 hemiplegic, admitted for subacute inpatient stroke rehabilitation, diagnosed with CRPS I	18 female, 22 male. Mean age exercise group 65.95±8.7 years, control group 67.5±11.2 years	Conventional standardized CPRS type I physiotherapy – TENS analgesic current, cold-packs, retrograde massage, contrast baths (N = 20) vs Addition of aerobic exercise program with arm crank ergometry (N = 20)	4 weeks	Exercise group presented less hyperalgesia (P=0.005), metacarpophalangeal joint tenderness (P=0.002), tenderness upon wrist extension (P=0.005), and hand sweating (P=0.0013). General linear repeated measures: Shoulder region – VPS score improvement in exercise group significant (F=5.293, P=0.027), not significant on night pain (F=0.082, P=0.776) or on movement pain (F=3.410, P=0.073), Hand region – VPS score improvement in exercise group significant (F=8.284, P=0.007) and in movement pain (F=6.796, P=0.013),	"Aerobic exercises should be prescribed in addition to the conventional treatment of CRPS in order to increase the functional independence of hemiplegic patients with CRPS, to improve their participation in the activities of daily life, to reduce their depressive symptoms, and to improve their general well-being. Aerobic exercises should be prescribed for hemiplegic patients with CRPS."	Stroke patients with CRPS only. Exercise intervention is not standardized or reproducible. Data suggest aerobic exercise of additive benefit.

								not significant on night pain (P=2.003, P=0.165)		

DMSO

Author Year (Score):	Category	Study type:	Conflict of Interest	Sample size:	Age/Sex	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Zuurmond 1995 (3.5)	DMSO	RCT	No mention of sponsorship or COI.	N=31 individuals diagnosed with Acute Reflex Sympathetic Dystrophy (RSD).	14 males, 17 females: Mean age group 1: 47 (40-61), group 2 : 48 (41-68)	Group 1 (N=16) patients received fatty cream with 50% dimethyl sulfoxide (DMSO). vs Group 2 (N=14) patients received fatty cream without DMSO	Follow up at baseline and 2 months (check in every two weeks within follow up)	RSD median score difference, baseline to 2 month difference, group 1 vs 2 (Median (Min-Max)): 4 (0-5) vs 3 (0-5) (p<0.01). No difference in Visual analogue scale. Side effects include some skin scaling and garlicy taste and odor after using DMSO cream.	"We conclude that treatment of acute RSD with DMSO 50% added to white soft paraffin-cetomacrogol-cream and physiotherapy is recommendable. "	Methodological details sparse. RSD score difference between groups, but there were no differences in pain outcomes.

Tumor Necrosis Factor-Alpha Blockers

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Dirckx 2013 (3.5)	CRPS	RCT	No mention of sponsorship or COI	N = 13 with CRPS	Mean age 47.8. 13 female.	Treatment group infliximab (5mg/kg) in saline solution (0.9%) administered at weeks 0, 2, and 6. N = 6 Placebo saline solution (0.9%). N = 7 at weeks 0, 2, 6.	6 weeks.	No significant change in ISS score between 2 groups. No significant difference in cytokine levels. Treatment group showed greater reduction of TNf-alpha. Decrease in health status in the intervention group.	"This study was terminated before the required number of participants had been reached for sufficient statistical power. Nevertheless, a trend was found toward an effect of infliximab on the initially high TNF-a concentration."	Small sample size (n=13). Participant flow and exclusion poorly described. Co-interventions poorly described. Trial terminated prematurely.

Regional Sympathetic Blocks

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Rocha 2014 (3.5)	Thoracic sympathetic blocks	RCT	No COI. Supported by The Pain Center, Neurology Department, University of São Paulo, Brazil.	N = 36 diagnosed via The International Association for the Study of Pain 1994 for CRPS type I, pain for at least 6 months, pain relief failure after conventional treatment	19 female, 17 male. Mean age 44.7 years	Thoracic sympathetic blocks, 10 mL of anesthetic + corticosteroid solution (5 mL of 0.75% ropivacaine, 5 mL of 2% triamcinolone) injected into T2 sympathetic thoracic ganglion, paralateral to T2 vertebrae on affected side (N = 17) vs control, sham injection (N = 19)	12 months	Mean Brief Pain Inventory pain intensity at month 1: TSB (3.59 ± 3.2), Control (4.84 ± 2.7) (P = 0.249). At 12 months TSB (3.47 ± 3.5), control (5.86 ± 2.9) (P = 0.046). Mean BPI difference from baseline at 1 month – TSB (5.59 ± 2.9 to 3.53 ± 3.7, P = 0.035), Control (6.16 ± 3.0 to 5.84 ± 2.9). Mean McGill Pain Questionnaire scores at 1 month – TSB (36.56 ± 16.2), Control (42.33 ± 8.5) (P = 0.024). 12 month – TSB (27.20 ± 22.2), Control (45.43 ± 23.6) (P = 0.042).	"In conclusion, our data showed that a single TSB is a safe procedure and has both short- (1-month) and long-(12-month) term positive impact on upper limb CRPS type I as an add-on treatment to a standardized rehabilitation and pharmacological treatment program. While the impact of the procedure on quality of life is slightly significant, pain reduction, decrease in evoked pain, and amelioration of depressive symptoms, were significantly superior to the control treatment."	Methodological details sparse. Poor description of intervention and comparison treatments and co-interventions. Difficult to replicate based on description.

