CLINICAL GUIDELINES

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Low Back Pain
Clinical Practice Guidelines
Linked to the International Classification
of Functioning, Disability, and Health
from the Orthopaedic Section of the
American Physical Therapy Association

J Orthop Sports Phys Ther. 2011:41(A)A – A

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**Low Back Pain: Clinical Practice Guidelines**

**Recommendations***

**Clinical Course:** The clinical course of low back pain can be described as acute, sub acute, transient, recurrent, or chronic. Given preponderance of recurrent and chronic low back pain and the associated costs, clinicians should place high priority on interventions that prevent (1) recurrences and (2) the transition to chronic low back pain. (Recommendation based on theoretical/foundational evidence.)

**Diagnosis/Classification:** Low back pain, without symptoms or signs of serious medical or psychological conditions, associated with 1) mobility impairment in the thoracic, lumbar, or sacroiliac regions, 2) referred or radiating pain into a lower extremity, and 3) generalized pain are useful clinical findings for classifying a patient with low back pain into the following International Statistical Classification of Diseases and Related Health Problems (ICD) categories: low back pain, lumbago, lumbosacral segmental/somatic dysfunction, low back strain, spinal instabilities, flatback syndrome, lumbago due to displacement of intervertebral disc, lumbago with sciatica, and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of low back pain (b28013 Pain in back, b28018 Pain in body part, specified as pain in buttock, groin, and thigh) and the following, corresponding impairments of body function:

- **Acute low back pain with mobility deficits** (b7101 Mobility of several joints)
- **Sub acute low back pain with mobility deficits** (b7101 Mobility of several joints)
- **Acute low back pain with movement coordination impairments** (b7601 Control of complex voluntary movements)
- **Sub acute low back pain with movement coordination impairments** (b7601 Control of complex voluntary movements)
- **Chronic low back pain with movement coordination impairments** (Control of complex voluntary movements)
- **Acute low back pain with related lower extremity pain** (28015 Pain in lower limb)
- **Acute low back pain with radiating pain** (b2804 Radiating pain in a segment or region)
- **Sub acute low back pain with radiating pain** (b2804 Radiating pain in a segment or region)
- **Chronic low back pain with radiating pain** (b2804 Radiating pain in a segment or region)
- **Acute or sub acute low back pain with related cognitive or affective tendencies** (b2703 Sensitivity to a noxious stimulus, b1522 Range of emotion, b1608 Thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons, b1528 Emotional functions, specified as the tendency to elaborate physical symptoms for emotional/affective reasons)
- **Chronic low back pain with related generalized pain** (b2800 Generalized pain, b1520 Appropriateness of emotion, b1602 Content of thought)

**Differential Diagnosis:** Clinicians should consider diagnostic classifications associated with serious pathological conditions or psychosocial factors and initiate referral to the appropriate medical practitioner when (1) the patient's clinical findings are suggestive of serious medical or psychological pathology, (2) the reported activity limitations or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or (3) when the patient’s symptoms are not resolving with interventions aimed at
normalization of the patient’s impairments of body function. (Recommendation based on strong evidence.)

**Risk Factors:** Clinicians should consider screening for factors that increase the probability of developing recurrent or chronic low back pain. Risk factors for development of recurrent pain include 1) history of previous episodes, 2) excessive mobility in spine, and 3) excessive mobility in other joints. Risk factors for development of chronic pain include 1) presence of symptoms below knee, 2) psychological distress or depression, 2) fear of pain, movement, and re-injury or low expectations of recovery, 3) pain of high intensity, and 4) a passive coping style. (Recommendation based on moderate evidence.)

**Examination – Outcome Measures:** Clinicians should use validated self-report questionnaires, such as the Modified Oswestry Low Back Disability Index and the Roland Morris Disability Index. These tools are useful for identifying a patient’s baseline status relative to pain, function, and disability and for monitoring a change in patient’s status throughout the course of treatment. (Recommendation based on strong evidence.)

**Examination – Activity Limitation and Participation Restriction Measures:** Clinicians should routinely assess activity limitation and participation restriction through validated self-report or performance based measures. Changes in the patient’s level of activity limitation and participation restriction should be monitored with these same measures over the course of treatment. (Recommendation based on expert opinion.)

**Interventions – Manual Therapy:** Clinicians should consider utilizing thrust manipulative procedures to reduce pain and disability in patients with mobility deficits and acute (<16 days) low back and back-related buttock or thigh pain. Thrust and non-thrust mobilization procedures can also be used to improve hip mobility and reduce pain and disability in patients with sub acute and chronic low back and back-related limb pain. (Recommendation based on strong evidence.)

**Interventions – Trunk Coordination, Strengthening, and Endurance Exercises:** Clinicians should consider utilizing trunk coordination, strengthening, and endurance exercises to reduce low back pain and disability in patients with sub acute and chronic low back pain with movement coordination impairments and in patients post lumbar microdiscectomy. (Recommendation based on strong evidence.)

**Interventions – Centralization Procedures and Exercises:** Clinicians should consider utilizing specific repeated movements, exercises, or procedures to promote centralization to reduce symptoms in patients with acute low back pain with related lower extremity pain. (Recommendation based on strong evidence.)

**Interventions – Flexion Exercises:** Clinicians can consider flexion exercises, combined with other interventions such as manual therapy, strengthening exercises, nerve mobilization procedures, and progressive walking for reducing pain and disability in older patients with chronic low back pain with radiating pain. (Recommendation based on weak evidence.)

**Interventions – Lower Quarter Nerve Mobilization Procedures:** Clinicians should consider utilizing lower quarter nerve mobilization procedures to reduce pain and disability in patients
with sub acute and chronic low back pain and radiating pain. (Recommendation based on moderate evidence.)

**Interventions – Traction:** There are conflicting opinions regarding 1) the best use of intermittent or static lumbar traction for reducing acute and sub-acute low back pain with radiating pain, 2) the subgroup of patients that respond best to traction, and 3) the frequency, intensity, duration or type of traction for achieving the best outcomes. (Recommendation based on conflicting evidence.) Clinicians should not utilize intermittent or static lumbar traction for reducing symptoms in patients with acute or sub acute, non-radicular low back pain or for patients with chronic low back pain. (Recommendation based on weak evidence.)

**Interventions – Patient Education and Counseling:** Clinicians should not utilize patient education and counseling strategies that either directly or indirectly increase the perceived threat or fear associated with low back pain, such as education and counseling strategies that 1) promote extended bed-rest or 2) provide in-depth, pathoanatomical explanations for the causes of low back pain. Patient education and counseling strategies for patients with low back pain should emphasize 1) the promotion of the understanding of the anatomical/structural strength inherent in the human spine 2) the neuroscience that explains pain perception; 3) the overall favorable prognosis of low back pain, 4) the use of active pain coping strategies that decrease fear and catastrophizing, 5) the early resumption of normal or vocational activities, even when still experiencing pain, and 6) the importance of improvement in activity levels, not just pain relief. (Recommendation based on moderate evidence.)

**Interventions – Progressive Endurance Exercise and Fitness Activities:** Clinicians should consider 1) moderate to high intensity exercise for patients with chronic low back pain without generalized pain, and 2) incorporating progressive, low intensity, sub-maximal fitness and endurance activities into the pain management and health promotion strategies for patients with chronic low back pain with generalized pain. (Recommendation based on strong evidence).

*These recommendations and clinical practice guidelines are based on the scientific literature published prior to January 2011.*
AIM OF THE GUIDELINE

The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based practice guidelines for orthopaedic physical therapy management of patients with musculoskeletal impairments described in the World Health Organization’s International Classification of Functioning, Disability, and Health (ICF).286

The purposes of these clinical guidelines are to:

- Describe evidence-based physical therapy practice including diagnosis, prognosis, intervention, and assessment of outcome for musculoskeletal disorders commonly managed by orthopaedic physical therapists
- Classify and define common musculoskeletal conditions using the World Health Organization’s terminology related to impairments of body function and body structure, activity limitations, and participation restrictions
- Identify interventions supported by current best evidence to address impairments of body function and structure, activity limitations, and participation restrictions associated with common musculoskeletal conditions
- Identify appropriate outcome measures to assess changes resulting from physical therapy interventions in body function and structure as well as in activity and participation of the individual
- Provide a description to policy makers, using internationally accepted terminology, of the practice of orthopaedic physical therapists
- Provide information for payers and claims reviewers regarding the practice of orthopaedic physical therapy for common musculoskeletal conditions
- Create a reference publication for orthopaedic physical therapy clinicians, academic instructors, clinical instructors, students, interns, residents, and fellows regarding the best current practice of orthopaedic physical therapy

STATEMENT OF INTENT

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

Content experts were appointed by the Orthopaedic Section, APTA as developers and authors of clinical practice guidelines for musculoskeletal conditions of the low back region. These content experts were given the task to identify impairments of body function and structure, activity limitations, and participation restrictions, described using ICF terminology, that could (1) categorize patients into mutually exclusive impairment patterns upon which to base intervention strategies, and (2) serve as measures of changes in function over the course of an episode of care. The second task given to the content experts was to describe the supporting evidence for the identified impairment pattern classification as well as interventions for patients with activity limitations and impairments of body function and structure consistent with the identified impairment pattern classification. It was also acknowledged by the Orthopaedic Section, APTA content experts that only performing a systematic search and review of the evidence related to diagnostic categories based on International Statistical Classification of Diseases and Health Related Problems (ICD) terminology would not be sufficient for these ICF-based clinical practice guidelines as most of the evidence associated with changes in levels of impairment or function in homogeneous populations is not readily searchable using the ICD terminology. Thus, the authors of this guideline independently performed a systematic search of the MEDLINE, CINAHL, and the Cochrane Database of Systematic Reviews (1966 through 2010) for any relevant articles related to classification, examination, and intervention for musculoskeletal conditions related to the low back region. The lead author (AD) assigned a specific subcategory (classification, measures, and intervention strategies for musculoskeletal conditions of the low back region) to search based upon their specific area of expertise. Two authors were assigned to each subcategory and both individuals performed a separate search, including but not limited to the 3 databases listed above, to identify articles to assure that no studies of relevance were omitted. Additionally, when relevant articles were identified their reference lists were hand-searched in an attempt to identify other articles that might have contributed to the outcome of these clinical practice guidelines. Articles from the searches were compiled and reviewed for accuracy by the authors. Articles with the highest levels of evidence that were most relevant to classification, examination, and intervention for patients musculoskeletal conditions related to the low back region were included in this guideline.

This guideline was issued in 2011 based upon publications in the scientific literature prior to January 2011. This guideline will be considered for review in 2016, or sooner if new evidence becomes available. Any updates to the guideline in the interim period will be noted on the Orthopaedic Section of the APTA website: www.orthopt.org

Levels of Evidence

Individual clinical research articles will be graded according to criteria described by the Center for Evidence-Based Medicine, Oxford, United Kingdom (http://www.cebm.net/index.aspx?o=1025) for diagnostic, prospective, and therapeutic studies. If the 2 content experts did not agree on a grade of evidence for a particular article, a third content expert was used to resolve the issue.
Table 1

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Evidence obtained from high quality diagnostic studies, prospective studies, or randomized controlled trials</td>
</tr>
<tr>
<td>II</td>
<td>Evidence obtained from lesser-quality diagnostic studies, prospective studies, or, randomized controlled trials (eg, weaker diagnostic criteria and reference standards, improper randomization, no blinding, &lt;80% follow-up)</td>
</tr>
<tr>
<td>III</td>
<td>Case controlled studies or retrospective studies</td>
</tr>
<tr>
<td>IV</td>
<td>Case series</td>
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<tr>
<td>V</td>
<td>Expert opinion</td>
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GRADES OF EVIDENCE

Grades of Evidence
The overall strength of the evidence supporting recommendations made in this guideline will be graded according to guidelines described by Guyatt et al,¹¹⁸ as modified by MacDermid and adopted by the coordinator and reviewers of this project. In this modified system, the typical A, B, C, and D grades of evidence have been modified to include the role of consensus expert opinion and basic science research to demonstrate biological or biomechanical plausibility (Table 2 below).

