

Active Rehabilitation of Work-Related Low Back Conditions

Purpose

This document provides the following: concise summaries of published literature regarding effectiveness of commonly used approaches for rehabilitation of low back pain conditions; key management recommendations for active rehabilitation of occupational low back pain based on the committee's review and synthesis of evidence and practical application approaches; practical clinical resources including outcomes and progress tracking surveys and forms (useable without licensing/charge in practice for non commercial use).

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Development

This document was developed by the Industrial Insurance Chiropractic Advisory Committee (IICAC) of the Washington State Department of Labor and Industries. It offers a summary of current evidence for practitioners. It is not a practice guideline, standard of care, claim management standard, or a substitute for clinical judgment in an individual case. This practice resource does not change L&I coverage or payment.

A comprehensive search of available scientific literature on active rehabilitation procedures for low back conditions was conducted by the Policy, Practice, and Quality (PPQ) Subcommittee of the IICAC and department staff during Fall 2010. Literature was reviewed, assessed for relevance and quality and summaries were drafted by consensus of the subcommittee with expert content input from consultants in March 2011. It was posted for public comment and revision, and approved for distribution by the IICAC in April 2011. This resource is expected to be updated periodically by the IICAC. Interested parties may submit new published scientific report for consideration for future revisions.

This and other practice resources are available for download at the State of Washington Department of Labor & Industries website. Contact information for public input and submission of studies for future revisions is available there.

<http://www.lni.wa.gov/ClaimsIns/Providers/Treatment/IICAC/>

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PRACTICAL APPLICATION POINTS

- Acute and sub-acute conditions appear to respond better to light activity which may include light duty.
- Chronic pain (>3 months) appears to do better with more intense activities or programs.
- Any oversight, such as activity diary or in-office performance of exercises, is more effective than advice or consultation alone.
- Any activity, even walking, is better than doing nothing.
- No particular exercise regime has been shown to be any more effective than another.

Work-Related Low Back Conditions

Low back pain accounts for the majority of occupational injury claims. This resource focuses on active rehabilitation options for low back pain of “mechanical” origin (e.g., soft tissue strains and sprains, non-specific low back pain, and back pain accompanied by leg pain). It does not address diagnostic or pathophysiological/pain generator models. Proper clinical assessment to rule out “red flags” for serious non-mechanical causes of back pain, such as fracture and neoplasm should be completed prior to considering active rehabilitation. It is assumed that work-relatedness of the low back condition has been established. *Note: This resource does not summarize evidence on other management therapies (e.g. passive modalities, mobilization, ergonomic interventions) beyond reporting results when they were included in intervention/comparison groups in active rehabilitation trials.*

Case Definitions

- Work-related low back conditions typically are causally linked to a specific triggering mechanical event, task, or activity at work. This resource focuses exclusively on active rehabilitation options and assumes the back condition has been accepted as occupationally related.

Typical Active Rehabilitation Interventions and Response Thresholds

1-2 wks	3-6 wks	7-8 wks	Beyond 8 wks
<ul style="list-style-type: none"> • <i>Emphasize that increasing activity a little each day speeds recovery .</i> • <i>Identify & address concerns about performing work activities.</i> • <i>Assess baseline functional status with standardized questionnaire.</i> • <i>Prescribe specific activities using a goal-oriented weekly activity diary.</i> • <i>Consider prescribing a specific exercise program, even walking.</i> 	<ul style="list-style-type: none"> • <i>Improvement is best assessed by increasing functional gains, ideally including ability to return to work.</i> • <i>Most low back conditions should achieve good functional and symptomatic response within this time frame.</i> • <i>Inadequate improvement is reflected primarily in inadequate return to normal activities and work. If not achieved, consider more intensive supervised exercise. Screen for underlying psychosocial concerns (e.g., fear avoidance, anxiety, depression)</i> 	<ul style="list-style-type: none"> • <i>Good Improvement: Back to light-regular work. Progressing & mastering in-clinic & mastering home exercises. Effectively implementing prescribed task/ergonomic changes.</i> • <i>Inadequate improvement: Inability to return to light/regular work. Consider specialist referral for clinical or occupational concerns</i> 	<ul style="list-style-type: none"> • <i>Good Improvement: Return to normal activities & function. Progressing back to full or near full duty work activities.</i> • <i>Inadequate improvement: Inability to return to modified or regular work. Consider consultation with occupational health specialist.</i>

Evaluation Summary

- Rule out non-mechanical causes of low back pain prior to considering active rehabilitation. Red flags include history of cancer, unexplained weight loss, immunosuppression, prolonged use of steroids, intravenous drug use, urinary tract infection, pain that is increased or unrelieved by rest, fever, significant trauma, bladder or bowel incontinence, and urinary retention (with overflow incontinence). Examination red flags include saddle anesthesia, loss of anal sphincter tone, substantial and/or progressive motor weakness in lower extremities, fever, unremitting vertebral tenderness, and neurologic findings persisting beyond one month.

Intervention Summary

- Most acute and sub-acute back conditions resolve successfully within days to weeks. Less intensive rehabilitation interventions (eg, in-office, short duration PT) are preferred initially for individuals at low risk of developing chronicity (e.g., availability of modified work, good recovery expectations, willingness to increase activity levels and return to normal activities including work, good response to conservative interventions). Studies indicate that intensive programs requiring prolonged patient attendance (eg, work hardening) may hinder recovery during this period.
- Chronic back pain (typically characterized as > 3 months duration) appears to be most responsive to various combinations of motivation, exercise, and pain control. A large variety of aerobic and conditioning approaches have been shown to be helpful as has cognitive self management.

Improvement Progress

- Achieving and monitoring functional progress is central to active rehabilitation. The best overall long term outcomes are associated with even small, but consistent, incremental increases in functional ability (e.g., mobility, return to usual activities including work)

PROGRESS CHECKLIST

(Voluntary educational / practice aid. This is not an L&I documentation requirement.)