Desensitization Techniques for CRPS

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Length of Follow-up:	Results:	Conclusion:	Comments:
Fialka, 1996 (score=1.5)	CRPS	RCT	No mention of Sponsorship or COI.	N = 18 patients with reflex sympathetic dystrophy of the upper limb	Mean age: Control Group: 63.4±3.7 Training Group: 64.2±6.6 Sex(M:F) 6:12	Autogenic Training group (N =9) received home therapy and autogenic training once a week for 10 weeks. vs Control group (N =9) received home therapy.	*10 weeks*	Both groups experienced pain relief over the trail period. Skin temperature significantly decreased in Training Group, in comparison, the Control group demonstrated a slight numerical increase. (Training group reduction: 2.3°C vs Control group change +0.8°C ($p<0.006$))	"It is concluded that autogenic training may be helpful in certain aspects of reflex sympathetic dystrophy but its potential value requires further study."	Methodological details are sparse. No differences in pain score, range of flexion, range of extension and volume difference between hands. Skin temperature was different between treatment and controls co-interventions poorly described.

Ketamine

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Schilder 2013 (2.5)	CRPS	RCT secondary analysis	No COI. Supported by a grant from the Dutch Ministry of Economic Affairs.	N = 19 patients with CRPS I in the arm, participating in a ketamine-placebo trial	15 female, 4 male. Mean age placebo group 47.0 years, ketamine group 42.3 years	S[339]-ketamine (N = 15) vs placebo/saline (N = 14). Both administered through intravenous infusion for 4.2 days	12 weeks	Linear mixed model analysis – a pain increase of 1 on the numerical rating scale (NRS) pain was associated with reduced velocity of 1.14 cm/s (95% CI = -2.00 – -0.27, P = .011), with reduced frequency of 0.07 Hz (95% CI = -0.13 – -0.01, P = .023), and with a decrease in amplitude of 0.19 cm (95% CI = -0.35 – -0.03, P = .023). Higher NRS pain scores significantly associated with various arrests: 1 point increase led to 4.26 extra arrests during 15 seconds of finger tapping (95% CI = 2.19 – 6.34, P < .001).	"To summarize, our results show that at each time point pain scores were directly related to motor function in CRPS, irrespective of whether patients received ketamine or placebo. Pain relief should be regarded as an important treatment goal in the management of motor disturbances in CRPS patients."	Methodological details spares. Secondary analysis of ketamine study. No meaningful difference between treatment groups at 12 weeks.

Magnesium Sulfate

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Collins 2009 (2.5)	CRPS	RCT	No mention of sponsorship or COI	N = 10 with CRPS 1 patients	Mean age 44. 8 women 2 men.	Received 70mg/kg magnesium sulphate infusions 4 hours for 5 days. N = 8 Vs Control received NaCl 0.9% solutions N = 2.	1 week	Reduced pain at follow up vs baseline. (T1: p = 0.01,T3: p = 0.04, T6: p = 0.02 T12: p =0.02) McGill sensory improvement T1: p = 0.03 pain rating index p = 0.01. Impairment level (p = 0.030). Quality of life (EuroQol p = 0.04, SF-36 physical p = 0.01)	"Intravenous magnesium significantly improved pain, impairment and quality of life and was well tolerated."	Methodological details sparse.