Table 2

<table>
<thead>
<tr>
<th>Grades of Recommendation</th>
<th>Strength of Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Strong evidence</td>
</tr>
<tr>
<td></td>
<td>A preponderance of level I and/or level II studies support the recommendation. This must include at least 1 level I study</td>
</tr>
<tr>
<td>B</td>
<td>Moderate evidence</td>
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<tr>
<td></td>
<td>A single high-quality randomized controlled trial or a preponderance of level II studies support the recommendation</td>
</tr>
<tr>
<td>C</td>
<td>Weak evidence</td>
</tr>
<tr>
<td></td>
<td>A single level II study or a preponderance of level III and IV studies including statements of consensus by content experts support the recommendation</td>
</tr>
<tr>
<td>D</td>
<td>Conflicting evidence</td>
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<tr>
<td></td>
<td>Higher-quality studies conducted on this topic disagree with respect to their conclusions. The recommendation is based on these conflicting studies</td>
</tr>
<tr>
<td>E</td>
<td>Theoretical/foundational evidence</td>
</tr>
<tr>
<td></td>
<td>A preponderance of evidence from animal or cadaver studies, from conceptual models/principles, or from basic sciences/bench research support this conclusion</td>
</tr>
<tr>
<td>F</td>
<td>Expert opinion</td>
</tr>
<tr>
<td></td>
<td>Best practice based on the clinical experience of the guidelines development team</td>
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</tbody>
</table>
REVIEW PROCESS

The Orthopaedic Section, APTA also selected consultants from the following areas to serve as reviewers of the early drafts of this clinical practice guideline:

- Claims review
- Coding
- Epidemiology
- Low back pain rehabilitation
- Manipulative therapy
- Medical practice guidelines
- Movement science
- Orthopaedic physical therapy residency education
- Outcomes research
- Pain sciences
- Physical therapy academic education
- Rheumatology
- Spinal biomechanics
- Sports physical therapy residency education
- Sports rehabilitation

Comments from these reviewers were utilized by the authors to edit this clinical practice guideline prior to submitting it for publication to the *Journal of Orthopaedic & Sports Physical Therapy*. In addition, several physical therapists practicing in orthopaedic and sports physical therapy settings were sent initial drafts of this clinical practice guideline along with feedback forms to assess its usefulness, validity, and impact.

Several practicing clinicians and reviewers noted that classification criteria summary, Table 4, of the ICF-based Neck Pain Clinical Practice Guidelines was extremely useful in linking data gathered during the patient’s subjective and physical examinations to diagnostic classification and intervention. Thus, similar recommended classification criteria was included in the authors for this ICF-based Low Back Pain Clinical Practice Guideline (Table 5), which provides a summary of symptoms, impairment findings, and matched interventions for each diagnostic category.

CLASSIFICATION

The primary ICD-10 codes and conditions associated with low back pain are: **M99.0 Lumbosacral segmental/somatic dysfunction**, **M53.2 Spinal instabilities**, **M40.3 Flatback syndrome**, **M51.2 Lumbago due to displacement of intervertebral disc**, **M54.4 Lumbago with sciatica**, **M54.5 Low back pain**, **G96.8 Disorder of central nervous system, specified as central nervous system sensitivity to pain**, and **F45.4 Persistent somatoform pain disorder**. The corresponding ICD-9 CM codes and conditions, which are used in the USA, are **739.3 Nonallopathic lesion, lumbar region**, **846.0 Lumbosacral ligament sprain**, **724.3 Sciatica**, and **724.2 Lumbago**.

The primary ICF body function codes associated with the above noted ICD-10 conditions are the sensory functions related to pain, the movement functions related to joint motion and control of voluntary movements, and the mental functions related to appropriateness of emotion and content of thought. These body function codes are **b28013 Pain in back**, **b28018 Pain in body**.
part, specified as pain in buttock, groin, and thigh, 28015 Pain in lower limb, b2803 Radiating pain in a dermatome, b2703 Sensitivity to a noxious stimulus, b2800 Generalized pain, b7101 Mobility of several joints, b7108 Mobility of joint functions, specified as mobility in a vertebral segment, b7601 Control of complex voluntary movements, b789 Movement functions, specified as mobility of the meninges, peripheral nerves and adjacent tissues, b1520 Appropriateness of emotion, b1522 Range of emotion, b1528 Emotional functions, specified as the tendency to elaborate physical symptoms for emotional/affective reasons, b1602 Content of thought, and b1608 Thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons.

The primary ICF body structure codes associated with low back pain are s76001 Thoracic vertebral column, s76002 Lumbar vertebral column, s7602 Ligaments and fasciae of trunk, s130 Structure of meninges, s1201 Spinal nerves, s7601 Muscles of trunk, s7401 Joints of pelvic region, s7402 Muscles of pelvic region, s75001 Hip joint, s75002 Muscles of thigh, s1100 Structure of cortical lobes, s1101 Structure of midbrain, s1102 Structure of diencephalon, s1103 Basal ganglia and related structures, s1104 Structure of brainstem, and s1200 Structure of spinal cord.

The primary ICF activities and participation codes associated with low back pain are d4108 Bending, d4106 Shifting the body’s centre of gravity, d4158 Maintaining a body position, d4153 Maintaining a sitting position, d2303 Completing the daily routine, d5701 Managing diet and fitness, d7105 Physical contact in relationships, and d7203 Interacting according to social rules.

The ICD-10 and ICF codes associated with low back pain are provided in Table 3.
### Table 3

ICD-10 and ICF Codes Associated With Low Back Pain

**International Statistical Classification of Diseases and Related Health Problem (ICD) Codes**

#### Acute Low Back Pain with Mobility Deficits

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>M99.0</td>
<td>Lumbosacral segmental/somatic dysfunction</td>
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#### Sub Acute Low Back Pain with Mobility Deficits

<table>
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<th>Code</th>
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<tr>
<td>M99.0</td>
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#### Acute Low Back with Movement Coordination Impairments

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<th>Code</th>
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<tr>
<td>M53.2</td>
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#### Chronic Low Back with Movement Coordination Impairments

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<tr>
<td>M53.2</td>
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#### Acute Low Back Pain with Related Lower Extremity Pain

<table>
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<tr>
<th>Code</th>
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<tbody>
<tr>
<td>M40.3</td>
<td>Flatback syndrome</td>
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<tr>
<td>M51.2</td>
<td>Other specified intervertebral disc displacement (Lumbago due to displacement of intervertebral disc)</td>
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#### Acute Low Back Pain with Radiating Pain

<table>
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<tr>
<th>Code</th>
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<tr>
<td>M54.1</td>
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<td>Lumbago with sciatica</td>
</tr>
</tbody>
</table>
**Acute or Sub Acute Low Back Pain with Related Cognitive or Affective Tendencies**

M54.5  Low back pain  
G96.8  Disorder of central nervous system, specified as central nervous system sensitivity to pain

**Chronic Low Back Pain with Related Generalized Pain**

M54.5  Low back pain  
G96.8  Disorder of central nervous system, specified as central nervous system sensitivity to pain  
F45.4  Persistent somatoform pain disorder

**International Classification of Functioning, Disability, and Health (ICF) Codes**

**Acute Low Back Pain with Mobility Deficits**

Body functions:  
b28013  Pain in back  
b28018  Pain in body part, specified as pain in buttock, groin, and thigh  
b7101  Mobility of several joints  
b7108  Mobility of joint functions, specified as mobility in a vertebral segment

Body structure:  
s76001  Thoracic vertebral column  
s76002  Lumbar vertebral column  
s7401  Joints of pelvic region

Activities and participation:  
d4108  Bending

**Sub Acute Low Back Pain with Mobility Deficits**

Body functions:  
b28013  Pain in back  
b28018  Pain in body part, specified as pain in buttock, groin, and thigh  
b7101  Mobility of several joints  
b7108  Mobility of joint functions, specified as mobility in a vertebral segment

Body structure:  
s76001  Thoracic vertebral column  
s76002  Lumbar vertebral column  
s7401  Joints of pelvic region  
s7402  Muscles of pelvic region  
s75001  Hip joint  
s75002  Muscles of thigh  
s75003  Ligaments and fascia of thigh
Activities and participation: d4108 Bending

**Acute Low Back Pain with Movement Coordination Impairments**

Body functions:
- b28013 Pain in back
- b28015 Pain in lower limb
- b7601 Control of complex voluntary movements

Body structure:
- s7601 Muscles of trunk
- s7602 Ligaments and fasciae of trunk
- s7402 Muscles of pelvic region

Activities and participation:
- d4106 Shifting the body’s centre of gravity
- d4158 Maintaining a body position, specified as maintaining alignment of the trunk, pelvis and lower extremities such that the lumbar vertebral segments function in a neutral, or mid-range, position

**Sub Acute Low Back Pain with Movement Coordination Impairments**

Body functions:
- b28013 Pain in back
- b28015 Pain in lower limb
- b7601 Control of complex voluntary movements

Body structure:
- s7601 Muscles of trunk
- s7602 Ligaments and fasciae of trunk
- s7402 Muscles of pelvic region
- s75001 Hip joint
- s75002 Muscles of thigh
- s75003 Ligaments and fascia of thigh

Activities and participation:
- d4106 Shifting the body’s centre of gravity
- d4158 Maintaining a body position, specified as maintaining alignment of the trunk, pelvis and lower extremities such that the lumbar vertebral segments function in a neutral, or mid-range, position
- d4153 Maintaining a sitting position
- d4108 Bending
- d4302 Carrying in the arms
- d4303 Carrying on shoulders, hip and back
- d5701 Managing diet and fitness
- d2303 Completing the daily routine
- d6402 Cleaning living area
- d6601 Assisting others in movement
- d9202 Arts and culture
Chronic Low Back Pain with Movement Coordination Impairments

Body functions:
- b28013 Pain in back
- b28015 Pain in lower limb
- b7601 Control of complex voluntary movements

Body structure:
- s7601 Muscles of trunk
- s7602 Ligaments and fasciae of trunk
- s7402 Muscles of pelvic region
- s75001 Hip joint
- s75002 Muscles of thigh
- s75003 Ligaments and fascia of thigh

Activities and participation:
- d4106 Shifting the body’s centre of gravity
- d4158 Maintaining a body position, specified as maintaining alignment of the trunk, pelvis and lower extremities such that the lumbar vertebral segments function in a neutral, or mid-range, position
- d4153 Maintaining a sitting position
- d4108 Bending
- d4302 Carrying in the arms
- d4303 Carrying on shoulders, hip and back
- d5701 Managing diet and fitness
- d2303 Completing the daily routine
- d6402 Cleaning living area
- d6601 Assisting others in movement
- d9201 Sports
- d9202 Arts and culture
- e1151 Assistive products and technology for personal use in daily living
- e1351 Assistive products and technology for employment
- e1351 Assistive products and technology for culture, recreation, and sport