Baseline

1-2 wks

3-6 wks

7-8 wks

Beyond 8 wks

ASSESSMENT / PROGRESS	<p>Date: _____</p> <p>Leg Pain <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Baseline Function Score: _____</p> <p>Pain Interference 0 1 2 3 4 5 6 7 8 9 10 <i>None</i> <i>Unable to do any activities</i></p> <p>Self-control of pain 0 1 2 3 4 5 6 7 8 9 10 <i>Complete control of pain</i> <i>No control of pain</i></p> <p>Work Status <input type="checkbox"/> Full Duty <input type="checkbox"/> Modified <input type="checkbox"/> None</p>	<p>Date: _____</p> <p>Leg Pain <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Function Score: _____</p> <p>Pain Interference 0 1 2 3 4 5 6 7 8 9 10 <i>None</i> <i>Unable to do any activities</i></p> <p>Self-control of pain 0 1 2 3 4 5 6 7 8 9 10 <i>Complete control of pain</i> <i>No control of pain</i></p> <p>Work Status <input type="checkbox"/> Full Duty <input type="checkbox"/> Modified <input type="checkbox"/> None</p>	<p>Date: _____</p> <p>Leg Pain <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Function Score: _____</p> <p>Pain Interference 0 1 2 3 4 5 6 7 8 9 10 <i>None</i> <i>Unable to do any activities</i></p> <p>Self-control of pain 0 1 2 3 4 5 6 7 8 9 10 <i>Complete control of pain</i> <i>No control of pain</i></p> <p>Work Status <input type="checkbox"/> Full Duty <input type="checkbox"/> Modified <input type="checkbox"/> None</p>	<p>Date: _____</p> <p>Leg Pain <input type="checkbox"/> Yes <input type="checkbox"/> No</p> <p>Function Score: _____</p> <p>Pain Interference 0 1 2 3 4 5 6 7 8 9 10 <i>None</i> <i>Unable to do any activities</i></p> <p>Self-control of pain 0 1 2 3 4 5 6 7 8 9 10 <i>Complete control of pain</i> <i>No control of pain</i></p> <p>Work Status <input type="checkbox"/> Full Duty <input type="checkbox"/> Modified <input type="checkbox"/> None</p>
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INTERVENTION OPTIONS	<p>Function score: from standard survey (eg Roland, Oswestery) Pain Interference: ask, 'In past week, how much has pain interfered with your daily activities?' Self-control of pain: ask, 'In past week, how much have you been able to control/help/reduce your back pain on your own?'</p> <p>Discuss Recovery</p> <ul style="list-style-type: none"> • Most recover in days to weeks • Address concerns with work activity <p>Address Activity</p> <ul style="list-style-type: none"> • Avoid prolonged rest, sitting • Activity Diary – prescribe specific goals, exercises 	<p>Assess Functional Recovery</p> <ul style="list-style-type: none"> • Assess compliance with activity diary goals weekly. Make modifications as needed • Recheck function score, pain interference, and ability to control back pain. These scores are sensitive to overall change/improvement. <p>Incrementally Increase Activity</p> <ul style="list-style-type: none"> • Goal to maintain normal activities & routines (including work) • Revise goals on Activity Diary – increase intensity, frequency, duration as appropriate • If referral is made for PT/OT, communicate regularly with therapist to assure care minimizes passive approaches and emphasizes active ones 	<p>Assess Functional Recovery</p> <ul style="list-style-type: none"> • Functional score/pain interference • Should approach pre-episode capacities • Poor/worsening self control scores may reflect underlying psychosocial concern to screen for (anxiety, depression, fear avoidance) <p>Continue to Increase Activity</p> <ul style="list-style-type: none"> • If progress is less than optimal consider more intensive active rehabilitation including supervised exercise • Assess potential cognitive barriers (eg catastrophising, significant fear avoidance, low recovery expectation, depression) and consider appropriate intervention options such as structured multidisciplinary programs that emphasize activation <p>Patient Name: _____</p>
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When your back hurts, you may find it difficult to do some things you normally do. This list contains sentences that people have used to describe themselves when they have back pain. When you read them, you may find that some stand out because they describe you today.

As you read the list, think of yourself today. When you read a sentence that describes you today, put a check in the box next to it. If the sentence does not describe you, then leave the space blank and go on to the next one. Remember, only check the sentence if you are sure it describes you today.

- I stay at home most of the time because of my back.
- I change position frequently to try and get my back comfortable.
- I walk more slowly than usual because of my back.
- Because of my back I am not doing any of the jobs that I usually do around the house.
- Because of my back, I use a handrail to get upstairs.
- Because of my back, I lie down to rest more often.
- Because of my back, I have to hold on to something to get out of an easy chair.
- Because of my back, I try to get other people to do things for me.
- I get dressed more slowly than usual because of my back.
- I only stand for short periods of time because of my back.
- Because of my back, I try not to bend or kneel down.
- I find it difficult to get out of a chair because of my back.

Patient Name _____

Claim # _____ Date: _____

- My back is painful almost all the time.
- I find it difficult to turn over in bed because of my back.
- My appetite is not very good because of my back pain.
- I have trouble putting on my socks (or stockings) because of the pain in my back.
- I only walk short distances because of my back.
- I sleep less well because of my back.
- Because of my back pain, I get dressed with help from someone else.
- I sit down for most of the day because of my back.
- I avoid heavy jobs around the house because of my back.
- Because of my back pain, I am more irritable and bad tempered with people than usual.
- Because of my back, I go upstairs more slowly than usual.
- I stay in bed most of the time because of my back.

SCORE: _____

Please mark only one box in each section that most closely describes your current condition.

Pain Intensity

- I can tolerate the pain I have without having to use pain medication.
- The pain is bad, but I can manage without having to take pain medication.
- Pain medication provides me with complete relief from pain.
- Pain medication provides me with moderate relief from pain.
- Pain medication provides me with little relief from pain.
- Pain medication has no effect on my pain.

Personal Care (e.g., Washing, Dressing)

- I can take care of myself normally without causing increased pain.
- I can take care of myself normally, but it increases my pain.
- It is painful to take care of myself, and I am slow and careful.
- I need help, but I am able to manage most of my personal care.
- I need help every day in most aspects of my care.
- I do not get dressed, I wash with difficulty, and I stay in bed.

Lifting

- I can lift heavy weights without increased pain.
- I can lift heavy weights, but it causes increased pain.
- Pain prevents me from lifting heavy weights off the floor, but I can manage if the weights are conveniently positioned (e.g., on a table).
- Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.
- I can lift only very light weights.
- I cannot lift or carry anything at all.

Walking

- Pain does not prevent me from walking any distance.
- Pain prevents me from walking more than 1 mile. (1 mile = 1.6 km).
- Pain prevents me from walking more than 1/2 mile.
- Pain prevents me from walking more than 1/4 mile.
- I can walk only with crutches or a cane.
- I am in bed most of the time and have to crawl to the toilet.

Sitting

- I can sit in any chair as long as I like.
- I can only sit in my favorite chair as long as I like.
- Pain prevents me from sitting for more than 1 hour.
- Pain prevents me from sitting for more than 1/2 hour.
- Pain prevents me from sitting for more than 10 minutes.
- Pain prevents me from sitting at all

Score: _____pts / 50 x 100% = _____

Patient Name _____

Claim # _____ Date: _____

Standing

- I can stand as long as I want without increased pain.
- I can stand as long as I want, but it increases my pain.
- Pain prevents me from standing for more than 1 hour.
- Pain prevents me from standing for more than 1/2 hour.
- Pain prevents me from standing for more than 10 minutes.
- Pain prevents me from standing at all.

Sleeping

- Pain does not prevent me from sleeping well.
- I can sleep well only by using pain medication.
- Even when I take medication, I sleep less than 6 hours.
- Even when I take medication, I sleep less than 4 hours.
- Even when I take medication, I sleep less than 2 hours.
- Pain prevents me from sleeping at all.

Social Life

- My social life is normal and does not increase my pain.
- My social life is normal, but it increases my level of pain.
- Pain prevents me from participating in energetic activities (e.g., sports, dancing).
- Pain prevents me from going out very often.
- Pain has restricted my social life to my home.
- I have hardly any social life because of my pain.

Traveling

- I can travel anywhere without increased pain.
- I can travel anywhere, but it increases my pain.
- My pain restricts my travel over 2 hours.
- My pain restricts my travel over 1 hour.
- My pain restricts my travel to short necessary journeys under 1/2 hour.
- My pain prevents all travel except for visits to the physician / therapist or hospital.

Employment / Homemaking

- My normal homemaking / job activities do not cause pain.
- My normal homemaking / job activities increase my pain, but I can still perform all that is required of me.
- I can perform most of my homemaking / job duties, but pain prevents me from performing more physically stressful activities (e.g., lifting, vacuuming).
- Pain prevents me from doing anything but light duties.
- Pain prevents me from doing even light duties.
- Pain prevents me from performing any job or homemaking chores.