Injections

Safarpour 2011 (score=2.0)	CRPS	RCT	Jabbari serves on the advisory board for Allergen Inc. the Supported by Allergen Inc.	N = 8 with CRPS (according to the International Association for the study of PAIN [ISAP]) with allodynia	5 female, 3 male. Mean age 47.12 years	Botulinum (BoNT) toxin (N = 4) vs Saline (N = 4)	3 weeks, 2 months	Mean average pain intensity at baseline: BoNT 8.25, Saline 7, (*P* ⍰⍰0.05). At week 3 and 2 months – mean pain days: Placebo 24.8, BoNT 28.0, (*P* = 0.391), mean maximum pain intensity – BoNT 3 week 8.5 (P = 0.215), 2 month 8.3 (P = 0.182), Saline 8.5 (P = 0.215), 8.3 (P = 0.638). Average pain – 3 week BoNT 7.5 (*P* = 0.215), 2 moths 7.3 (*P* = 0.182), Saline 7 (*P* ⍰⍰0.5), 6 (*P* = 0.252). Study stopped prematurely due to lack of pain relief and no improvements	Intradermal and subcutaneous administration of BoNT-A into the allodynic skin of the patients with complex regional pain syndrome (CRPS) failed to improve pain and was poorly tolerated."	Study stopped early due to adverse events, participants reported "Injections intolerable" and "patients indicated that even if the injections work, they will not consider this mode for treatment due to extreme level of discomfort." Methodological details sparse.

Lidocaine Infusions

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Wallace 2000 (2.5)	Lidocaine	RCT	Supported by the international Anesthesia Research Society. No mention of COI.	N=16 patients with Chronic Regional Pain Syndrome (CRPS) stage I and stage II.	7 females, 9 males; mean age of 44±15.	Group 1 Received intravenous lidocaine achieving a 1ug/ml to 3 ug/ml concentration. vs Group 2 received placebo diphenhydramine.	Patients were followed up at baseline, 1 and 2 weeks.	Plasma level 3 ug/ml, lidocaine produced a higher "Hot Pain" threshold from 44.7°C to 47.9°C ($p<0.05$). Lidocaine had significant decrease in response to stroking, cold allodynia, cool stimulus, and spontaneous pain. Side effects: lidocaine produced significantly more light headedness in patients, also significantly raised Systolic Blood pressure 134.9±20.2 mmHg to 150.6±21 mmHg in 3 ug/ml group.	"Lidocaine is an example of a drug that may be the choice for pain that has a strong cool-evoked component. Until further studies are completed with different classes of agents, we can make no further conclusions on how to select the drugs."	Small sample size (n=16). Methodological details sparse. Short term study of 2 weeks.

Spinal Cord Stimulators

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size/Population:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Kemler, 2001 (3.0)	Spinal Cord Stimulation	RCT	No mention of COI or sponsorship.	N=54 patients with chronic complex regional pain syndrome	Mean age: 38.4 years. 17 males, 37 females.	SCS+PT: Received spinal cord stimulation and physical therapy (n=36) vs PT: received only physical therapy (n=18)	3, 6, 12 months	No significant difference was observed in SCS patients and control from T1 to T5.	"Although SCS has previously been shown to cause a significant pain reduction in complex regional pain syndrome type I, the treatment has no long-term effect on detection and pain thresholds for pressure, warmth, or cold. The treatment seems to have only minimal influence on mechanical hyperalgesia."	Spinal cord stimulator only implanted in responsive patients, not truly randomized study for all participants.
Meier 2015 (3.5)	Chronic, CRPS	RCT	This PhD study was funded by Aarhus University, Aarhus, Denmark, St Jude Medical, St. Paul, Minnesota and the Danish Medical	N = 14, 5 patients with CRPS, and 9 with chronic pain due to peripheral nerve injury.	Mean age 53, 9 female, 5 male.	One group (N = 7) following quantitative sensory testing (QST) had spinal cord stimulation (SCS) for a 10-12 hour interval. The other group (N = 7) received no SCS for 10-12 hours after	Follow-up consisted of QST 3 times: at baseline, and after each (2) 12 hour treatment session.	No statistically significant results were seen in any 3 QST from both groups. There were no significant changes in mechanical or thermal thresholds, nor intensity of pain, or reduction of areas with painful symptoms.	"[D]ata seem to suggest that active SCS treatment does not change sensory perception. In addition, there was no significant change in pain intensity, suggesting a chronic effect of	Small sample size (n=15). Short duration. Methodological details poorly described.