Acute Low Back Pain with Related Lower Extremity Pain

Body functions:
- 28013 Pain in back
- 28015 Pain in lower limb
- b7101 Mobility of several joints

Body structure:
- s76002 Lumbar vertebral column

Activities and participation:
- d4153 Maintaining a sitting position
d4158 Maintaining a body position, specified as maintaining the lumbar spine in an extended, or neutral position, such as when getting in and out of a sitting or standing position, or when lifting, carrying, or putting down objects

**Acute Low Back Pain with Radiating Pain**

**Body functions:**
- 28013 Pain in back
- b2803 Radiating pain in a dermatome
- b789 Movement functions, specified as mobility of the meninges, peripheral nerves and adjacent tissues

**Body structure:**
- s1201 Spinal nerves
- s130 Structure of meninges

**Activities and participation:**
- d4108 Bending
- d4150 Maintaining a lying position
- d4154 Maintaining a standing position
- d4158 Maintaining a body position, specified as maintaining a slump or long-sitting position
- d4751 Driving motorized vehicles

**Sub Acute Low Back Pain with Radiating Pain**

**Body functions:**
- 28013 Pain in back
- b2803 Radiating pain in a dermatome
- b789 Movement functions, specified as mobility of the meninges, peripheral nerves and adjacent tissues

**Body structure:**
- s1201 Spinal nerves
- s130 Structure of meninges
- s75002 Muscles of thigh
- s75003 Ligaments and fascia of thigh

**Activities and participation:**
- d4108 Bending
- d4150 Maintaining a lying position
- d4154 Maintaining a standing position
- d4158 Maintaining a body position, specified as maintaining a slump or long-sitting position
- d4751 Driving motorized vehicles
**Chronic Low Back Pain with Radiating Pain**

Body functions:
- 28013 Pain in back
- b2803 Radiating pain in a dermatome
- b789 Movement functions, specified as mobility of the meninges, peripheral nerves and adjacent tissues

Body structure:
- s1201 Spinal nerves
- s130 Structure of meninges
- s75001 Hip joint
- s75002 Muscles of thigh
- s75003 Ligaments and fascia of thigh

Activities and participation:
- d4108 Bending
- d4150 Maintaining a lying position
- d4154 Maintaining a standing position
- d4158 Maintaining a body position, specified as maintaining a slump or long-sitting position
- d4751 Driving motorized vehicles

**Acute or Sub Acute Low Back Pain with Related Cognitive or Affective Tendencies**

Body functions:
- b2703 Sensitivity to a noxious stimulus
  (Sensory function of sensing painful or uncomfortable sensations)
- b1522 Range of emotion
  (Mental functions that produce the spectrum of experience of arousal of affect or feelings such as love, hate, anxiousness, sorrow, joy, fear and anger)
- b1608 Thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons
- b1528 Emotional functions, specified as the tendency to elaborate physical symptoms for emotional/affective reasons

Activities and participation:
- d2303 Completing the daily routine
- d5701 Managing diet and fitness
- d129 Purposeful sensory experiences, specified as repetitive perception of non-injurious sensory stimuli
# Chronic Low Back Pain with Related Generalized Pain

**Body functions:**

- **b2800** Generalized pain
  - (Sensation of unpleasant feeling indicating potential or actual damage to some body structure felt all over, or throughout the body)

- **b1520** Appropriateness of emotion
  - (Mental functions that produce congruence of feeling or affect with the situation, such as happiness at receiving good news)

- **b1602** Content of thought
  - (Mental functions consisting of the ideas that are present in the thinking process and what is being conceptualized. Inclusions: impairments of delusions, overvalued ideas and somatization)

**Body structure:**

- **s1100** Structure of cortical lobes
- **s1101** Structure of midbrain
- **s1102** Structure of diencephalon
- **s1103** Basal ganglia and related structures
- **s1104** Structure of brainstem
- **s1200** Structure of spinal cord

**Activities and participation:**

- **d7105** Physical contact in relationships
  - (Making and responding to bodily contact with others, in a contextually and socially appropriate manner)

- **d7203** Interacting according to social rules
  - (Acting independently in social interactions and complying with social conventions governing one’s role, position or other social status in interactions with others)
CLINICAL GUIDELINES

IMPAIRMENT/FUNCTION-BASED DIAGNOSIS

PREVALENCE

Expert opinion has likened the frequency of low back pain experienced by modern society to an “epidemic” and reports in the literature consistently support this view. A Dutch postal questionnaire study demonstrated that low back pain was the most prevalent form of musculoskeletal pain reported by adults 25 years of age and older. Specifically, the point prevalence of low back pain in the study was 26.9% (95% CI = 25.5-28.3), which was significantly higher than the point prevalence of the next two most common categories; shoulder pain = 20.9% (95% CI = 19.6-22.2); and neck pain = 20.6% (95% CI = 19.3-21.9).

While it is clear that individuals in all strata of society commonly experience low back pain, its prevalence does appear to vary based on factors like sex, age, occupation, and socioeconomic status. Women tend to have a higher prevalence of low back pain than men, although the differences reported vary in magnitude. For example, in the previously mentioned Dutch study, the point prevalence for women was 28.1% (95% CI = 26.1 – 30.1) and for men was 25.6% (95% CI = 23.5 – 27.7). In a study involving Arabic subjects, the difference in overall prevalence was larger, reported as 56.1% for males and 73.8% in females. An increase in age is also associated with higher prevalence of low back pain. In a Greek population-based study, the odds of experiencing any low back pain in the past month were significantly higher for the 46-65 (OR = 1.82; 95% CI = 1.38 – 2.38) and 66+ (OR = 2.70; 95% CI = 1.85 – 3.93) year old categories, when compared to those 45 years old and younger. In a Danish study of 12 – 41 year olds, the prevalence of low back pain in the past year increased from 7% for 12-year olds to 56% for 41 year olds. A separate epidemiological review suggests that this trend in increasing prevalence of low back pain continues past 41 and peaks in the 6th decade of life. After the 6th decade, the prevalence of LBP appears to level and eventually decline in the later decades.

Occupational differences in low back pain prevalence are demonstrated in a study of Chinese workers. A 50% annual prevalence rate of low back pain (defined as lasting 24 hours or more) was reported, but this rate was significantly higher for garment workers than teachers (74% vs. 40%). In a study involving 1,562 Canadian utility workers, lifetime and point prevalence of low back pain was 60% and 11%, respectively. In this same sample, low back pain prevalence was significantly higher in workers who had jobs that were physically demanding or involved heavy lifting. In a group of 288 scaffolders who were followed for 3 years, 60% experienced low back pain in the past year and the prevalence was significantly associated with high material handling or job demand. It is interesting to note that although differences exist between different occupational groups, similar low back pain prevalence rates have been reported between working and non-working groups.
There are specific socioeconomic factors that appear to be associated with the prevalence of low back pain. In the previously mentioned Greek study, being married resulted in an OR = 1.53 (95% CI = 1.15 – 2.03) for experiencing low back pain in the past month and the study of Canadian utility workers found a similar association between low back pain and marriage. In addition, lower educational levels have been linked with higher prevalence of low back pain, and social classes involving unskilled occupations have been weakly linked with a higher prevalence of low back pain.

**PATHOANATOMICAL FEATURES**

Any innervated structure in the lumbar spine can cause symptoms of low back and referred pain into the extremity or extremities. This long list of potential pain generators includes the muscles, ligaments, dura mater and nerve roots, zygapophyseal joints, annulus fibrosis, thoracolumbar fascia, and vertebrae. One might expect that improving the resolution of imaging technology increased the likelihood of detecting a link between pathology and pain in the lumbar spine. However, the determination of a pathoanatomic origin of low back pain is made difficult by the rate of false-positive findings on imaging studies; that is, subjects without low back pain showing abnormal findings. For example, evidence of herniated disc material is shown on computed tomography scan, magnetic resonance imaging (MRI), and myelography, in 20% to 76% of persons with no sciatica. Furthermore, Savage et al. reported that 32% of asymptomatic subjects had had ‘abnormal’ lumbar spines (evidence of disc degeneration, disc bulging or protrusion, facet hypertrophy, or nerve root compression) and only 47% of subjects who were experiencing low back pain had an abnormality identified.

In longitudinal studies, low back pain can develop in the absence of any associated change in radiographic appearance of the spine. Boos et al. followed asymptomatic patients with a herniated disc for five years and determined that physical job characteristics and psychological aspects of work were more powerful than MRI-identified disc abnormalities in predicting the need for low back pain-related medical consultation. Thus, the association between clinical complaints and concurrent pathological examination and radiological findings must be considered cautiously.

There are instances when the anatomy of the lumbar spine may be relevant, such as lumbar spinal stenosis, herniated nucleus pulposus and various bony abnormalities, such as spondylolisthesis. Perhaps one of the most recognized pathoanatomical diagnoses that can be relevant to a patient’s complaints is lumbar spinal stenosis, which is defined as any narrowing of the central canal or intervertebral foramina at one or multiple levels that can compress nerves and related structures. Lumbar spinal stenosis is being diagnosed increasingly in older people as advanced imaging studies become more widely available and clinicians become more familiar with the presentation of this condition. Lumbar spinal stenosis symptoms include lower-back pain and groin and leg pain,
numbness, or weakness. Neurogenic claudication is the hallmark symptom\textsuperscript{211,259}, but not all patients report it. Patients with symptoms suggestive of lumbar spinal stenosis require a careful history and physical examination to assess symptom severity, functional impairment, and to identify other clinical disorders that can present with similar symptoms. Similar to other radiographic findings whereby symptoms are not highly associated with pathology\textsuperscript{104,288} the finding of lumbar spinal stenosis must be interpreted cautiously and corroborated with patient signs and symptoms. Similarly, diagnoses of herniated nucleus pulposus and bony abnormalities should be accompanied with corroborative clinical findings, such as compressive nerve root signs and symptoms. Even when present, however, establishing a direct cause and effect between the pathological finding and the patient condition has proven to be elusive.

**CLINICAL COURSE**

Classically, the course of low back pain has been described to consist of acute, sub acute, and chronic phases, with temporal definitions typically associated with each phase. Different operational definitions have been reported in the literature, but commonly accepted definition for the acute phase is between 0 - 1 month since episode of low back pain the sub acute phase is between 2 - 3 months since episode of low back pain, and the chronic phase is greater than 3 months since episode of LBP. The prognosis of low back pain appears to be favorable, predictable, and static when these temporal definitions are used.

Since low back pain is often recurrent in nature, exclusive use of temporal definitions to describe its course has been challenged in the literature.\textsuperscript{263,264,266} The primary argument is that when low back pain is recurrent the time to improvement from a single episode does not accurately describe its outcome. This is not purely an academic issue, as the prognosis of low back pain changes when the influence of recurrence is considered. Of patients with acute low back pain who were followed for 1 year, 65% reported 1 or more additional episodes.\textsuperscript{18} In that same study, 2 months was the median time to another episode of LBP and 60 days was the median time to experience LBP in the year. Other studies have reported lower, but still substantial, recurrence rates ranging from to 20% - 35% (between 6 – 22 months)\textsuperscript{38} to 45% (4 years).