HISTORY – Prognostic Indicators

<p>Prognostic Factors for Recovery</p>	<ul style="list-style-type: none"> • In a cross-sectional study of 221 patients with non-specific CLBP: <ul style="list-style-type: none"> ○ Cardiovascular capacity, pain intensity, and personal factors (e.g., fear of injury, catastrophizing, depression) had only limited impact on ability to perform various capacity tasks ○ Leg pain, age and duration of complaints had no impact on ability to perform tasks. ○ Men outperformed women on most tasks. (Smeets 2006a ch 9) • In a test-retest study of 53 patients with non-specific CLBP: <ul style="list-style-type: none"> ○ Performance on six tasks was compared over repetitions of task performance. ○ Prior task experience did not affect test-retest validity (which was good). ○ 5 minute walking and one minute stair climbing are clinically useful. Progressive lifting is not clinically useful. ○ Increases in pain prior to task performance were not associated with reduced task performance. (Smeets 2006b) • Physical capacity tasks in CLBP (cross-sectional), cardiovascular capacity, pain intensity, fear of injury/movement, cognitions, and depression had statistically significant, but clinically minor, effects on several, but not all, capacity tasks. Radiating pain, age and duration of complaints had no significant influence. Due to anthropometric differences, men outperformed women on most tasks. The influence of many personal, physical and especially psychological factors on the selected capacity tasks is minimal. (Smeets 2007)
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OVERSIGHT APPROACHES – For Active Rehabilitation

<p>Type of Instruction (e.g. home exercise, supervised instruction, hardening/intensive programs)</p>	<ul style="list-style-type: none"> • Among low back pain patients: <ul style="list-style-type: none"> ○ Any oversight, regardless of the approach, is more effective than advice or consultation alone. ○ Home exercise seems to be the most commonly implemented approach. It is also highly effective as long as compliance is not an issue. ○ Supervised oversight and hardening programs are not as commonly described in the reviewed literature. Among other patient populations, however, these approaches have been found to be effective. ○ Group exercise for work hardening programs proves to be low cost compared to individual care. Additionally, group exercise can increase a patient's self-confidence.
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EXERCISE STRATEGIES - Stretching

<p>Passive Stretch/ Movement</p>	<ul style="list-style-type: none"> • In patients with subacute LBP with or without leg pain, routine physiotherapy (60 min exam to determine type of treatment- any combo of joint mobilization and manipulation; soft tissue techniques including stretching, spinal mobility and strengthening exercises; heat or cold treatments; and advice for duration of 30 min/session for 5 sessions) seemed to be no more effective than one session of assessment and advice from a physiotherapist (1 session, up to 60 min; exam and advice to remain active as specified in the advice booklet) after one year. (Frost 2004)
<p>Active Movement</p>	<ul style="list-style-type: none"> • Active treatment generally is associated with lower disability from CLBP. (Smeets 2009a) • Based on a systematic review of randomized controlled trials, intensive reconditioning appears to be no better than general active treatment. (Smeets 2006a ch 2)

<p>Directional Preference (centralization of leg symptoms)</p>	<ul style="list-style-type: none"> • Several case studies have documented reliability of directional assessment and correlation/prediction of directional findings with positive outcomes to directional therapy. <ul style="list-style-type: none"> ○ Directional preference therapy (combined) reduced pain and improved function more effectively than opposite directional preference therapy and general exercise. (Long 2004) ○ For mixed back pain patients, both manual therapy (3–5 home-exercises to actively mobilize the low back, 2–3 sets of 15–20 reps for each, and lumbar stabilization exercises with 10 repetitions of 10 sec, and stretching exercises once a day for 45–60 sec) and directional preference therapy (education, active therapy with exercise instruction, 10-15 reps every 1-2 hrs with or without sustained end-range position) appeared marginally more effective, in improving VAS and ROM at 6 and 12 months, than advice only. (Paatelma 2008) ○ For patients with non-specific low back pain, one month of high velocity manipulation only and directional preference therapy had similar costs and treatment times. Outcomes such as satisfaction, disability, recurrences and subsequent visits for back pain did not differ significantly between groups. Both treatment groups had marginally better outcomes than those receiving an educational booklet. (Cherkin 1998)
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EXERCISE STRATEGIES – Conditioning & Strengthening

<p>General Aerobic</p>	<ul style="list-style-type: none"> • CLBP patients have aerobic deconditioning (stronger trend in males). (Smeets 2006a ch 3) • In patients with CLBP-associated disability, most had a lower level of aerobic fitness, but this was not associated with fear avoidance. (Smeets 2009b) • Physiotherapy (30 min, 2x/wk for 3 mo; individual treatment with PT focusing on strengthening coordination and aerobic exercise), muscle reconditioning (60 min, 2x/wk for 3 mo; small class used exercise equipment, aerobic warm-up and stretching cool down), and aerobics (low impact aerobic class for 60 min, 2x/wk for 3 mo) significantly improved pain intensity for patients with CLBP (with or without leg pain) after 3 months. Self-reported disability decreased among muscle reconditioning and aerobics groups. (Mannion 2001) • In patients with non-specific LBP, an exercise program at work, consisting of 6 training exercises that included aerobic and coordination exercises (20 min/mo, 13 mos) and instruction (30 min/session, 5 sessions), helped to decrease absenteeism at work, lower pain intensity, and increase back muscle strength on by 20%, on average. (Gundewall 1993)
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<p>General Physical Conditioning</p>	<ul style="list-style-type: none"> • Active physical exercise (30 min bicycle, 5 minute stretch, 15 min trunk leg strengthening to fatigue), instruction on graded activity, or combinations of both all reduce pain and improve function (questionnaire & observation) better than no treatment. No differences observed between groups (individually or in combination). This trend sustained in 1 yr follow-up. (Smeets 2006a ch 4 & 5) • Review of RCTs of exercise for CLBP (SR): In general, when all types of exercise are analyzed, small, but significant reductions in pain and disability are observed compared with minimal care or no treatment. Despite many possible sources of heterogeneity in exercise trials, only dosage was found to be significantly associated with effect sizes. (Ferreira 2010) • In non-specific CLBP patients, 10 weeks of APT (aerobic training, extensor strengthening) versus graded activity coaching with problem solving versus combined, there was no difference in Roland scores at 1 year, although self-perceived improvement was better in either individual treatment compared to combine treatment. (Smeets 2008a) • General ROM muscle group exercise showed no advantages over other passive interventions (e.g. motor driven traction, Maitland manipulation, fabric corset) for sciatic patients seeking hospital-based PT care in the UK. All groups showed small improvement with manipulation and combination treatments being most significant. All treatment was at therapist discretion and combination groups had shorter durations of care. (Coxhead 1981) • In mixed chronic back and leg pain patients, endurance and lumbar muscle strength increased similarly with individual PT-supervised exercise (30 min session of strengthening, aerobic, coordination 2x/wk, 3 mo), small group exercise equipment (1 hr 2-3/wk for 3 mo with aerobic warm up) or low impact aerobic class (1 hr 2x/wk for 3 mo). (Mannion 2001) • Examination, information, and recommendations to remain active (advice to stay active, take daily walks, and stretch at home) can have a significant effect in reducing sick leave for patients with subacute LBP compared to no recommendations to remain active at one year.
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(Hagen 2000) The number of reported sick days for the intervention group was not significantly different than the number reported for the control group at years 2 and 3. **(Hagen 2003)**