			Research Council, Copenhagen, Denmark. Authors K.M. and J.C.S. have teaching funding from St Jude Medical and are paid consultants for Biolab Technology.			QST. After the 12th hour, groups switched treatments of SCS for another 10-12 hours.			SCS in long-term implanted patients rather than acute changes."	
Eckmann 2011 (2.5)	CRPS	RCT	No mention of sponsorship or COI	N = 10 with unilateral CRPS I (International Association for the Study of Pain modified diagnostic criteria).	N=10 aged ≥18	Each patient was Randomized to receive 4 IVRB treatments 1 week apart. Each patient received a standard 50mL lidocaine 0.5%. The dose of ketorolac 0, 30, 60 and 120 mg was a randomized order.	4 weeks	1 outcome showed significant improvement. 2 day pain reduction in the ketorolac groups (median NRS 6 to 4 (p= 0.002)). Overall pain NRS week 1 6.2 ± 0.53, 6.5 ± 0.89, 6.0 ± 0.88, 5.9 ± 1.07 and 5.8 ± 0.9 at baseline 0, 20, 60, 120mg. (p = 0.80 pain with movement. 7.15 ± 0.69, 5.7 ± 1.07, 6.1 ± 0.86, 5.0 ± 0.97, and 5.6 ± 0.86, (p =0.059. Edema 2% reduction (p = 0.6).	"IVRB with ketorolac and lidocaine produced only short-term pain reduction in patients with CRPS involving the lower extremity after 4 serial injections"	Methodological details sparse.

Back Schools

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Norbye, 2016 (score=3.5)										Wait list control bias. Data suggest similar efficacy at 12 month follow-up between groups for return to work (RTW) between groups with a slight trend toward WL group returning earlier.
Tavafian, 2007 (score=3.5)										No placebo. Both groups received meds. Interventional group reported better quality of life measures at 3, 6, 12mo. Generalizability of study data beyond Iran unclear.
Bendix, 1997 (score=3.0)										Data suggest FR program better than other less intensive programs for improved back pain, already to return to work (improved disability) less analgesic use

										and improved physical activity.
Devasahayam, 2014 (score=3.0)										Small sample (pilot study). High dropout rate. Baseline differences between groups for BMI and VNP.
Paolucci, 2012 (score=2.0)										Small sample size. Conclusions limited due to sparse methods and limited description of sample characteristics.
Pain Management										
Szulc, 2015 (score=3.0)										Standard care control bias. Sparse methods. Data suggest combination MET and McKenzie Method improved pain and disability.

Chronic Pain Management Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Dear, 2013 (score=3.5)										Waitlist control bias. Data suggest clinician guided internet-delivered CBT

										maybe useful for managing anxiety disability depression in chronic pain.
Mitchell, 1994 (score=3.5)										Only small differences between treated and control groups. Aerobic exercise components appear weak, possibly contributing to suboptimal results.
Haas, 2005 (score=3.5)										Waitlist control bias. Data suggest no advantage to CDSMP over waitlisted controls for improvement in pain, or self-efficacy, but there was a trend towards improving fatigue, emotional well-being and disability days.
Anderson, 2015 (score=3.5)										Data suggest TPA may be effective in earlier return to work in sick

										listed individuals.
Ruehlman, 2011 (score=2.5)										Wait list control bias. High dropout rate. Data suggest increased knowledge regarding pain in study population as well as a reduction in depression, anxiety, and stress as well as pain outcome measures if the program was utilized.
Brown, 2013 (score=2)										Usual care bias. Data suggest improved perceived pain control in MBPM group.

Multidisciplinary Rehabilitation Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
De Buck, 2005 (score=3.5)										Population of chronic rheumatologic diseases. Usual care bias. High dropout rate. Data suggest although the VR

										program did not decrease job loss, mental health and fatigue improved.
Abbasi, 2012 (score=3.5)										Small sample size. Sparse methods.
Martins, 2014 (score=3.5)										Small sample, sparse methods. Data suggest weekly multidisciplinary programs (WIPs) may improve quality of life in patients diagnosed with fibromyalgia syndrome.
Streibelt, 2013 (score= 3.0)										High dropout rate (approximately 50% at 12 months). Baseline differences between groups (depression 90.4 vs 70.5) and current episode of sick leave (74.1 vs 87.5).

										No pain medication history or current use.
Turner-Stokes, 2003 (score=3.0)										Open trial with baseline differences between groups for chronicity of pain (10.26 vs 6.76). At 12 months, combined dropout rate about 33%. No control group nor medication details.
Brendbekken, 2016 (score= 3.0)										At 12 months, both groups had an approximate 40% dropout rate. Pain history and current use not described.
van der Maas, 2016 (score=3.0)										High dropout rate of 45%, usual care bias. Pain medication details not included.

Heutink, 2012 (score=3.0)										Wait list control bias. Medication history and use not described. Data suggest anxiety and participation improved in intervention group but not on pain intensity.
Heutink, 2014 (score=3.0)										Follow-up from Heutink 2012. Small sample for long term analysis. CBT may be useful for teaching coping strategies to individuals with chronic pain.
Castell 2013 (score=2.5)										High dropout rate, contact bias in experimental group. Data suggest improved sleep, psychological distress and catastrophizing improved and

										improvement was maintained at 12 months.
Casaneuva-Fernández (score=2.5)										Data suggest improvement in experimental group in terms of 6 minute walking test, grip strength, social function and vitality.
Toussaint 2012 (score=1.5)										High dropout rate. Standard care bias.