When these other factors are considered, the prognosis for LBP becomes less favorable and more variable. At 1-year follow-up of primary care back patients, 69% of patients with recent onset (within the past 6 months) of LBP reported having pain in the last month.\textsuperscript{265} Only 21% of these patients were pain free at 1-year, with 55% reporting low disability and pain intensity, 10% reporting low disability and high pain intensity, and 14% reporting high disability with varying amounts of pain intensity.\textsuperscript{265} Similar trends were noted for the 82% of patients with prevalent (onset longer than the past 6 months) LBP that reported having pain in the last month.\textsuperscript{265} At 1-year follow-up, only 12% were pain-free, with 52% reporting low disability and pain intensity, 16% reporting low disability and high pain intensity, and 20% reporting high disability with varying amounts of
The clinical course of low back pain can be described as acute, sub acute, transient, recurrent, or chronic. Given preponderance of recurrent and chronic low back pain and the associated costs, clinicians should place high priority on interventions that prevent (1) recurrences and (2) the transition to chronic low back pain.

**DIAGNOSIS/CLASSIFICATION**

Attempts to identify effective interventions for individuals with LBP have been largely unsuccessful, with most interventions being found to be ineffective or having only marginal effect sizes. Most of the interventions studies have taken an approach whereby low back pain is treated as a homogeneous entity once medical red flags and nerve root compression are excluded. Most clinicians, however, perceive that recognizable subgroups exist, and researchers agree that clinical care may be improved with effective sub-grouping methods. The utility of sub-grouping based on pathoanatomy is limited by an inability to identify a pathological mechanism for most patients. Emphasis in the development of sub-grouping methods for conservative care has therefore been placed on patterns of signs and symptoms from the clinical examination. The development of classification systems has been identified as a priority among researchers in the primary care management of patients with LBP. This challenge has been taken on largely by researchers who have focused on non-surgical interventions with the goal of identifying sub-groups of patients in whom tailored interventions can be administered with the goal of more rapid recovery.

The best available evidence supports a classification approach that de-emphasizes the importance of identifying specific anatomical lesions after red flag screening is completed. While many interventions have been dismissed as either ineffective or accompanied with small effect sizes, recent reports in the literature suggesting that interventions based on sub-group classification have the potential to enhance effect sizes over studies where the identical interventions administered in a one-size fits-all approach.

There are a variety of low back pain classifications described in the literature. The underlying premise is that classifying patients into groups based on clinical characteristics and matching these patient subgroups to management strategies likely to benefit them will improve the outcome of physical therapy interventions. Therefore, the authors of this guideline recommend a synthesis of these classification approaches by highlighting particular subgroups of LBP that have high levels of evidence supporting their identification and management. The classification system described by Fritz et al uses information from the history and physical examination to place patients into 1 of 4 separate treatment subgroups. The labels of these 4 subgroups, which are mobilization, specific exercise, immobilization, and traction, intend to capture the primary focus of the
physical therapy intervention. Fritz et al,\textsuperscript{95} utilizing a randomized clinical trial of 78 patients with acute, work-related low back pain, reported that patients who received interventions matched with their impairments of body function found during the physical examination had better outcomes than patients who received interventions that were not matched with their physical examination findings. The classification system described in this practice guideline linked to the ICF, parallels the Fritz et al\textsuperscript{94} classification with 2 noteworthy differences. The first difference is that the labels in this clinical practice guideline incorporate the following ICF impairments of body functions terminology: Low back pain with mobility deficits, low back pain with movement coordination impairments, low back pain with related lower extremity pain, low back pain with radiating pain and low back pain with related generalized pain. The second difference is the addition of additional treatment categories to expand upon the classification system previously described. For example a “Generalized Pain” category to provide a classification for patients with longstanding pain who, in addition to movement related impairments of body function, have impairments of sensory function (generalized pain) and impairments of mental functioning (appropriateness of emotion, content of thought).

These clinical guidelines will expanded on the work of others\textsuperscript{222, 245} in attempting to incorporate the ICF model into low back pain management. Specifically, these clinical guidelines will describe the diagnostic classification categories using ICF impairment of body functions terminology and linked those categories to the associated ICD condition. These clinical guidelines will also incorporate the patient's level of acuity in the description of the impairment of body functions category, describing the impairment category/pattern as either acute, sub acute or chronic. In addition to the temporal definitions typically associated with the acute, sub acute, and chronic phases of a patient's low back pain episodes, the level of acuity in these clinical guidelines will also incorporate the relation of the patient's reported pain to active movements that the patient performs, such as bending, or to passive movements that the clinician utilizes during the physical examination of the patient, such as segmental motion testing or straight leg raising. Pain that occurs during the initial to mid ranges of active or passive movements will be a clinical finding associated with an acute condition. Pain that occurs during the mid ranges of active or passive movements will be a clinical finding associated with a sub acute condition. And pain that occurs only at the end ranges of active or passive movements will be a clinical finding associated with a chronic condition. Where there is suspected tissue injury, these movement/pain relations also incorporate the common clinical findings of (1) an acute injury in the inflammatory phase of tissue healing where pain precedes the presence of tissue resistance during performance of an active or passive movement, (2) a sub acute presentation in the fibrogenesis/tissue proliferation phase of tissue healing where pain occurs concomitant with tissue resistance, and (3) a chronic presentation where tissue remodeling is occurring or has occurred where pain is present only at end ranges - after the onset of tissue resistance - during performance of an active or passive movement.
In the randomized clinical trials suggesting that interventions based on impairment-based classifications are an effective strategy for management of low back pain, the subjects in the impairment-based classification groups were reevaluated continually during the patient’s episode of care and, if the patient’s examination finding changed resulting in a new classification, the treatment was altered to match the new classification. Thus, it is important for clinicians to reassess and adjustment of the treatment program on the basis of changes in physical examination findings. In addition, when using impairment-based classification approaches, patients with low back pain often fit more than one impairment/function-based category, or do not definitively fit a single category. Therefore, clinicians must realize that the most relevant impairments of body function, primary intervention strategy, and the associated impairment/function-based category(ies) may change during the patient's episode of care and that the expectation is to categorize the majority of patients, not all of them.

The ICD diagnosis of *lumbosacral segmental/somatic dysfunction* and the associated ICF diagnosis of **acute low back pain with mobility deficits** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Acute low back, buttock or thigh pain (duration < 16 days)
- Restricted lumbar range of motion and segmental mobility
- Low back and low back-related lower extremity symptoms reproduced with provocation of the involved lower thoracic, lumbar or sacroiliac segments

The ICD diagnosis of *lumbosacral segmental/somatic dysfunction* and the associated ICF diagnosis of **sub acute low back pain with mobility deficits** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Sub acute, unilateral, low back, buttock or thigh pain
- Symptoms reproduced with *end-range* spinal motions and provocation of the involved lower thoracic, lumbar or sacroiliac segments
- Presence of thoracic, lumbar, pelvic girdle, or hip active, segmental, or accessory mobility deficits

The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **acute low back pain with movement coordination impairments** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Acute exacerbation of recurring low back pain and associated (referred) lower extremity pain
- Symptoms produced with *initial* to *mid-range* spinal movements and provocation of the involved lumbar segment(s)
- Movement coordination impairments of the lumbopelvic region with low back flexion and extension movements

The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **sub**
**Acute low back pain with movement coordination impairments** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Sub acute exacerbation of recurring low back pain and associated (referred) lower extremity pain
- Symptoms produced with *mid-range* motions that *worsen with end range* movements or positions and provocation of the involved lumbar segment(s)
- Lumbar segmental hypermobility may be present
- Mobility deficits of the thorax and pelvic/hip regions may be present
- Diminished trunk or pelvic region muscle strength and endurance
- Movement coordination impairments while performing self care/home management activities

The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **chronic low back pain with movement coordination impairments** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Chronic, recurring low back pain and associated (referred) lower extremity pain
- Presence of one or more of the following:
  - Low back and/or low back-related lower extremity pain that *worsens with sustained end-range* movements or positions
  - Lumbar hypermobility with segmental motion assessment
  - Mobility deficits of the thorax and lumbopelvic/hip regions
  - Diminished trunk or pelvic region muscle strength and endurance
  - Movement coordination impairments while performing community/work related recreational or occupational activities

The ICD diagnosis of *flatback syndrome*, or *lumbago due to displacement of intervertebral disc*, and the associated ICF diagnosis of **acute low back pain with related lower extremity pain** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Low back pain and associated (referred) lower extremity pain that worsens with flexion activities and sitting
- Low back and lower extremity pain that can be centralized and diminished with specific postures and/or repeated movements
- Lateral trunk shift, reduced lumbar lordosis, limited lumbar extension mobility, and clinical findings associated with the Sub Acute or Chronic Low Back Pain with Movement Coordination Impairments category are commonly present

The ICD diagnosis of *lumbago with sciatica* and the associated ICF diagnosis of **acute low back pain with radiating pain** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Acute low back pain with associated radiating pain in the involved lower extremity
Lower extremity paresthesias, numbness, and weakness may be reported. Symptoms are reproduced or aggravated with initial to mid-range spinal mobility, lower limb tension/straight leg raising, and/or slump tests. Signs of nerve root involvement may be present.

It is common for the symptoms and impairments of body function in patients who have acute low back pain with radiating pain to also be present in patients who have acute low back pain with related lower extremity pain.

The ICD diagnosis of lumbago with sciatica and the associated ICF diagnosis of sub acute low back pain with radiating pain is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Sub acute, recurring, mid-back and/or low back pain with associated radiating pain and potential sensory, strength, or reflex deficits in the involved lower extremity.
- Symptoms are reproduced or aggravated with mid-range and worsen with end range lower limb tension/straight leg raising and/or slump tests.

The ICD diagnosis of lumbago with sciatica and the associated ICF diagnosis of chronic low back pain with radiating pain is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Chronic, recurring, mid back and/or low back pain with associated radiating pain and potential sensory, strength, or reflex deficits in the involved lower extremity.
- Symptoms are reproduced or aggravated with sustained end-range lower limb tension/straight leg raising and/or slump tests.

The ICD diagnosis of low back pain/low back strain/lumbago and the associated ICF diagnosis of acute or sub acute low back pain with related cognitive or affective tendencies is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Acute or sub acute low back and/or low back-related lower extremity pain.
- Presence of one or more of the following:
  - Two positive responses to Primary Care Evaluation of Mental Disorders for depressive symptoms.
  - High scores on the Fear-Avoidance Beliefs Questionnaire and behavior consistent with an individual who has excessive anxiety or fear.
  - High scores on the Pain Catastrophizing Scale and cognitive processes consistent with individuals with high helplessness, rumination, or pessimism about low back pain.