- In patients with CLBP, function-centered treatment (work simulation, strength and endurance training through isokinetic exercise, cardiovascular training performed by walking and water aerobics, sports therapy, and self-exercise; 4 hr/day, 6days/wk, 3wks) increased work days (10 days), decreased work-related disability, and significantly decreased pain intensity compared to pain-centered treatment (individually selected passive and active mobilization, stretching, strength training, and a mini back school; 2.5 hrs/day, 6 days/wk for 3 wks) at 3 month and 1 year. **(Kool 2005, 2007)**
- At 1 year, both group exercise (10 pts/class, 8 1-hr sessions for 2 months) and individual exercise (8 30-minute sessions for 2 months) were effective in the management of CLBP disability. Group exercise significantly increases patients' confidence and is 40% less costly than individual care. **(Lewis 2005)**
- 234 chronic disabling LBP patients randomized to 1) mailed educational packet with 6 weekly 1-hour sessions of general exercise and cognitive behavioral therapy (encouragement, coaching on importance of activity) and 2) mailed self-management educational packet. The PT administered group had a small additional benefit in improved pain (VAS) and function (RMDQ) at 6 month follow up. **(Johnson 2007)**
- Small RCT randomized to 16 sessions of manual PT administered low and high velocity manipulation with individual home exercise versus 16 session PT administered supervised 45 minute exercise sessions (10 min warm-up bike, 35 min individualized strengthening, stretching, mobilizing, coordination, and stabilizing exercises for the abdominal, back, pelvic, and lower limb muscles, suited to the clinical findings) and the same individualized home exercise program. Both groups improved, but the manual therapy approach resulted in significantly greater improvements than exercise therapy of spinal range of motion (Schobers), pain (VAS), function (Oswestry), general health (COOP) and sick leave (self-report) which was sustained at 1 year. **(Aure 2003)**
- 235 subjects with CLBP were randomized to either 4 weeks of DC-administered flexion-distraction manipulation or 4 weeks of a PT administered exercise program (general strengthening, flexibility, aerobic). At 1 year, both groups demonstrated meaningful decreases in pain (VAS) and disability (RMDQ), with the FD group demonstrating significantly greater pain reduction. **(Cambron 2007)**
- A well-designed prospective 4 arm trial randomized 1334 patients to 12 weeks of either usual medical care, manipulation, exercise, or exercise/manipulation combination. The study concluded that manipulation followed by exercise and manipulation alone both provided a moderate benefit at three months and small benefit at 12 months but exercise alone provided only a small benefit at 3 months and no benefit at 12 months. Although, essentially a clinical trial in design, the effort was a pragmatic policy exercise designed to make coverage recommendations. The study concluded that manipulation alone offered the best cost per quality adjusted life year over a one year period. **(UK BEAM 2004a, UK BEAM 2004b)**
- A Cochrane review of the literature assessing the effectiveness of exercise therapy for non-specific LBP for pain intensity, functional status, overall improvement, and return to work. 61 randomized, controlled trials of all types of exercise therapy for individuals with acute (<6 wks), subacute (6-12 wks) and chronic (> 12 wks) non-specific LBP. Studies of specific low back conditions (e.g. radiculopathy) were excluded. **(Hayden 2005)**
 - In ALBP, exercise does not appear to be more effective than other conservative treatments. Meta-analysis showed no advantage over no treatment for pain and functional outcomes over short or long-term follow-up specific follow-up ranges were not reported.
 - Graded-activity exercise programs (gradually increasing intensity) appear to improve outcomes for subacute occupational low back conditions. The effectiveness for other types of exercise therapy in other populations is not clear from existing studies.
 - Evidence strongly suggests that exercise is at least as effective as other conservative treatments for CLBP. Individually designed strengthening or stabilizing programs seem to be effective in health care settings with meta-analysis indicating small but statistically significant improvements in pain and function measures both short and long term.
- For patients with CLBP lasting for more than 6 weeks, manipulative therapy (3 mo) and physiotherapy (3 mo) are better than general practitioner (3 mo) and placebo treatment (exam followed by detuned shortwave diathermy (10 min) and detuned ultrasound (10 min), 2x/wk for 6 wks) at 3 mo. Furthermore, manipulative therapy is slightly better than physiotherapy after 12 months. Number of treatments was much lower for manipulative therapy than physiotherapy. **(Koes 1992)**
- High velocity low amplitude manipulation (daily, 6 days/wk, 2 wks) is more effective in pain and function improvement for subacute (defined as >7wks) LBP patients compared to a sham treatment or a back education program. **(Triano 1995)**
- A Cochrane review of the literature comparing the effectiveness of physical conditioning programs (e.g. work conditioning, work

	<p>hardening, or function restoration/exercise programs) in reducing time lost from work for workers with back pain. Twenty-three RCTs that studied workers with work disability related to back pain were referenced (Schaafsma 2010). Findings included:</p> <ul style="list-style-type: none"> ○ Positive effect of interventions with workplace involvement. ○ Light physical exercise had no significant effect on chronic or subacute pain in workers. ○ Physical conditioning programs probably have a small effect on return to work with chronic back pain workers. ○ Conflicting results for intense physical conditioning to other exercise therapy in the first 2 years of sick leave. ○ No difference in effect was found between a light or an intense physical conditioning program. ○ Time-loss (sick leave) appeared to be decreased in workers with chronic back pain with the implementation of physical conditioning programs.
<p>Specific Strengthening Trunk Flexion / Extension</p>	<ul style="list-style-type: none"> • Back support and extended duration rehab back school emphasizing trunk flexor & extensor strengthening had better Oswestry, 15D scores, and trunk strength at 6 mo & 12 mo than shorter general rehab programs alone. However, significance of Oswestry disappeared with ANOVA test. Physiological measures (ROM or O2 capacity) were not different at 6 mo & 12 mo (Penttinen 2002) • After two months, an intervention for acute and subacute lbp that included one session of individualized physical treatment or injection and a simple back program (McKenzie technique carried out for an average of 10 reps, 3-4x/day and group exercise for 1 hr, 3 x/ wk in a gym for 1-2 weeks) combined with a package of information and advice resulted in a quicker return to work than intervention that provided information, advice, and the normal route of care. (Wright 2005) • In patients with ALBP, with leg pain, manipulation (lumbar oscillatory rotation , 3x/wk) was found superior to conventional therapy (heat (short wave diathermy) 20 min, followed by gentle isometric exercise (classic pelvic tilt type of the back and abdominal involving ten contractions with each contraction held for 5 seconds with 10 seconds relaxation between contractions, 3x/wk) in treatment of symptoms. Both groups showed significant differences pre vs. post treatment in flexion and extension. Manipulative group significantly differed in treatment time (160 min vs. 121 min.) Manipulative group had significantly fewer patients returning for treatment after 3 months (11.5 % vs. 28%). (Nwuga 1982) • Manipulation with stabilizing exercises (4x/wk for 4 wks, patients also received a 25-page educational booklet on basic anatomy and physiology of the spine, principles of ergonomics for LBP patients, and instructions on how to exercise and cope with the acute phase of LBP) was more effective in reducing pain intensity and disability than the physician consultation (patients received same 25 page educational booklet, the patients received individual instruction regarding their posture and 3 to 4 exercises aiming to increase their spinal mobility, muscle stretch, and/or trunk muscle stability, also advised to avoid long standing static work by performing several counter movements) alone, for patients with CLBP (with and without leg pain). (Niemisto 2003) • Active manipulation (patients treated according to a pre-planned 30-day protocol with a number of sessions that depended on pain relief of up to a maximum of 20. Sessions scheduled 5 days/ wk for 5 min) has more effect than simulated manipulation (patients received soft muscle pressing apparently similar to manipulations but not following any specific patterns and not involving rapid thrusts. Each participant was treated according to the same pre-planned 30-day protocol as the active treatment group) on pain relief for acute back pain and sciatica after 180 days. Patients in the active manipulation group spent fewer days with moderate-to-severe pain and consumed fewer drugs for pain control. (Santilli 2006) • Mobilization (all patients were instructed to do two simple extension exercises, 3-5x with gradual increase of extension. After a short break the procedure was to be repeated 4-6x. The patients were instructed to perform these exercises as often as possible during the day and at least 1x/hr) is effective in reducing pain for patients with CLBP, with or without leg pain. The addition of manipulation before mobilizing extension exercises does not increase benefit of mobilization. (Rasmussen 2008) • In patients with sub-acute non-specific LBP, manipulation followed by general lumbar ROM (side posture SI joint manipulation performed moving the SI A/P 3x/wk) was more effective than extension-oriented exercise and a postural program (McKenzie method) in improving function (Oswestry). Manipulation may produce a short-term effect of increasing ROM and decreasing pain-allowing patient participation in an exercise program. (Erhard 1994) • Systematic lit review of RCTs of clearly defined supervised lumbar extensor strengthening in adults w CLBP. 11 RCTs included. Published systematic reviews also considered (e.g. Cochrane) but all were too broad in scope of exercise type, or too general in their assessments conclusion to inform lumbar extensor strengthening. (Mayer 2008)