Interdisciplinary Pain Rehabilitation Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Olason 2004 (3.5)										No control/reference group. Patients served as their own controls. Data suggest patients returning to work increased from 18.4% to 59.2% post discharge. Data also suggest anxiety and

										depression treated via CBT decreased and analgesics were withdrawn and there was reduced pain.
Martín 2014 (score=3.5)										Sparse methods. High overall dropout rate (39% CG, 64% EG_1) making robust conclusions impossible.
Saral 2016 (score=3.5)										Data suggest comparable efficacy on most FM outcomes.

Other Functional Restoration Programs

Author Year (Score):	Category:	Study type:	Conflict of Interest:	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Kim, 2015 (3.5)	Functional restoration	RCT	No sponsorship or COI.	53 patients with chronic lower back pain.	Mean age 29.1; No mention of sex.	CORE programme the 30-minute CORE programme, five times per week, for eight weeks, with additional use of hot-packs and transcutaneous electrical nerve stimulation	2 months	Pain pressure threshold in quadratus lumborum CORE vs Control 1.3 vs 0.1 ($p < 0.001$) Pain pressure threshold in sacroiliac joint 1.2 vs 0.1 ($p < 0.001$)	"The CORE programme is an effective intervention for reducing pain at rest and movement induced pain, and for improving the active range of motion and trunk proprioception in female office	High dropout rate. Data suggest intensity of pain during movement was improved.

						(N = 27) vs Control (N = 26)			workers with chronic low back pain."	
Monteiro-Junior 2015 (score=3.5)	Functional Restoration	RCT	No mention of sponsorship. No COIs.	N=34 older woman with Low Back Pain (CLBP	Mean age 68 ± 4 years. Females only.	Control Exercise Group did strength exercises and core training (n=14) vs. Experimental Wii Group (n=16).	Pre-post intervention.	Non-significant changes in functional capacity stand up in either group. Mean functional sit changed from 2.3±1.5 pre to 3.3±0.9 post intervention in the Wii group, p=0.04.	"[P]hysical exercises with Nintendo Wii Fit Plus additional to strength and core training were effective only for sitting capacity, but effect size was small."	Data suggest similar results between groups for pain and small advantages to Wii groups for sitting capacity.
Patti, 2014 (3.0)	Functional restoration	RCT	No mention of COI or sponsorship.	N = 38 participants with nonspecific low back pain, who had experienced pain for >12 months	Mean age: 41.48 years, gender: not specified	Intervention in Experimental Group (EG) (n =19) vs Intervention in Control Group (CG) (n =19) The EG completed a 14-week program of Pilates exercises, performed thrice per week under the supervision of an exercise specialist, while the CG was managed with a social program only	T0: immediately prior to the study randomization (baseline) and T1, 14 weeks after T0 (conclusion of the Pilates program)	Posturography measures improved for patients in the EG, with both eyes open and eyes closed (P<0.05). There were no statistical differences in posturography in the CG. ODI decreased significantly in both groups over the 14 weeks of the study protocol: EG, T^0, 13.7 ±5.0 compared with T^1, 6.5±4.0 (P<0.001); and CG, T^0, 10.7 ±7.8 compared with T^1, 8.4±7.8 (P<0.01). A greater extent of reduction in pain was achieved in the EG.	"The Pilates exercise program yielded improvements in pain and posturography outcomes. Our study also confirms the applicability of posturography in evaluating postural instability in patients with NSLBP. Due to our relatively small study group, future studies would be necessary to confirm our findings"	Spare details on baseline characteristics of groups. Data suggest Pilates group (EG) had improved posture and pain.