The ICD diagnosis of low back pain/low back strain/lumbago and the associated ICF diagnosis of chronic low back pain with related generalized pain is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Low back and/or low back-related lower extremity pain with symptom...
duration for > 3 months
- Generalized pain not consistent with other impairment-based classification criteria presented in this clinical guideline
- Presence of depression, fear-avoidance beliefs, and/or pain catastrophizing

Low back pain, without symptoms or signs of serious medical or psychological conditions, associated with 1) mobility impairment in the thoracic, lumbar, or sacroiliac regions, 2) referred or radiating pain into a lower extremity, and 3) generalized pain are useful clinical findings for classifying a patient with low back pain into the following International Statistical Classification of Diseases and Related Health Problems (ICD) categories: low back pain, lumbago, lumbosacral segmental/somatic dysfunction, low back strain, spinal instabilities, flatback syndrome, lumbago due to displacement of intervertebral disc, lumbago with sciatica, and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of low back pain (b28013 Pain in back, b28018 Pain in body part, specified as pain in buttock, groin, and thigh) and the following, corresponding impairments of body function:

- Acute low back pain with mobility deficits (b7101 Mobility of several joints)
- Sub acute low back pain with mobility deficits (b7101 Mobility of several joints)
- Acute low back pain with movement coordination impairments (b7601 Control of complex voluntary movements)
- Sub acute low back pain with movement coordination impairments (Control of complex voluntary movements)
- Chronic low back pain with movement coordination impairments (Control of complex voluntary movements)
- Acute low back pain with related lower extremity pain (28015 Pain in lower limb)
- Acute low back pain with radiating pain (b2804 Radiating pain in a segment or region)
- Sub acute low back pain with radiating pain (b2804 Radiating pain in a segment or region)
- Chronic low back pain with radiating pain (b2804 Radiating pain in a segment or region)
- Acute or sub acute low back pain with related cognitive or affective tendencies (b2703 Sensitivity to a noxious stimulus, b1522 Range of emotion, b1608 Thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons, b1528 Emotional functions, specified as the tendency to elaborate physical symptoms for emotional/affective reasons)
- Chronic low back pain with related generalized pain (b2800 Generalized pain, b1520 Appropriateness of emotion, b1602 Content of thought)
Differential Diagnosis

A primary goal of diagnosis is to match the patient’s clinical presentation with the most efficacious treatment approach. A component of this decision is determining whether the patient is, in fact, appropriate for physical therapy management. Clinical findings that increase the level of suspicion that there is a serious medical condition presenting as common, non-serious, musculoskeletal conditions, are commonly described as “red flags.” Table 4 lists examples of red flags for the low back region.21

In the vast majority of patients with low back pain, symptoms can be attributed to non-specific mechanical factors. However, in a much smaller percentage of patients, the cause of back pain may be something more serious, such as cancer,75 cauda equina syndrome,77 spinal infection,272 spinal compression fractures,128 spinal stress fractures,129 ankylosing spondylitis,116 or aneurysm.88 Clinicians must be aware of the key signs and symptoms associated with serious pathological low back conditions, develop a system to continually screen for the presence of these conditions, such as administering medical screening questionnaires that question patients regarding the nature, onset, and progression of their symptoms, specific movements or positions that make the symptoms better or worse, and any 24-hour pattern of symptom behavior. Clinicians should initiate referral to the appropriate medical practitioner when a potentially serious medical condition is suspected.

There is some specific research investigating red flags and spinal fractures from Henschke et al.128, 129 In a systematic review of 12 studies this group identified 5 factors consistent with identifying spinal fractures, including age greater than 50 years (+LR = 2.2, -LR = 0.34), female gender (+LR = 2.3, -LR = 0.67), history of major trauma (+LR = 12.8, -LR = 0.37), pain and tenderness (+LR = 6.7, -LR = 0.44), and distracting painful injury (+LR = 1.7, -LR = 0.78).128 In a follow up study involving an inception cohort of patients seeking primary care treatment for low back pain, the rate of serious pathology was quite low (0.9%) with most of the identified red flag cases being fracture (8/11). Because most patients had at least 1 red flag, these authors cautioned against use of isolated red flags because of poor diagnostic accuracy. They also developed a diagnostic prediction rule for identifying spinal fracture and it included being female, older than 70 years old, and prolonged used of corticosteroids.

Clinicians must be aware of the key signs and symptoms associated with serious pathological low back conditions, develop a system to continually screen for the presence of these conditions, such as administering medical screening questionnaires that question patients regarding the nature, onset, and progression of their symptoms, specific movements or positions that make the symptoms better or worse, and any 24-hour pattern of symptom behavior. Clinicians should initiate referral to the appropriate medical practitioner when a potentially serious medical condition is suspected.

In addition to medical conditions, clinicians should be aware of psychological
and social factors that may be contributing to a patient’s persistent pain and
disability, or that may contribute to the transition of an acute condition to a
chronic, disabling condition. Researchers have shown that psychosocial factors
are an important prognostic indicator of prolonged disability. Identification of
psychological factors is assisted with the use of standard questionnaires
described in the Measures section of this clinical guideline. When relevant
psychological factors are identified, the rehabilitation approach should be
modified to emphasize active rehabilitation, graded exercise programs, positive
reinforcement of functional accomplishments, and/or graduated exposure to
specific activities that a patient fears as potentially painful or difficult to perform.
These approaches will be described in the Interventions section of this clinical
guideline. Severe psychiatric disturbances (e.g., clinical depression) should be
screened and referred for appropriate care. For example, use of the Primary Care
Evaluation of Mental Disorders tool has been described for depression screening
in physical therapy settings.

Clinicians should consider diagnostic classifications associated with serious
pathological conditions or psychosocial factors and initiate referral to the
appropriate medical practitioner when (1) the patient's clinical findings are
suggestive of serious medical or psychological pathology, (2) the reported
activity limitations or impairments of body function and structure are not
consistent with those presented in the diagnosis/classification section of this
guideline, or (3) when the patient’s symptoms are not resolving with
interventions aimed at normalization of the patient’s impairments of body
function.
<table>
<thead>
<tr>
<th>Condition</th>
<th>History and Physical Examination Data</th>
<th>Likelihood Ratio</th>
<th>Odds Ratio (95% CI)</th>
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<tbody>
<tr>
<td><strong>Back related tumor</strong></td>
<td>Constant pain not affected by position or activity; worse with weight-bearing, worse at night</td>
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<td></td>
<td>Age over 50</td>
<td>14.7</td>
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<td></td>
<td>History of cancer</td>
<td>2.7</td>
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<td>Failure of conservative intervention</td>
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<td>Unexplained weight loss</td>
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<td>Ambiguous presentation in early stages</td>
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<td></td>
<td>Erythrocyte sedimentation rate ≥ 20 mm/hr</td>
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<td>Erythrocyte sedimentation rate ≥ 50 mm/hr</td>
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<td>Erythrocyte sedimentation rate ≥ 100 mm/hr</td>
<td>55.5</td>
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<td><strong>Cauda equina syndrome</strong></td>
<td>Urine retention or incontinence</td>
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<td>Fecal incontinence</td>
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<td>Saddle anesthesia</td>
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<td>Global or progressive weakness in the lower extremities</td>
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<td>Sensory deficits in the feet (L4, L5, S1 areas)</td>
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<td>Ankle dorsiflexion, toe extension, and ankle plantar flexion weakness</td>
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<tr>
<td><strong>Back related infection</strong></td>
<td>Recent infection (e.g., urinary tract or skin infection)</td>
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<td>Intravenous drug user/abuser</td>
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<td></td>
<td>Concurrent immunosuppressive disorder</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deep constant pain, increases with weight bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fever, malaise, and swelling</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Spine rigidity; accessory mobility may be limited</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fever: Tuberculosis osteomyelitis</td>
<td>13.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fever: Pyogenic osteomyelitis</td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fever: Spinal epidural abscess</td>
<td>41.5</td>
<td></td>
</tr>
<tr>
<td><strong>Spinal compression fracture</strong></td>
<td>History of major trauma, such as an vehicular accident, fall from a height, or direct blow to the spine For osteoporotic or elderly individuals, the trauma may be minor, including a heavy lifting maneuver</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age over 50</td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age over 70</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prolonged use of corticosteroids</td>
<td>12.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Loss of function or mobility</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Point tenderness over site of fracture</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased pain with weight-bearing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Edema in local area</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Abdominal aneurysm (≥4cm)</strong></td>
<td>Back, abdominal, or groin pain</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presence of peripheral vascular disease or coronary artery disease and associated risk factors (&gt;50 years old, smoker, hypertension, diabetes mellitus)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Smoking history</td>
<td>5.07 (4.13-6.21)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Family history</td>
<td>1.94 (1.63-2.32)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age</td>
<td>1.71 (1.61-1.82)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-Caucasian</td>
<td>1.02 (0.77-1.35)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>0.18 (0.07-0.48)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Symptoms not related to movement stresses associated with somatic LBP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abdominal girth ≤ 100cm</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Presence of a bruit in the central epigastric area upon auscultation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Abnormal width of aortic or iliac arterial pulses: Each 1cm increase in abdominal aortic aneurysm diameter</td>
<td>1.95 (1.06-3.58)</td>
<td></td>
</tr>
</tbody>
</table>
IMAGING STUDIES

Imaging modalities have frequent false positive and negative results, limiting their utility in identification of active anatomic pain generators. Therefore, the utility of imaging lies in interventional and/or surgical planning or ruling out of red flags as noted above. For these purposes, lumbar MRI represents the most useful tool. However, routine ordering of imaging for low back pain should be discouraged. In particular, imaging in acute low back pain has not been shown to yield significant new findings or alter outcomes. In chronic low back pain, the role of routine diagnostic imaging is even less well established. Current recommendations from the American College of Physicians are that 1) imaging is only indicated for severe progressive neurological deficits or when red flags are suspected, and 2) routine imaging does not result in clinical benefit and may lead to harm.

Low back pain with mobility deficits
As this is described as acute symptoms, lasting less than 16 days, in the absence of red flag signs, no imaging is indicated.

Low back pain with movement coordination impairments
Poor trunk muscle function has been associated with back pain, though it is not clear if this is a cause or a consequence of back pain. Nevertheless, this represents the basis for treatment efforts designed to improve the firing pattern of the muscle involved in stabilization of the lumbar spine. On imaging, multiple techniques have been used to assess the lumbar muscles. In examining the cross sectional area of the multifidus muscle in patients with acute low back pain, muscle atrophy has been identified. In addition, functional activity of lumbar muscles assessed by MRI demonstrated differences in usage and signal intensity of patients with low back pain. Similarly, cross sectional area changes in the multifidus with different postures demonstrate altered patterns in patients with low back pain. In addition to changes in cross sectional area, muscle composition has also been examined. Severe fat infiltration has been shown to be strongly associated with a history of low back pain (OR 9.2) and low back pain within the last year (OR 4.1). Similarly, association has been established between trunk attenuation on CT scanning (as an assessment of fat infiltration) and functional capacity among older adults with low back pain.

Evidence exists that these observed changes can be modified with exercise based approaches. For example, the cross sectional area of the multifidus muscle in athletes with low back pain was shown to increase in response to a stabilization program involving voluntary contraction of the multifidus, transversus abdominis, and pelvic floor muscles. This change was concomitant with a decrease in pain.

These findings indicate that muscle based changes do exist in association with low back pain and can be altered with exercise based approaches. Therefore, in
considering more targeted approaches to exercise based rehabilitation, this type of information may help in guiding future specific therapies aimed at correcting aberrant muscle function as it relates to low back pain.