	<ul style="list-style-type: none"> ○ Short term lumbar extensor strengthening (alone or with co-interventions) is more effective than no treatment or passive treatment in improving pain & disability. There is no clear benefit of lumbar extensor strengthening compared to other exercise programs. The role of exercise intensity is unclear and hyper-extension during dynamic lumbar strengthening exercise does not offer additional benefit. ● In patients with recurrent non-specific LBP, a general exercise program (exercises activating the extensor (paraspinals) and flexor (abdominals) muscle groups; 45-60 min, 2x/wk, 8 wks) reduced disability in the short term (<3 mo) to a greater extent than a stabilization-enhanced exercise approach (low-load activation without movement with minimal loading positions progressing to increased holding time and number of contraction repetitions, instruction of avoidance of incorrect muscle activation, integration with dynamic function (spinal or limb movements) through the incorporation of stabilizing muscles; 45-60 min, 2x/wk, 8 wks). (Koumantakis 2005)
<p>Specific Strengthening Core</p>	<ul style="list-style-type: none"> ● Mixed LBP (w/wo leg pain) randomized to pilates (n=21) & usual care (n=18; PCP care as usual with continue normal activity). Pilates did better on self-report pain (NRS-101) & function (RM) scores at 3, 6, 12 mos. (Rydeyard 2006) ● Four sessions of isometric core strengthening exercise combined with muscle energy manipulation and physician consultation encouraging activity and reassuring recovery is more effective at improving self-reported pain (VAS) and function (Oswestry) than physician consultation with an instruction booklet alone. Differences persisted at 5 mo and 1 year (questionable clinical meaningfulness) but diminished at 2 year follow up. Both groups improved significantly and cost analysis suggested that physician consult was more cost effective. There was higher satisfaction in the combination group. (Niemesto 2003, 2005) A secondary study evaluated relationship of dysfunctional psychological profile to recovery and found that such profiles predicted more sensitive response to treatment in both groups. (Riipinen 2005) ● A spinal stabilization program (functionally progressive exercise class, 10 1-hour sessions, 10wks; followed by back school) is more effective than manually applied therapy (physical therapy without exercise followed by back school) or an education booklet (followed by back school) in treating chronic low back disorders at 24 months. Both manual therapy and the spinal stabilization program are significantly effective in pain reduction in comparison to an active control. (Goldby 2006) ● Evidence, in a Cochrane review, strongly suggests that exercise is at least as effective as other conservative treatments for CLBP. Individually designed strengthening or stabilizing programs seem to be effective in health care settings with meta-analysis indicating small but statistically significant improvements in pain and function measures both short and long term. (Hayden 2005) ● For management of acute and chronic LBP, dynamic muscular stabilization techniques (stage 1: isolation abdominal hollowing; stage 2: trunk stabilization under static condition; stage 3: trunk stabilization during movement of the lumbar spine; stage 4: lumbar stabilization on high speed and skilled movements 40 min/day for 35 days) demonstrated enhanced capacity of walking, number of stand up and climbing along with reduced pain more significantly than conventional treatment (ultrasound, short wave diathermy, lumbar strengthening exercises 40 min/day for 35 days). (Kumar 2009) ● Patients with subacute LBP, with or without leg pain, can benefit from both stabilization exercises (initial assessment lasted 60 min and follow-up sessions lasted 30 min, max of 12 visits/12 wk; back book provided; endurance training for the deep abdominal and back extensor muscles was predominant component) and conventional physiotherapy (initial assessment lasted 60 minute and follow-up sessions lasted 30 min, max of 12 visits/12 wk; back book provided; exercises using low load, high repetition muscle activity were excluded) There does not seem to be any benefit in adding specific spinal stabilization exercises to conventional PT at 6-12 months. (Caims 2006) ● Patients with CLBP had better outcomes (pain and return to work) when engaged in an exercise program which improved lumbar stability and coordination (stretching and relaxation was applied after each specific lumbar exercise, and functional muscle and coordination exercises (e.g. sit-ups) were included in the program during the last 6 weeks of 14 weeks total; restoration included controlled movements in lumbar and thoracic flexion, extension, rotation, and lateral flexion). (Taimela 2000)