Gatchel, 2009 (score=3.0)	Functional Restoration	RCT	Sponsored by Congressionally Directed Medical Research Program's Peer Review Medical Research Program, and National Institutes of Health. No mention of COI.	N = 66 military participants with a diagnosed musculoskeletal disorder such as CLBP.	Mean age: 35.65 years; 44 males, 22 females.	Standard Treatment (medical care with anesthesia pain clinic, N = 36) vs Functional Restoration (N = 30).	Follow-up at baseline, post-intervention, and at 6 months, and 1 year after treatment.	Mean Pain Visual Analog Scale score at pre-intervention and post-intervention, respectfully: Functional restoration 6.1±2.1, 3.8±2.3, Standard treatment 6.1±1.8, 6.0±2.1 (ANOVA p=0.008).	"These results clearly demonstrate the efficacy and military relevance of a FR program for active duty military personnel who have chronic musculoskeletal pain disorders."	No details included on pain medications. Data suggest FR group better than standard pain treatment group.
Castro-Sánchez 2016 (score=3.0)	Functional Restoration	RCT	Supported by a grant from a university institution (B). No COI.	N=62 with chronic low back pain.	Mean age 45±7 years. 39 females, 33 males.	Spinal manipulative therapy group or the functional technique group once a week for 3 weeks.	Follow-up 1 month post intervention.	Spinal manipulation showed greater reduction in the RMQ (within groups change score 2.4) vs functional technique therapy (within-groups change score 1.4) at both follow-up periods.	"The results of the current randomized trial showed that three sessions of spinal manipulative therapy did not result in any clinically important short-term benefits over functional technique therapy."	Medication use not described. Data suggest similar results for pain relief in both groups with short term improvement in disability in manipulation group.
Tsauo JY, 2009 (score=2.0)	Functional Restoration	RCT	Sponsored by the National Science Council of the Republic of China. No mention of COI.	N = 25 patients with non-specific low back pain.	Mean age: 47.46 years; 13 males, 12 females.	FCT Group (n=13) – Participants performed warm-up exercise (jogging or walking), a strengthening exercise, work/activity simulation training and fitness and endurance	Baseline and 3 months (posttreatment).	The Oswestry Disability Index (ODI) pre and post treatment scores in the training group were 22±9 and 16±9 ($p<0.05$), and in the control group were 13±6 and 13±6, respectively. The change scores for the FCT group were -6.0±8.1 ($p<0.05$) and for the	"In conclusion, the preliminary results showed an individualised training with trunk stabilisation training programme benefits the chronic LBP patients."	Small pilot sample, high dropout rate. Medication use not available in paper. Data suggest FCT group had improvement in 12 outcome measurements versus only one

						training for 2-3 months. Vs. Control Group (n=12) – participants continued their regular treatment.		control group were 0.1±0.3.		in control group.

Brief Symptom Inventory (BSI)

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Diagnoses:	Comparison:	Results:	Conclusion:	Comments:
Bruehl, 1996 (Score = 3.5)										Data suggest there may be psychological functional difference between RSD and LBP patients perhaps due to pain location and/or symptomatic medication.
Roth, 2002 (Score = 3.5)										Data suggest there is a relation between educational achievement and chronic pain as lower LOE was associated with less perceived control over pain and higher LOE individuals were more likely to utilize coping strategies.
Tuzer, 2010 (Score = 3.0)										Data suggest no difference between groups regarding causal attributions.
Bair, 2013 (Score = 3.0)										Data suggest depression and anxiety along with chronic pain is strongly associated with increased disability, more severe pain and decrease in HRQL.

Geisser, 1998 (Score = 2.5)										Data suggest the high profile reported more pain disability and display p, poorer psychological functioning.

Multidimensional Pain Inventory (MPI) or Westhaven Yale Multidimensional Pain Inventory

Author Year (Score):	Category :	Study type:	Conflict of interest	Sample size:	Age/Sex:	Diagnoses:	Comparison:	Results:	Conclusion:	Comments:
Choi, 2013 (Score = 3.5)										Data suggest MPI may successfully distinguish those chronic pain patients regarding additional psychological intervention.
Wilson, 2002 (Score = 3.0)										Data suggest those patients with concomitant chronic pain, depression and insomnia typically report the highest levels of functional improvement but insomnia without depression is associated with increased amounts of pain and distress.

Brief Pain Inventory Short Form

Author Year (Score):	Category :	Study type:	Conflict of interest	Sample size:	Age/Sex:	Diagnoses:	Comparison:	Results:	Conclusion:	Comments:
Walton, 2016 (score=3.5)										Data suggest comparable efficacy of 10 item vs 7 item Brief Pain Inventory (BPI).
Keller, 2004 (score=3.5)										Data suggest Brief Pain Inventory (BPI) may be used for pain in noncancer patients, particularly for arthritic pain and LBP.
Ares, 2015 (score=3.0)										Data suggest Brief Pain Inventory Short Form (BPI-SF) is reliable and valid to measure pain and

										recall period did not significantly affect scores.
Naegeli, 2015 (score=3.0)										Data suggest Brief Pain Inventory Short Form (BPI-SF) may be used to assess pain in systemic lupus erythematosus (SLE) patients.
Raichle, 2006 (score=3.0)										Self-report data only. Almost 50% of original participants failed to respond.

Tests of Malingering Memory

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Diagnoses:	Comparison:	Results:	Conclusion:	Comments:
Greve, 2006 (score=3.0)										Data suggest TOMM may be excluded if another validated forced choice SVT is administrated.