**Low back pain with related lower extremity pain**
Similar to low back pain with mobility impairments, in the absence of red flags, routine imaging is not indicated. In addition, among adults 65 years of age or older in whom imaging changes are ubiquitous, severity of disc and facet disease was not associated with pain severity. However, contributions from other arthritic joints should be considered. For example, in older adults with chronic low back pain, 48% had co-existing hip pain compared to 0% in the no back pain control group. If hip pathology is suspected, hip plain X-rays may assist in identifying the active pain generator. However, physical exam may assess these contributions reliably as well, obviating the need for imaging.

**Low back pain with radiating pain**
In patients with severe or progressive neurologic deficits, prompt workup with MRI or CT is recommended because delayed treatment in patients with progressive neurologic involvement is associated with poorer outcomes. In addition, if the patients are potential candidates for surgery or epidural steroid injections, MRI (or CT if unable to undergo MRI) may be indicated. In the absence of these findings, there is no evidence that routine imaging affects treatment decisions or outcomes in these patients.

**Low back pain with related generalized pain**
Evidence exists that in addition to not having additional prognostic utility, knowledge of changes on routine imaging in patients with low back pain is associated with a lesser sense of well being. This is particularly relevant in patients with generalized pain disorders, suggesting that non-indicated imaging should be strongly discouraged.

While not currently being used clinically, functional MRI (fMRI) has been used in patients with low back pain to demonstrate relationships between high sustained back pain and altered activity of brain regions involved in negative emotions. Currently being used in research studies, this may represent a useful assessment tool in the future to appreciate the brain related changes contributing to patients’ pain experience.

Therefore, while traditional imaging provides additional diagnostic insight only in select indications as outlined above, novel imaging technology which focuses on function may provide additional prognostic and therapeutic information in the future. Additional examples include technologies such as SPECT imaging, which varies with time and stability of spondylolytic processes, and diffusion weighted MRI in detection of early active disease may offer advantages over traditional imaging which assess only anatomic changes, which may or may not be active processes.
RISK FACTORS

Studies of risk factors are important because they seek to provide information about variables important in the etiology of mechanical low back pain as well as the potential for resistance to recovery from low back pain. A number of factors have been examined for their value in predicting the first onset LBP. The two major categories of suspected risk factors for LBP are individual and activity-related (work and leisure) factors. Individual factors include but are not limited to demographic, anthropometric, physical and psychosocial factors.

The individual factors for which there is the most research include genetics, gender, age, body build, strength and flexibility. Genetic factors have been linked to specific disorders of the spine such as disc degeneration. The link of heredity to development of non-specific low back pain, however, remains questionable. A study by Battie et al demonstrated that there appears to be some relationship of genetics, body build and early environmental influences in determining the degenerative changes of the spine frequently associated with aging. Degenerative changes on imaging, however, are not strongly related to low back pain symptoms, MRI and myelography findings. The trend for back pain to increase with age is supported. There is some evidence that supports back pain associated with heavy operating equipment. Cardiovascular hypertension and lifestyle (smoking, overweight, obesity) risk factors are associated with sciatica. There is inconclusive evidence for a relationship between trunk muscle strength, or mobility of the lumbar spine and the risk of low back pain.

Psychosocial factors would appear to play a larger prognostic role than physical factors in low back pain and there are some reviews that question if changes in behavioral variables and reductions of disability which facilitate an improvement in function, may be more important than physical performance factors for successful treatment of chronic low back pain. There is some evidence to suggest that fear may play a role when pain has become persistent. There is a growing consensus that distress/depression plays an important role at early stages, and clinicians should focus on these factors. Physical distress, depression, and fear avoidance are well-defined psychosocial entities that are best assessed with specific screening tools. There is no high quality evidence to support pain-drawing use as a psychological assessment tool; therefore, pain drawings are not recommended for this purpose.

Though some individual and lifestyle variables have been associated with prevalence of low back pain, the same factors may not have an influence on the recovery of patients who already have back pain. For example, a previous history low back pain, job satisfaction, educational level, marital status, number of dependants, smoking, working more than 8 hour shifts, occupation, and size of industry or company do not influence duration of sick leave due to low back pain. In addition, the clinical course for co-morbid patients, who may seem more complicated at the start of treatment, is just as favorable as for those
Consistent evidence was found for own expectations of recovery as predictor for the decision to return to work. Patients with higher expectations had less sickness absence at the moment of follow-up measurement. Consistent evidence was found for the predictive value of pain intensity (more pain associated with worse outcome), several work-related parameters (e.g., high satisfaction associated with better outcome), and coping style (active coping associated with better outcome).

In adolescents, the overall risk of LBP is similar to adults, with prevalence rates as high as 70-80% by 20 years of age. Similar to adults, girls appear to have a higher prevalence, with one study demonstrates that females have almost three-times the risk of back pain as their male counterparts. Anthropometrics (e.g., height, weight, body mass index) do not appear to be strongly associated with LBP in adolescents, nor does lumbar mobility or trunk muscle weakness. In adolescents, lifestyle factors that have been studied with respect to risk for low back pain include physical activity, sedentary activity and mechanical load. With regard to physical activity, there appears to be mixed findings, with certain activities related to specific sports (e.g., weightlifting, body building, rowing) have been associated with low back pain. In cross-sectional studies, activity and prevalence of back pain takes on a “U” shaped function with back pain increased at the sedentary and higher activity end. However, in longitudinal studies, the relationship between modifying physical activity and back pain prevalence has not been well-established. As is the case in adults, psychological and psychosocial factors are commonly increased in children with low back pain and there is some evidence that such factors can predict future onset of low back pain.

Clinicians should consider screening for factors that increase the probability of developing recurrent or chronic low back pain. Risk factors for development of recurrent pain include 1) history of previous episodes, 2) excessive mobility in spine, and 3) excessive mobility in other joints. Risk factors for development of chronic pain include 1) presence of symptoms below knee, 2) psychological distress or depression, 2) fear of pain, movement, and re-injury or low expectations of recovery, 3) pain of high intensity, and 4) a passive coping style.
SELF-REPORTED OUTCOME MEASURES

Patient-reported outcomes have become well-established in the low back pain area. Consensus documents have agreed on a “core” set of domains that should be captured in outcome assessment of low back pain, including pain, back specific function, work disability, generic health status and patient satisfaction.25, 26, 74 The most often used generic health status index is the Medical Outcomes Survey Short-Form-36 (SF-36), in particular, the Physical Functioning domain.73 The SF-36 has the distinct advantage of being more comprehensive in capturing these domains but has been reasonably responsive in trials of comparative effectiveness and also is easily transferable in cost-effectiveness studies.

For a number of reasons related to responsiveness and ease of administration, region-specific measures are more commonly used in low back pain treatment and research. The Oswestry Low Back Disability Index (ODI) is a commonly utilized outcome measure to capture perceived disability in patients with low back pain. Originally described by Fairbank et. al.,87 the ODI contains 10 items, 8 related to activities of daily living, 2 related to pain. Each item is scored from 0-5 and the total score is expressed as a percentage, with higher scores corresponding to greater disability. The ODI has long-standing recognition as an acceptable standard, with numerous studies that speak to its reliability, validity and responsiveness. Numerous studies have been undertaken to determine the error associated with the measure and the minimally important change with a most recent international consensus conference determining that the minimally important change of 10 points or 30% from baseline.199

The Roland Morris Disability Index (RMI) is a practical alternative to the ODI. Originally described by Roland and Morris,220 the questionnaire was derived from the generic Sickness Impact Profile by choosing 24 items that appeared to have face validity in describing patients with low back pain. The RMI asks patients to gauge whether or not each of the 24 items are possible to accomplish. The activities are led by the stem, “Because of my back pain,” thus allowing it to be region-specific. Like the ODI, the Roland and Morris index has excellent psychometrics, is easy to administer and has been shown to be responsive in clinical trials. Ostelo and colleagues report from a consensus conference a minimally important change of 5 points or 30% change from baseline.199

Other self-report measures have been reported, including the Quebec Back Pain Disability Scale,157 but have failed to gather widespread adoption with at least showing lower responsiveness as compared to the ODI.101 In addition, visual analog scales (VAS) and numeric pain rating scales (NRS) are in common use both in the literature and clinically. These scales have the advantage of ease of administration but fail to adequately capture the majority of the “core” areas of
Clinicians should use validated self-report questionnaires, such as the Modified Oswestry Low Back Disability Index and the Roland Morris Disability Index. These tools are useful for identifying a patient’s baseline status relative to pain, function, and disability and for monitoring a change in patient’s status throughout the course of treatment.

**ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES**

There are instances where clinicians have to rely on more than self-reported instruments in determining a person’s overall functional abilities as described in the ICF. This is especially true in decisions regarding activity limitations and participation restrictions (e.g., return to work). There are a variety of tools used to assess Functional Capacity Evaluation (FCE). A systematic review was conducted by Gouttebarge and colleagues on four commercially available FCEs: the Blankenship system, the ERGOS work simulator, the Ergo-Kit and the Isernhagen work system, which identified 12 papers for inclusion. The interrater reliability and predictive validity of the Isernhagen work system were evaluated as good. However, the systematic review concluded that more rigorous studies were needed to demonstrate the reliability and the validity of FCE methods.

Schult and Ekholm attempted to incorporate the ICF core data sets for chronic widespread pain and low back pain and compare clinical work capacity evaluations. They found that the work capacity evaluation generally agreed with the comprehensive ICF core set representing body functions, body structures, activities and participation and environmental factors. However, both assessments lacked specific on-the-job analyses that would provide critical information about job demands.

It would appear that in some instances when activity limitation and participation restriction are an expectation (e.g., chronic low back pain), outcome assessment would need to be expanded from self-reported region-specific tools to include clinician measured tools such as functional capacity evaluations.

Clinicians should routinely assess activity limitation and participation restriction through validated self-report or performance based measures. Changes in the patient’s level of activity limitation and participation restriction should be monitored with these same measures over the course of treatment.
PHYSICAL IMPAIRMENT MEASURES

LUMBAR ACTIVE RANGE OF MOTION

ICF category Measurement of impairment of body function – mobility of several joints

Description The amount of active lumbar flexion, extension, and sidebending motion measured using an inclinometer

Measurement Method Inclinometers are placed at thoracolumbar junction and on the sacrum zeroed with patient in neutral position. Patient is asked to bend forward maximally and motion is recorded at the thoracolumbar junction (total flexion measure) and at sacrum, which is presumed to be motion in the sacroiliac and hip joints. The difference in motion represents the lumbar flexion measure. Patient is then asked to bend backward and the difference in motion is the lumbar extension measure.

Nature of variable Continuous

Units of measurement Degrees

Measurement properties In a study by Saur et al., this method approximated lumbar motion obtained with radiographic measures (r=0.93 overall; r = 0.95 with flexion and r = 0.85 with extension). Inter-rater (MD and physiotherapist) was r = 0.88 for flexion standard error of measurement (SEM) = 4.6 and r= 0.42 for extension, SEM = 2.3.