**Graded
(incrementally
increasing) exercise**

- Graded activity in the short term and immediate term is slightly more effective than a minimal intervention, but is not more effective than other forms of exercise for LBP. Limited evidence suggests that graded exposure is as effective as minimal treatment or graded activity for persistent LBP. **(Macedo 2010)**
- After 8 wks, graded lumbar stabilizing exercises with low-load endurance, seemed to provide greater reduction in pain (SF-36) in both short and long term (1yr) and in disability (Oswestry) in the short term and improved perceived physical health and self-efficacy (SF-36) for patients with non-specific recurrent low back pain over daily walking program (30 min. daily walk, as fast as possible without pain). **(Rasmussen-Barr 2009)**
- A trial comparing a group functional restoration program (FRP) (supervised 5 week group exercises with increasing intensity for each participant weekly culminating in work hardening activities) versus individual 5 wk active PT care (agreed exercise program initially supervised and prescribed for home, including flexibility, jogging, stretching, endurance) reported that pain, self-reported resumption of work activity and trunk strength improved similarly in both groups. Endurance improved in FRP. **(Roche 2007)**
- Non-specific CLBP patients were randomized into one of three groups: supervised active physical treatment (APT) (aerobic 30 min bike; trunk and leg strengthening), cognitive behavioral treatment (CBT) (life goals, increased activity coaching, problem solving, modification of dysfunctional beliefs, <12 hrs total), combined treatment of APT and CBT (CT) and a waiting list control (WL). At the end of 10 wks, significant functional improvement, pain reduction and higher satisfaction was observed in all three treatments compared to WL. Physical performance improved in APT and CT over WL and CBT. There was no clinical difference between combined and single treatments. **(Smeets 2006c)**
- In a well done case series of 95 chronic (> 8 wk duration) low back pain patients (categorized as specific, non-specific, and widespread CLBP), pain and disability improved significantly using an intervention that included a cognitive behavioral approach (3 weeks of inpatient program consisting of daily 6-8 hours of activities, including cognitive behavioral approaches and physical training - exercises of low intensity and many repetitions). **(Wormgoor 2008)**
- In non-specific CLBP patients, 10 weeks of APT (aerobic training, extensor strengthening) versus graded activity coaching with problem solving versus combined, there was no difference in Roland scores at 1 year, although self-perceived improvement was better in either individual treatment compared to combine treatment. **(Smeets 2008a)**
- In a Cochrane review, graded-activity exercise programs (gradually increasing intensity) appear to improve outcomes for subacute occupational low back conditions. **(Hayden 2005)**
- CLBP patients (n=59) were randomized to an active rehabilitation program (24 PT supervised 90 min small group graded exercise sessions with behavioral support over 12 weeks) and a control program (4 sessions of passive thermal treatment and massage over 4 weeks - intended as a placebo). Active rehabilitation was more effective in reducing pain (VAS) and functional disability (Pain and Disability Index) that was sustained at 1 year follow-up. Lumbar endurance (extensor strength/fatigue) improved after treatment in the active rehab group but differences disappeared at 6 mo and 1 yr follow-ups. **(Kankaanpaa 1999)**
- A mini-intervention (clinical exam, information, support and advice plus exercise) administered by a PT and a physician specialized in back pain, reduced daily symptoms and sickness absenteeism and resulted in better treatment satisfaction and adaptation to pain for patients with subacute LBP. A work site visit did not appear to add clinical effectiveness to the mini-intervention. **(Karjalainen 2003)**
- In an RCT included patients with non-specific low back pain, a graded activity program (measurements of functional capacity, work-place visit, back school education, and individual, submaximal, gradually increased exercise), with an operant-conditioning behavioral approach, was significantly more effective in returning patients to work when compared to a control. The graded activity program increased occupational function as measured by return to work and significantly reduced long-term sick leave. **(Lindstrom 1992a)**
- Patients with nonspecific LBP who enrolled in a graded activity program with a behavioral therapy approach returned to work earlier than patients in a control group. Graded activity significantly increased mobility, strength, and overall fitness. Spinal rotation, abdominal muscle endurance time and lifting capacity were significantly correlated to rate of return to work. The graded activity program in this RCT proved to be a successful method of restoring occupational function and facilitating return to work in SLBP patients. **(Lindstrom 1992b)**
- In patients with low back pain, a graded activity program was more effective in improving functional status and pain and reducing the number of time loss days. The effects in this RCT were small and not statistically significant. **(Stal 2004)**
- In an RCT of 135 workers, a graded activity group returned to work quicker than a usual care group. **(Hlobil 2005)**

EXERCISE STRATEGIES – Neural Re-education

<p>Coordination – Balance- Proprioception</p>	<ul style="list-style-type: none"> In a systematic review of 14 randomized controlled trials, motor control exercises, when performed alone or in conjunction with another form of therapy (e.g. education, general exercise, manual therapy, physical therapy, CBT), significantly reduced pain and disability in patients with persistent non-specific LBP. It is unclear whether motor control exercises are more effective than manual therapy, other forms of exercise, or surgery. (Macedo 2009)
<p>Muscle Energy – Contract-Relax</p>	<ul style="list-style-type: none"> In patients with ALBP, with leg pain, manipulation (lumbar oscillatory rotation , 3x/wk) was found superior to conventional therapy (heat (short wave diathermy) 20 min, followed by gentle isometric exercise (classic pelvic tilt type of the back and abdominal involving ten contractions with each contraction held for 5 seconds with 10 seconds relaxation between contractions, 3x/wk) in treatment of symptoms. Both groups showed significant differences pre vs. post treatment in flexion and extension. Manipulative group significantly differed in treatment time (160 min vs. 121 min.) Manipulative group had significantly fewer patients returning for treatment after 3 months (11.5 % vs. 28%). (Nwuga 1982) Manipulation with stabilizing exercises (4x/wk for 4 wks, patients also received a 25-page educational booklet on basic anatomy and physiology of the spine, principles of ergonomics for LBP patients, and instructions on how to exercise and cope with the acute phase of LBP) was more effective in reducing pain intensity and disability than the physician consultation (patients received same 25 page educational booklet, the patients received individual instruction regarding their posture and 3 to 4 exercises aiming to increase their spinal mobility, muscle stretch, and/or trunk muscle stability, also advised to avoid long standing static work by performing several counter movements) alone, for patients with CLBP (with and without leg pain). (Niemisto 2003)

COGNITIVE MANAGEMENT STRATEGIES – Behavioral and Self-management approaches

<p>Disability Prediction</p>	<ul style="list-style-type: none"> In patients with ALBP, psychological factors were useful in predicting disability, but did not predict patients' responses to physiotherapist-guided exercise and/or advice. Psychological factors tested include: catastrophizing, coping, pain self-efficacy, fear of injury/movement, depression, anxiety, and stress. (Smeets 2009b)
<p>Catastrophizing</p>	<ul style="list-style-type: none"> A 3 year follow-up on active physical exercise (30 min bicycle, 5 min stretch, 15 min trunk leg strengthening to fatigue), instruction on graded activity, or combinations - focused on the role of pain catastrophizing. All 3 interventions reduced catastrophizing compared to control. (Smeets 2006a ch 4, 5 & 6, Smeets 2006d)
<p>Fear Avoidance & Recovery Expectation Confidence in Treatment</p>	<ul style="list-style-type: none"> A randomized controlled trial included CLBP patients who were randomized to an active physical therapy (APT) group, cognitive behavioral therapy (CBT) group, or a combination (CT) group to assess the effects of expectancy and credibility on outcome found: <ul style="list-style-type: none"> Lower levels of credibility of the treatment (CEQ) were associated with higher pain-related fear and lower internal control of pain. Lower levels of recovery expectation were associated with higher pain-related fear and no radiculopathy Higher treatment credibility was associated with satisfaction. Higher expectancy predicted better overall outcome for active exercise only Higher credibility predicted better overall outcome for instruction on grading only. (Smeets 2006a ch 7) In patients with CLBP, treatment expectancy and credibility was associated with the outcomes of various treatment interventions (active physical therapy (APT), cognitive behavioral therapy (CBT), or a combination of both (CT)). Expectancy was significantly associated with disability (Roland-Morris) and satisfaction. Credibility was significantly associated with patient-specific symptoms (VAS) and satisfaction. (Smeets 2008b) Risk of potentiating chronicity and fostering physician dependence is believed to result from over-utilization of passive means of treatment - this is a critical time during which many patients begin to exhibit signs of inappropriate illness behavior and other signs of