Wechsler Memory Scale III

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Diagnoses:	Comparison:	Results:	Conclusion:	Comments:
Robinson, 2007 (score=3.5)										Data suggest memory and concentration problems more likely an indication of heightened somatic vigilance not poor effort non neuropsychological deficits.

Minnesota Multiphasic Personality Inventory 2 (MMPI-2)

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Diagnoses:	Comparison:	Results:	Conclusion:	Comments:
Duckro, 1985 (score=3.5)										Small sample. Data suggest SLC-90-R subscales for depression and anxiety correlated with several pain measures.

Cognitive Therapy

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Vowles, 2011 (score = 3.5)										Data suggest at 3 years post treatment 64.8% of chronic pain patients participating in ACT had functional improvements from baseline.
Carmody, 2013 (score = 3.5)										High dropout rate, sparse methods Data suggest minimal improvements in mental and physical health and some decreased pain & depression as physical health improved catastrophizing decreased.
Shpaner, 2014 (score = 3.5)										Statistically significant differences in pain medication use between groups (CBT 8.8 years vs EDU 5.2 years). Data suggest CBT is associated with changes in resting state functional connectivity.
Berry, 2015 (score = 3.5)										High dropout rate. Waitlist control bias. No significant differences between group outcomes.
Thorn, 2011 (score = 3.5)										Relatively high dropout rate with CBT group requiring additional study participant recruitment. Missing baseline group comparison details both groups proved in pain outcomes.
Ang, 2011 (score = 3.5)										Secondary analyses of Ang 2010 small sample , all females data suggest clinical pain correlated with nociceptive responsiveness
Verwoerd 2015 (Score=3.5)										Subgroup (post hoc analysis) of another RCT. Standard care bias. Small sample. Data suggests patients with sciatica and significant kinesiophobia may benefit from PT.
Lazaridou, 2016 (score = 3)										Data suggest CBT may decrease catastrophizing and thus reduce pain.
Fales, 2016										Participant baseline characteristics missing standard care bias data suggest

(score = 3.0)										each of efficacy for online CBT for pain management did not result in improved sleep.
Mundt, 2016 (score = 3.0)										Timing was dissimilar between groups. Methods are sparse. Data suggest actigraphy was generally more correlated with PSG than diaries although actigraphy was most sensitive to treatment related changes compared to PSG.
Miró, 2011 (score = 3.0)										Data suggest executive function improvement is related to changes in sleep.
Edinger, 2005 (score = 3.0)										Usual care bias. High dropout rate. Data suggest CBT group reduced nocturnal wake time by 50% and the other two groups experienced only a 20% reduction in nocturnal wake time.
Thieme, 2003 (score = 2.5)										Data suggest improvement in operant pain treatment (OTG) group for pain intensity and decreased pain medications, physician appointments and hospital days.
Koulil, 2011 (score = 2.5)										Waitlist control bias, sparse methods. Data suggest both pain avoidance and pain persistence treatments improved CB factors.
Vlaeyen, 1996 (score = 2.5)										Waitlist control bias. Data suggest each of efficacy of a highly structured CBT plus group education to enhance pain coping skills.
Williams, 2002 (Score = 2.5)										Standard care control bias, sparse methods Data suggest short term benefits from CBT
Martínez-Valero, 2008 (Score = 2)										Pilot study, small individual group sizes both CBT and CB groups had more contact time with the therapy vs control.

Castel, 2007 (Score = 2.0)										Data suggest hypnosis then analgesia better then hypnosis then relaxation for pain.
Linden, 2014 (Score = 2.0)										Sparse methods, results and data not clearly data suggest CBT may benefit chronic pain patients by increased coping skills.
Garcia, 2006 (Score = 2)										Small samples per group sparse methods. Data suggest immediate post intervention benefits as well as at 3 months with CBT. Also combination CBT treatment was no more effective than CBT alone.
Other Psychological Therapies										
Domenech , 2011 (Score = 3.0)									Data suggest attitudes and beliefs regarding LBP may change where education and training involves both biomedical and biopsychosocial construct.	
Campbell, 2012 (Score = 3.0)									Data suggest changes in catastrophizing may preside and trigger-pain response changes.	
Coppieters , 2016 (score = 2.5)									Crossover design, randomization failure. Population of different types of chronic pain patients.	

Fear Avoidance Belief Training (FABT)

Author Year (Score) :	Category :	Study type:	Conflict of interest	Sample size:	Age/ Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Wood, 2008 (Score= 3.0)										Waitlist control bias. High dropout rate. Data suggest a trend in pain disability in the treatment group.
Flink 2016	Fear Avoidance Belief Training									Waitlist control bias. High dropout rate. Data suggest significant castastrophization correlated to a poor treatment response.