Instrument variations One inclinometer methods have been described. In one method, the placement of the inclinometer is identical to Saur et al’s method but the subject bends forward twice, first with the inclinometer at the thoracolumbar junction and next with the inclinometer on the sacrum. The procedure is repeated with inclinometer placement but with the patient moving into extension. Lumbar flexion and extension are calculated as with the Saur et al method. A second method has been described in which total flexion and extension is recorded. The inclinometer is placed and zeroed at thoracolumbar junction and the subject bends forward once and the total flexion is recorded. The subject bends backward and the total extension is recorded.
## SEGMENTAL MOBILITY ASSESSMENT

<table>
<thead>
<tr>
<th>ICF category</th>
<th>Measurement of impairment of body function – mobility of joint functions, specified as mobility in a vertebral segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>With the patient prone, lower thoracic and lumbar spine segmental movement and pain response are assessed.</td>
</tr>
<tr>
<td>Measurement method</td>
<td>The patient is prone. The examiner contacts each lower thoracic and lumbar spinous process with the thumbs. The examiner should be directly over the contact area keeping elbows extended, then he/she uses the upper trunk to impart a posterior to anterior force in a progressive oscillatory fashion over the spinous process. This is repeated for each lower thoracic and lumbar segment. The pressures can be also be directed lateral to the spinous process, in the region of the zygapophyseal joints, multifidi muscles, or transverse processes. The examiner can also change his/her contact position and places the hypothenar eminence (just distal to the pisiform) of one hand over the spinous process of each lower thoracic or lumbar spinous process and repeat the same posterior to anterior forces in a progressive oscillatory fashion. The test result is considered to be positive if the patient reports reproduction of pain. The mobility of the segment is judged to be normal, hypermobile, or hypomobile. Interpretation of mobility is based on the examiner’s perception of the mobility at each spinal segment relative to those above and below the tested segment, and based on the examiner’s experience and perception of normal mobility.</td>
</tr>
<tr>
<td>Nature of variable</td>
<td>Categorical with various grades depending on the study</td>
</tr>
<tr>
<td>Units of measurement</td>
<td>Ordered or categorical</td>
</tr>
<tr>
<td>Measurement properties</td>
<td>Determining mobility: generally low reliability for ordered scales (ICC=0.25)(^2) in patient studies; kappas show poor to minimal agreement (k= -.2 - .17).(^2)</td>
</tr>
<tr>
<td>Instrument variations</td>
<td>Segmental motion is also be tested with the subject in sidelying, facing clinician with hips and knees flexed and the clinician grasping the knee and flexing and extending the hip, pelvis and lumbar spine while palpating intersegmental motion.</td>
</tr>
</tbody>
</table>
### PAIN PROVOCATION WITH SEGMENTAL MOBILITY TESTING

<table>
<thead>
<tr>
<th>ICF category</th>
<th>Measurement of impairment of body function – pain in back; pain in body part, specified as pain in buttock, groin, and thigh; and mobility of joint functions, specified as mobility in a vertebral segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Pain provocation during mobility testing</td>
</tr>
<tr>
<td>Measurement method</td>
<td>Patient is prone and examiner palpates lumbar spinous process and pushes with an anterior directed force to detect pain</td>
</tr>
<tr>
<td>Nature of variable</td>
<td>Categorical</td>
</tr>
<tr>
<td>Units of measurement</td>
<td>Present/absent</td>
</tr>
<tr>
<td>Measurement properties</td>
<td>Kappa values are moderate to good for pain provocation during spring testing of the lumbar vertebrae (k=.25-.55)^132,229</td>
</tr>
<tr>
<td>Instrument variations</td>
<td>None</td>
</tr>
</tbody>
</table>
**JUDGMENTS OF CENTRALIZATION DURING MOVEMENT TESTING**

**ICF category**
Measurement of impairment of body function – pain in back; pain in lower limb; and mobility of several joints

**Description**
Clinician judges the behavior of symptoms in response to movement testing to assess whether centralization or peripheralization occurs. Judgments of centralization requires that an accurate assessment of the patient's baseline location of symptoms is made followed by the precise application of active or passive movements and the associated assessments of any changes in the patient's baseline location of symptoms in response to the movements. Centralization occurs when the location of the patient's symptoms, such as pain or paresthesias, is perceived by the patient to be in a more proximal location in response to single and repeated movements or sustained positions. Peripheralization occurs when the location of the patient's symptoms is perceived in a more distal location, such as the calf or foot, response to single and repeated movements or sustained positions.

**Measurement method**
Patient is asked to flex and extend in the sagittal plane, or laterally shift the pelvis and trunk in the frontal plane, in standing, supine and prone with single and repeated movements in a systematic fashion. When appropriate, the clinician can manually guide the movements of the patient and apply passive overpressures to the movements. Judgments are made with regard to a directional preference of which movement, if any, produces centralization of the patient's symptoms.

**Nature of variable**
Categorical

**Units of measurement**
Present/absent

**Measurement properties**
Kappa 0.70-0.90 for novice and experienced physical therapists

**Instrument variations**
None
PRONE INSTABILITY TEST

ICF category Measurement of impairment of body function – pain in back; pain in lower limb; mobility of joint functions, specified as mobility in a vertebral segment, control of complex voluntary movements

Description The patient lies prone with the body on the examining table and legs over the edge and feet resting on the floor. While the patient rests in this position, the examiner applies posterior-to-anterior pressure to spinous processes of the lower portion of the lumbar spine. Any provocation of pain is noted. Then the patient lifts the legs off the floor (the patient may hold table to maintain position) and posterior-to-anterior pressure is again applied to the lumbar spine.

Measurement Method Positive Test - If pain is present in the resting position but subsides substantially (either reduces in severity/intensity, or resolves) in the second position, the test is positive. Mild improvement in symptoms does not constitute a positive test. Negative Test – If pain is present in the resting position, but does not subside substantially in the second position, the test is negative. Further, if the patient did not have any pain provocation with posterior-to-anterior pressures applied to the lumbar spine, then the test is judged “negative”.

Nature of variable Positive or negative

Units of measurement Categorical

Diagnostic accuracy and measurement properties Kappa is good – excellent agreement (k=.87) in 3 pairs of physical therapy raters evaluating 63 consecutive subjects currently experiencing LBP and with a previous history of LBP.
**JUDGMENTS OF THE PRESENCE OF ABERRANT MOVEMENT**

<table>
<thead>
<tr>
<th>ICF category</th>
<th>Measurement of impairment of body function – pain in back; pain in lower limb; mobility of several joints; and control of complex voluntary movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>“Aberrant movement” includes the presence of any of the following: Painful arc with flexion or return from flexion, instability catch, Gower sign, reversal of lumbopelvic rhythm,</td>
</tr>
<tr>
<td>Measurement method</td>
<td>Painful arc with flexion or return from flexion is positive if patient reports pain during movement but not at the end ranges of the motion. Instability “catch” is positive when patient deviates from straight-plane sagittal movement during flexion and extension. Gower sign is positive if the patient needs to utilize &quot;thigh-climbing&quot; on return from flexion. That is, the hands push against the anterior thighs in a sequential distal to proximal manner to diminish the load on the low back when returning to the upright position from a forward bent position. Reversal of lumbopelvic rhythm is positive if the patient, upon return from a forward bent position, suddenly bends his/her knees to extend hips shifting pelvis anterior as he/she returns to the standing position.</td>
</tr>
<tr>
<td>Nature of variable</td>
<td>Categorical</td>
</tr>
<tr>
<td>Units of measurement</td>
<td>Present/absent</td>
</tr>
<tr>
<td>Measurement properties</td>
<td>Kappa 0.60 for Aberrant Movement; variable for individual tests with (k=0.61-0.69) painful arcs being most reliable (k=0.61-0.69) in 3 pairs of physical therapy raters evaluating 63 consecutive subjects currently experiencing LBP and with a previous history of LBP.</td>
</tr>
<tr>
<td>Instrument variations</td>
<td>None (Observational)</td>
</tr>
</tbody>
</table>
STRAIGHT LEG RAISE

ICF category  Measurement of impairment of body function – radiating pain in a dermatome; and movement functions, specified as mobility of the meninges, peripheral nerves and adjacent tissues

Description  A dural and lower limb nerve mobility sign

Measurement method  Patient is supine and therapist passively lifts lower extremity flexing hip with an extended knee. Positive test is obtained with reproduction of lower extremity radiating/radicular pain

Nature of variable  Categorical

Units of measurement  Positive or Negative

Measurement properties  Kappa 0.68 for identifying pain in a dermatomal distribution\textsuperscript{268} \n
Instrument variations  None
### SLUMP TEST

<table>
<thead>
<tr>
<th>ICF Category</th>
<th>Measurement of impairment of body function – pain in back; pain in lower limb; radiating pain in a dermatome; mobility of several joints; and movement functions, specified as mobility of the meninges, peripheral nerves and adjacent tissues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Clinician judges whether symptom reproduction occurs in response to different positions of cervical spine, lumbar spine, and lower extremity.</td>
</tr>
<tr>
<td>Measurement method</td>
<td>Patient is asked to sit with cervical and lumbar spine flexed, hip flexed, knee extended, and ankle dorsiflexed. Clinician then adds overpressure at cervical spine and ankle. Judgments are made with regard to a reproduction of symptoms in this position, and relief of symptoms when cervical spine component is extended or nerve tension is relieved from one or more of the lower limb component, such as ankle plantar flexion or knee flexion.</td>
</tr>
<tr>
<td>Nature of variable</td>
<td>Categorical</td>
</tr>
<tr>
<td>Units of measurement</td>
<td>Absent, present</td>
</tr>
<tr>
<td>Measurement properties</td>
<td>Kappa: 0.83-.89 from six pairs of physical therapists of varying experience testing 93 patients receiving treatment for low back and/or leg pain.\textsuperscript{203}</td>
</tr>
</tbody>
</table>
PASSIVE HIP INTERNAL ROTATION, HIP EXTERNAL ROTATION, HIP FLEXION, AND HIP EXTENSION

ICF category: Measurement of impairment of body function – mobility of a single joint

Description: The amount of passive hip rotation and passive hip flexion measured prone and supine respectively. Although assessing the range in all 6 directions (3 planes) of hip motion is important in patients with low back pain, for brevity we included the 4 most commonly limited hip motions.

Measurement method

Hip External and Internal Rotation
The patient is positioned prone with feet over the edge of the treatment table. The hip measured is placed in 0 degree of abduction, and the contralateral hip is placed in about 30 degrees of abduction. The reference knee is flexed to 90 degrees, and the leg is passively moved to produce hip rotation. Manual stabilization is applied to the pelvis to prevent pelvic movement and also at the tibiofemoral joint to prevent motion (rotation or abduction/adduction), which could be construed as hip rotation. The motion is stopped when the extremity achieves its end of passive joint ROM or when pelvic movement is necessary for additional movement of the leg. The inclinometer is aligned vertically and along the shaft of the tibia, just proximal to the medial malleolus for both medial and lateral rotation ROM measurements. 

Hip Flexion
With the subject in the supine position, the therapist passively flexes the femur with the movement arm of the goniometer along the long axis of the femur and the stationary arm of the goniometer along the long axis of the trunk, while also monitoring the lumbar spine to avoid any posterior pelvic tilt. The patient was also asked to rate the pain experienced during the movement on a 0-10 numeric pain rating scale (NPRS).