	<p>chronicity and pending chronicity (Triano 1995)</p> <ul style="list-style-type: none"> • In patients with CLBP, with and without leg pain, changes in cognitive factors were not significantly associated with changes in pain intensity. Significant reductions were observed in disability. A reduction in fear avoidance beliefs about physical activity and about work, plus an increased perception of control over pain were related to decreased disability. A decrease in catastrophizing and an increased perception of control over pain were not associated with reductions in disability. (Woby 2004a, Woby 2004b) • A review of numerous studies looking at attitudes and expectations summarized the following: <ul style="list-style-type: none"> ○ Expectation- patients who think they are going to improve tend to improve. ○ Credibility- to the patient, the credibility of their care is related to their work status. If the patient is working then, to the patient, the care is more credible. ○ When patients work toward performing their normal activities, they tend to do better (make the patient a partner in his/her own care). ○ Activity fear- patients with higher fear of activity tend to do worse. ○ Treatment programs- giving the patient several types of treatment is not necessarily better than using fewer treatments. (Smeets 2006a ch 10)
<p>General Advice to Avoid Bed Rest and Stay Active</p>	<ul style="list-style-type: none"> • A Cochrane review of 10 trials comparing advice to rest and advice to remain active concluded that (Dahm 2010): <ul style="list-style-type: none"> ○ Acute Simple LBP: High quality evidence (n=2 trials) for small, consistent improvement in pain relief and functional status for advice to stay active over bed rest ○ Acute Simple LBP: Advice to rest increases sick days in 1st 12 weeks ○ Sciatica: Advice to rest has no effect on sick days, pain, or function compared to advice to stay active
<p>WORKERS' COMPENSATION ISSUES</p>	
<p>Causation & Work Relatedness</p>	<ul style="list-style-type: none"> • In Washington State, occupational conditions that may be a result of cumulative workplace exposure across multiple employers may have claim and experience costs apportioned to both former and current employers. Worker and employer appeals rights can factor into adjudication decisions and contribute to delays which are associated with worse outcomes. (Franklin 2007) • Exceptionally clear medical justification for specific work exposure(s) is essential for fair and timely decisions. Delayed adjudication and development of adversity in work-related carpal tunnel cases has been associated with poor outcomes. (Bonfiglioli 2006)
<p>Work Accommodation</p>	<ul style="list-style-type: none"> • In a Cochrane review, work-related programs, supervised by a PT or multidisciplinary group, that include cognitive behavioral approaches and physical conditioning (e.g. aerobic capacity, muscle strength and endurance, coordination) seem to be effective in reducing sick days in some workers with CLBP. There is no evidence of efficacy for ALBP. (Schonstein 2005)

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MISCELLANEOUS TERMINOLOGY

- Aerobic-** Exercise that increases heart and respiration rates. Typically aimed at increasing metabolism and fat burning.
- Anaerobic-** Exercise that exceeds the body's capacity to oxygenate tissues and may refer to maximal exertion such as may be seen in power lifting and sprinting.
- Cross-training-** Refers to doing more than one kind of exercise aimed at enhancing tolerance and capacity under different circumstances (load, position, mixes of aerobic and loading).
- Graded activity/exercise-** Refers to systematically increasing the amount of exercise (e.g., repetitions, duration, intensity, frequency), usually daily.
- Interval training-** Refers to short bursts of high intensity exertion alternated with lower intensity exertion for the duration of the exercise (e.g., 20 minutes of running that alternates between 1 minute of sprint and 3 minutes of jogging).
- Isometric exercise** – Involves muscle loading that maintains the muscle at a given length. Examples include some yoga positions.
- Low back pain (LBP)** – May be classified as acute (ALBP) typically less than 2-3 month; chronic (CLBP) typically of longer duration than 2-3 months; or mixed (MLBP). The term mechanical low back pain means the source of the problem may be in the spinal joints, discs, vertebrae or soft tissues.

STUDY METHODOLOGY TERMINOLOGY

- Randomized Controlled Trial (RCT)** – A study that randomly allocates patients to treatment groups, usually blinding patients, therapists and/or study evaluators.
- Reviews** – Studies that review previously published clinical trials. Ideally includes quantitative comparisons (e.g., meta-analyses) typical of Cochrane reviews. Systematic reviews imply screening for higher quality designs comprehensive inclusion of all relevant studies.

PROGRESS QUESTIONNAIRES – Implementation & Scoring Instructions

Administer at baseline, then every 2-4 weeks. Scores should reduce over time. Clinically meaningful changes have been reported to be between 4-16 on the Modified Oswestry Disability Index (Fritz 2001, Lauridsen 2006, Vianin 2008) and 3-5 on the Roland Morris Questionnaire (Lauridsen 2006).

Modified Oswestry (Fritz 2001) - *First box in each section = 0 pts, next = 1,2,3,4,5 points etc. Add total points from all sections; divide by 50 and multiply by 100%. Higher percentage score reflects higher level of disability.*

Roland Morris (Roland 1983) - *The score of the RDQ is the total number of items checked – i.e. from a minimum of 0 to a maximum of 24.*

EXERCISE OVERSIGHT APPROACHES

Home exercise prescription/casual prescription/instruction - Exercises are described to patient; printed materials are provided with general guidance, prescription for frequency, duration etc. A common first step in general practice, but compliance may be challenging.

- Supervised instruction** – In addition to a home exercise prescription, an effort is made to include demonstration and coaching of patient in performances of exercises until provider is confident that patient can do them. There may be some time set aside in-office for performance of certain exercises, but the majority of implementation is still by patient on their own.
- Hardening/intensive rehabilitation programs** – Time is scheduled for patient to perform full exercise routine at clinic/rehab facility with provider coaching and supervision (e.g. classes, work hardening programs, etc).

EXERCISE TYPES - Stretching

- Active stretch/movement** – Patient performs specific exercises, sustained positions to induce stretching of muscles. Many yoga techniques fall in this category.
- Directional Preference Therapy (DPT)**– This refers primarily to sustained trunk ROM end range movement but is targeted to positions that cause any leg pain to 'centralize' that is when in a certain position such as extension (lying prone arching back by propping up on ones hands), the patients leg pain reduces in the peripheral area of the leg but may continue to be uncomfortable in the low back. McKenzie techniques are an example of this approach.
- Passive stretch/movement** – Provider administers stretching of body parts (patient is passive during procedure). May be considered a soft tissue technique, however; muscle stretching is induced.
- ROM (range of motion) end range** – Patient performs sustained stretch aimed at reaching end ranges of movement. May involve sustaining position at end range or involve just patient controlled movement to joint/structure end range. Does not include any therapist assisted movement such as mobilization/manipulation.

EXERCISE TYPES – Conditioning/Strengthening

- General aerobic conditioning** – Aerobic exercise (induces temporary increases in respiration and heart rate e.g. running, walking, swimming). Not targeted at specific low back conditions.
- General physical conditioning** – Refers typically to anaerobic-like exercise that involved 'bursts' of exertion followed by rest. Examples include weight lifting, sprinting, crunches. This is differentiated from specific conditioning in that tissues and muscle groups being targeted are not selected based on the low back condition.
- Specific physical/strength training: core strengthening** – A systematic approach of strengthening trunk muscles under different loading conditions (e.g. using gym balls, different positions, some coordination variation, e.g. symmetrical vs. asymmetrical repetitions)
- Specific physical/strength training: trunk flexion/extension** – Refers to targeted anaerobic-like muscle strengthening directed at trunk flexors and extensors (e.g. sit-ups, crunches, extension strengthening). May involve weights.