(Score= 2.5)										

Biofeedback

Author Year (Score):	Category:	Study type:	Conflict of interest	Sample size:	Age/Sex:	Comparison:	Follow-up:	Results:	Conclusion:	Comments:
Weeks, 2015 (Score = 3.5)										Pilot study, therefore small sample high dropouts.
Buckelew, 1998 (score = 3.5)										Data suggest comparable efficacy between all three groups as all improved self efficacy but combination group maintained benefits for 2 years.
Sarnoch, 1997 (score = 3.0)										Small sample. Non-randomized. Data suggest intensity of pain appears to be associated with lowered baseline EMG activity.
Jensen 2013 (3.0)	Biofeedback	RCT	Sponsored by a research grant from the Craig H. Neilsen foundation. No mention of COI.	N=13 individuals with spinal cord injury induced chronic pain.	Mean age 46.1±12.6; 7 males.	All patients received 12 session of neurofeedback training for three different protocols.	Baseline, post treatment, 3 month follow up.	Worst pain intensity pre vs post treatment (mean±SD): 7.54±1.88 vs 6.75±1.72 (p=0.013). Pain unpleasantness pre vs post treatment (mean±SD): 6.76±2.15 vs 5.80±1.86 (p=0.026). No significant changes between the three	"[T]he findings suggest that some individuals with refractory chronic pain associated with spinal cord injury may benefit from NF training. Although the benefits found following 12 sessions of training were small, the majority of the participants were highly satisfied	Small sample. Data suggest NF may be efficacious for SCI-related pain.

								different protocols in pain reduction.	with the intervention.	
Hassett 2007 (2.0)	Biofeedback	Case series	No mention of sponsorship or COI.	N=12 women affected by Fibromyalgia.	Mean age 38.5±12.5; 12 females.	All patients received 10 trials of Heart rate variability biofeedback.	Baseline, session 10, and 3 months.	Fibromyalgia Impact Questionnaire / Beck Depression Index II / McGill Pain Questionnaire / score baseline vs 3 month (mean±SD): 55.5±18.4 vs 41.9±19.5 (p=0.0022) / 21.7±12.3 vs 15.5±12.1 (p=0.0055) / 25.1±8.9 vs 21.1±16.2 (p=0.0060).	"These data suggest that HRV biofeedback may be helpful as a treatment for FM. The major findings of this study indicate that a ten session trial of HRV biofeedback significantly improved overall functioning and depression in patients with FM."	Non-RCT using a small convenience sample with no comparison group. A trend towards pain improvement
Neblett 2010 (2.0)	Biodfeedback	RCT	No mention of sponsorship or COI.	N=140 patients with chronic lumbar pain. N=30 control patients.	Group 1: Mean age 44.3±10.0; 60 males. Group 2: Mean age 42.7±10.1; 26 males. Group 3: Mean age 37.6±9.3; 16 males.	Group 1: received surface electromyography (SEMG) biofeedback to assist in stretching and relieve fear of pain as well as muscle relaxation until flexion relaxation was achieved. (n=104) vs. Group 2:	Baseline and post treatment.	Group 1 vs group 2, post treatment number participants whom achieved relaxation flexion (n %): 61 (86%) vs 6 (26%). Group 1 vs group 2, post treatment mean SEMG/ Gross lumbar flexion/ pelvic flexion (Mean±SD): 3.3±4.1 vs 11.8±10.7 (p=0.000) /109.7±13.0 vs	"Although standard functional restoration treatment of CLBP subjects is effective for increasing lumbar flexion ROM and for improving MVF SEMG levels, the addition of a SEMGAS biofeedback training protocol can result in normalization of	High dropout rate especially in SEMG group with baseline comparability differences between groups.

						received functional restoration training which included intensive interdisciplinary programming to restore function 2-5 days per week over 2 or more months (160-240 hours), (n=36) Group 3: asymptomatic colleagues w/ no history of back pain.		94.4±19.7 (p=0.000) / 58.0±15.2 vs 46.1±46.1 (p=0.002). Group 1 vs Group 3, post treatment Max voluntary flexion (MVF), range of motion (ROM), SEMG: no significant difference. Group 2 was significantly worse in mean SEMG, ROM, and MVF vs group 3 post treatment.	the flexion-relaxation phenomenon, so that these subjects are comparable to a pain free control group."	
Tan, 2014 (score = 2.0)										High dropout rate. Data suggest self-hypnosis with audio recording may be as effective as professionally administered hypnosis.

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