EXERCISE TYPES – Neural reeducation

Coordination/balance/proprioception training - Therapeutic technique that is used to improve balance, coordination, posture, kinesthetic sense and proprioception. Examples include one-legged standing, progressive use of a wobble board.

Muscle energy/contract-relax procedures – Therapeutic technique that typically involves contracting muscles against resistance throughout various ranges of motion with the intent of normalizing motor firing patterns and reflex relation

COGNITIVE BEHAVIORAL & SELF-MANAGEMENT STRATEGIES

Cognitive behavioral therapy (CBT) - goal-oriented approach to address dysfunctional emotions, behaviors and cognitions. Fear avoidance, low recovery expectations, catastrophizing, is associated with poor outcomes in chronic back conditions. Interventions may include: Muscle relaxation training; Breathing techniques; Education to address fear-avoidance, catastrophizing low recovery expectations;

General advice – Providing information and reassurance about condition, recovery and activity (e.g., that bed rest is harmful, that paced activity will help promote recovery, that the natural history of these injuries is favorable and that the patient should expect over time to recover)

EXAMPLE IN-OFFICE EXERCISE OPTIONS

Overall approach should focus on what patient can do within their pain tolerance and active ranges of motion. Except where noted, all exercises should focus on keeping the spine in a neutral (normal curve and posture) throughout execution of the exercise. Dedicated office time for demonstration & observation of proper performance is important for optimal compliance, as is regular follow-up. If this cannot be done, a referral to a provider who can oversee and train the worker (e.g., physical therapist) is recommended.

Flexibility and Range of Motion: Typically emphasized during acute phase to re-introduce movement to injured area with little to no weight bearing.

- **Gluteal/Lumbopelvic Flexion Stretch** – Lie on back, raise one leg at a time bending the knee, reaching with the hands around the bent leg below the knee. Use slow, light pulling pressure bringing knee toward chest. Hold stretch a minimum 8-10 seconds. Perform 10 times on each leg, then 10 times with both legs.
- **Hamstring Stretch** – Lie on back, raise one leg at a time trying to keep knee straight. Using hands around knee area (or a towel around ankle), use light pulling pressure to stretch straight leg toward 90°. Hold stretch minimum 8-10 seconds. Perform 10 times on each leg.
- **Enhanced Gluteal Stretch** – Lie on back, raise one leg bending the knee to about 90°, rotating ankle in (like crossing one's leg). Reach hands around knee pulling it up towards center of chest to apply stretch in the buttocks area on the side of the bent knee. Hold for 8-10 seconds performing the stretch about 10 times, repeat with opposite leg.
- **Posterior Trunk Stretch** – Lay on stomach over appropriate size gym-ball with both hands and knees on ground. Relax musculature bending over gym-ball to stretch back muscles. Hold stretched position for approximately 20-30 seconds or to tolerance, returning to neutral position. Repeat 3 times.

- **Anterior Trunk Stretch** – Lay on back on appropriate sized gym-ball, with both hands and feet contacting the ground for balance and support. Relax musculature introducing extension into the spine. Hold stretched position for approximately 20-30 seconds to tolerance, returning to neutral position. Repeat 3 times.
- **Lateral Trunk Stretch** – Lay on one side over an appropriate sized gym-ball, with down side hand and both feet are on ground for balance and support (three point contact). Raise the up side arm and hand overhead while relaxing the trunk musculature to put a sideways (lateral) stretch into the spine. Hold stretched position for approximately 20-30 seconds to tolerance, returning to neutral position. Repeat 3 times.

Stabilization Exercises: Typically emphasized in early sub-acute phase to help maintain correct spinal posture with weight-bearing. Performing all of these while maintaining neutral spine position is key.

- **Hip Hinge** – Stand with legs shoulder width apart, toes pointed slightly outward, maintaining a slight (lordotic) arch in the low back. With arms extended, grasp a counter top or chair back for balance and slowly squat, bending both knees as far as 90° holding for 5 seconds, then return to original standing posture maintain normal upright spine curves throughout. Repeat 10 times.
- **Modified Side Bridge** – In a side-lying posture, prop upper body on bent elbow (~90°) directly under shoulder with the forearm positioned in front. Raise hips and thighs upward creating a "bridge" between the elbow and knee. Keep the spine in a neutral posture, maintaining a normal (lordotic) curve. Hold for 5 seconds, return to resting posture for 5 seconds. Repeat 10 times on both sides depending on tolerance.
- **Modified plank** – Get on all 4's using elbows/forearms (shoulder width apart) and knees. Straighten out trunk in order to lift stomach and thighs off floor into straightened "wooden plank" position between elbows and knees. Maintain position for 8-10 seconds and repeat 10 times depending on tolerance.
- **Bird-dog** – Get on all 4's with hands shoulder width apart and knees directly under hips. Keep spine in the neutral position, while simultaneously lifting one leg and the opposite arm off the ground creating a 2 point stance. Hold for 5 seconds, then return to 4 point stance. Alternate with opposite arms and legs repeating 10 times.

Functional/Strengthening Exercises: Used to incrementally progress from stabilizing exercises, introducing increased weight bearing and resistance without support through an increased range of motion. Usually initiated in sub acute phase and continued even beyond formal care to increase/maintain strength and endurance.

- **Cat/Camel** – Get on all 4's with hands shoulder width apart and knees directly under hips. Alternate arching the back upward with head and neck moving toward floor (camel) with lifting head and neck toward ceiling while dropping stomach and spine toward floor (cat). Hold each position for 5 seconds and repeat 10 times.
- **Side Bridge/Plank/Side Bridge** – Alternate between Full Side Bridge (between elbow and ankle) and Full Plank (similar to a starting position for doing a push up). In a side lying position, coming to a full bridged posture, hold for 3 seconds, then rotate entire body a quarter turn into the full plank (push-up) position with points of contact on both elbows/forearms at shoulders width, and on the toes, hold for 3 seconds. Continue rotating the body another quarter turn into a side bridge position on the other side. Repeat 5 times. Maintain neutral spine position throughout.

- **Unsupported Hip Hinge** – Stand with legs shoulder width apart, toes pointed slightly outward, maintaining a slight (lordotic) arch in the low back. Without holding onto anything, slowly squat, bending both as far as 90°, then return to original standing posture. Repeat 10 times.
- **Abdominal Bracing with Resistance** – Best accomplished with resistance bands (either of graded resistance or using longer levers by holding the bands close, then at the length of the forearm, then with arms extended fully straight in front). In a standing position, tighten abdominal muscles (bear down, Valsalva maneuver). While holding the resistance band at the prescribed length or

intensity, fully rotate the torso to the right then left, against the resistance. Keep spine in neutral (normal upright). Repeat 10 times each side.

Additional Exercises

- **Walking** – Include 20 minutes of walking at a comfortable pace to start, progressing with both time and intensity to tolerance.
- **Enhance Balance** – Incorporate a balance component into both the stabilization and functional/strengthening exercises by including at least one point of weight bearing contact on a wobble board, BOSU, foam pad, etc. This typically be will be dependent on the nature of injury and subsequent patient progress.