Hip Extension
With the subject in the prone position, the therapist passively extends the femur with the movement arm of the goniometer along the long axis of the femur while the stationary arm of the goniometer is positioned in line with the long axis of the trunk, while also monitoring the lumbar spine to avoid any anterior pelvic tilt. A second therapist may assist in handling the passive movement of the femur in order to accurately align the goniometer with anatomical landmarks. The patient was also asked to rate the pain experienced during the movement on a 0-10 numeric pain rating scale (NPRS).
<table>
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**Measurement properties**

There is strong evidence to support the intrarater reliability of hip rotation (medial and lateral) range of motion measurements (reported intraclass correlation coefficient (ICC) for hip medial and lateral rotation ranged from 0.96 to 0.99). The reliability for hip flexion has been shown to be excellent ICC 0.94 [CI= 0.89-0.97]. Van Dillen reported acceptable reliability (ICC= .70-.96) for hip range of motion in patients with low back pain. Pua showed that hip flexion and extension range of motion measurements had high (ICC= .97, .86, respectively) intrarater test-retest reliability with a standard error of measurement (SEM) of 3.5° and 4.7°, respectively. The MDC, determined using previously published data, for hip flexion is 5°, meaning any change more than 5° is considered an important clinical change. The MDC for pain for hip flexion is a change of 1.2 on the 0-10 NPRS.
THE FABER (PATRICK’S) TEST

ICF category: Measurement of impairment of body function – pain in joints

Description: A test to determine the irritability of the hip joint.

Measurement method
The FABER test is administered with the subject in supine, the heel of the lower extremity to be tested placed over the opposite knee. The hip joint was passively externally rotated and abducted by placing pressure over the ipsilateral knee, while stabilizing the contralateral innominate. After being zeroed against a wall, the inclinometer was placed on the medial tibia of the lower extremity to be tested, just distal to the medial tibial condyle. The range of motion measurement was taken at the point of maximal passive resistance or at the point where the subject stopped the test secondary to pain. The patient was also asked to rate the location of the pain as well as the amount of pain experienced during the movement on a 0-10 NPRS.

Nature of variable Nominal and Continuous

Units of measurement Binary: Yes/No for same or similar hip pain; Degrees

Measurement properties Reliability of ROM measurements was excellent for the functional FABER test (ICC, 0.87) [CI= 0.78-0.94] and good intrarater reliability was demonstrated with ratings of pain using the FABER test (ICC, 0.96) [CI=0.92-0.98]. Cibulka et al found that the FABER test was responsive in detecting improvement in patients with hip pain. The MDC for the Faber test for range of motion is 8° difference in motion, while the MDC for pain is a change of more than 1.6 points of the NPRS.
THE SCOUR TEST

ICF category: Measurement of impairment of body function – pain in joints

Description: A test to determine the irritability of the hip joint.

Measurement method: The hip scour test is performed with the patient lying in the supine position while the therapist flexes and adducts the hip until resistance to movement is detected. The therapist then maintains flexion into resistance and gently moves the hip into abduction, then bringing the hip through 2 full arcs of motion. If the patient reports no pain, then the examiner repeats the test while applying long-axis compression through the femur. This test must be administered with some caution so as to not irritate the hip joint. The patient is asked to rate the pain experienced during the movement on a 0-10 numeric pain rating scale (NPRS).62

Nature of variable: Nominal

Units of measurement: Binary: Yes/No for same or similar hip pain

Measurement properties: The reliability of the Scour test is good (ICC 0.87(ICC, 0.96) (ICC, 0.96) for rating of hip pain.62 The MDC for the Scour test for pain is a change of more than 1.5 points on the 0-10 NPRS.62
MENTAL IMPAIRMENT MEASURES

The identification of affective or cognitive factors that coexist with the patient’s presentation of low back pain allows the practitioner to determine the potential psychosocial or psychological influence on the clinical presentation. A variety of methods to screen for psychological disorders have been reported in the literature with the focus being self-report questionnaires. This clinical guideline's assessment of psychological influence on low back pain will include screening for depressive symptoms, measurement of fear-avoidance beliefs and pain catastrophizing, and screening for psychological distress with composite measures.

Depression is a commonly experienced illness or mood state, with a wide variety of symptoms ranging from loss of appetite to suicidal thoughts. Depression is commonly experienced in the general population, but it appears to be more commonly experienced in conjunction with chronic low back pain. Depressive symptoms are associated with increased pain intensity, disability, medication use, and unemployment for patients with low back pain. Based on this epidemiological information, routine screening for depression should be part of the clinical diagnosis of LBP.

Effective screening for depression involves more than just generating a clinical impression that the patient is depressed. Separate studies involving spine surgeons and physical therapists have demonstrated that clinical impressions are not sensitive enough to detect depression in patients with LBP. Available evidence suggests that 2 specific questions from the Primary Care Evaluation of Mental Disorders patient questionnaire can be used to screen for depressive symptoms in physical therapy settings. The questions suggested for use are (1) “During the past month, have you often been bothered by feeling down, depressed, or hopeless?” and (2) “During the past month, have you often been bothered by little interest or pleasure in doing things?” The patient responds to the questions with “yes” or “no” and the number of yes items are totaled, giving a potential range of 0-2.

Fear-avoidance beliefs are a composite measure of the patient’s fear related to low back pain, how these beliefs may affect physical activity and work. Prospective studies suggest fear-avoidance beliefs are predictive of the development of chronic low back pain. As a result, identification of elevated fear-avoidance beliefs has been suggested to as an important component in the assessment of low back pain. The Fear-Avoidance Beliefs Questionnaire (FABQ) is commonly used to assess fear-avoidance beliefs in patients with LBP and has physical activity (FABQ-PA) and work (FABQ-W) scales. Several studies indicate that the FABQ is a reliable and valid measure, suggesting it is appropriate for use in clinical settings.

Pain catastrophizing is a negative belief that the experienced pain will inevitably result in the worst possible outcome. Pain catastrophizing is believed to be a multidimensional construct comprised of rumination, helplessness, and pessimism. Pain catastrophizing has also been linked to the development and maintenance of chronic pain syndromes. Frequent pain catastrophizing during acute low back pain was predictive of self-reported disability 6 months and 1 year later, even after considering select historical and
clinical predictors. Pain catastrophizing is measured by the Pain Catastrophizing Scale (PCS), which is a 13-item scale that assesses the degree of catastrophic cognitions a patient experiences while in pain.247

In addition to assessing psychological constructs, clinicians also have the option to screen for psychosocial distress. One example is the Orebro Musculoskeletal Pain Questionnaire (OMPQ). A systematic review found that the OMPQ had moderate ability to predict long term pain and disability, and was recommended for clinical use.143 Another example of a questionnaire to screen for psychosocial distress is the Subgroups for Targeted Treatment (STarT) Back Screening Tool. The STarT measure has demonstrated sound measurement properties in an initial study that assessed its reliability and validity.139
FEAR-AVOIDANCE BELIEFS QUESTIONNAIRE

ICF Category Measurement of impairment of body function – content of thought (mental functions consisting of the ideas that are present in the thinking process and what is being conceptualized); and thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons

Description The Fear-avoidance Beliefs Questionnaire (FABQ) assesses fear-avoidance beliefs associated with low back pain and consists of a 4-item FABQ physical activity scale (FABQ-PA), potentially ranging from 0 to 24 – when only summing responses to items 2 through 5 – and a 7-item FABQ work scale (FABQ-W), potentially ranging from 0 to 42 – when only summing responses to items 6, 7, 9, 10, 11, 12 & 15), with higher scores indicating higher levels of fear-avoidance beliefs for both FABQ scales.270 Patients rate their agreement with statements related to either physical activity or work on a 7-point Likert scale (0 = “completely disagree,” 6 = “completely agree”).270

Measurement method Self-report

Nature of variable Continuous

Units of measurement Individual items: 7-point Likert scale (0 = “completely disagree,” 6 = “completely agree”)

Measurement properties The FABQ scales have been found to have acceptable reliability.146, 202, 241, 270 Test-retest reliability has been reported for the FABQ-PA (Pearson r = 0.84 to 0.88) and FABQ-W (Pearson r = 0.91 to 0.88).241, 270 Cronbach’s alpha estimates for the FABQ-PA (ranging from .70 to .83) and FABQ-W (ranging from .71 to .88) scores suggest both scales demonstrate internal consistency.159, 241, 250, 251, 270 The FABQ-W has demonstrated predictive validity for disability and work loss in patients with LBP.99, 100, 107, 241 A suggested FABQ-W cutoff score of >29 has been suggested as an indicator of return to work status in patients receiving physical therapy for acute occupational LBP99 and a cutoff score of >22 has been suggested in non-working populations.108 An FABQ-PA cutoff score of >14, based on a median-split of the FABQ has been suggested as an indicator of treatment outcomes in LBP patients seeking care from primary care or osteopathic physicians.35 Data from 2 separate physical therapy intervention clinical trials indicated that the FABQ-W cutoff score (>29) was a better predictor of self-reported disability at 6-months in comparison to the FABQ-PA cutoff score (>14).108
PAIN CATASTROPHIZING SCALE

ICF Category  Measurement of impairment of body function – content of thought (mental functions consisting of the ideas that are present in the thinking process and what is being conceptualized); and thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons

Description  The Pain Catastrophizing Scale (PCS) assesses the degree of catastrophic cognitions due to LBP.²⁴⁷ Pain catastrophizing has been broadly defined as an exaggerated negative orientation towards actual or anticipated pain experiences.²⁴⁷ The PCS is a 13-item questionnaire with a potential range of 0 to 52, with higher scores indicating higher levels of pain catastrophizing. The PCS assesses 3 independent dimensions of pain catastrophizing: rumination (items 8-11 – ruminating thoughts, worrying, inability to inhibit pain related thoughts); magnification (items 6,7,13 – magnification of the unpleasantness of pain situations and expectancies for negative outcomes); and helplessness (items 1-5, 12 – inability to deal with painful situations).²⁴⁷,²⁵⁵ Patients rate their agreement with statements related to thoughts and feelings when experiencing pain on a 5-point Likert scale (0 = “not at all,” 4 = “all the time”).²⁴⁷

Measurement method  Self-report

Nature of variable  Continuous

Units of measurement  Individual items: 5-point Likert scale (0 = “not at all,” 4 = “all the time”) 

Measurement properties  Test-retest reliability has been reported for the PCS at 6 (r = .75) and 10-weeks (r = .70).²⁴⁷ Cronbach’s alpha estimates ranging from .85 to .92 suggest the PCS is internally consistent.⁶⁷,⁶⁸,¹⁹⁸ and similar findings have been found for items related to rumination (.85), magnification (.75), and helplessness (.86).¹⁹⁸ The PCS has been found to demonstrate several different types of validity.⁶⁷,⁶⁸,¹⁹⁸,²⁴⁷
ÖREBRO MUSCULOSKELETAL PAIN SCREENING QUESTIONNAIRE

ICF Category Measurement of limitation in activities and participation - completing the daily routine; purposeful sensory experiences, specified as repetitive perception of non-injurious sensory stimuli; and interacting according to social rules Measurement of impairment of body function – pain in back; pain in lower limb; content of thought; and thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons

Description The Örebro Musculoskeletal Pain Screening Questionnaire (OMPSQ) (also referred to as the Acute Low Back Pain Screening Questionnaire) was originally developed to assist primary care practitioners in identifying psychosocial “yellow-flags” and patients at risk for future work disability due to pain. The OMPSQ is a 25-item screening questionnaire (of which 21 are scored) that consists of items involving pain location (item 4), work absence due to pain (item 5), pain duration (item 6), pain intensity (items 8 and 9), control over pain (item 11), frequency of pain episodes (item 10), functional ability (items 20 through 24), mood (items 12 and 13), perceptions of work (items 7 and 16), patients estimate of prognosis (items 14 and 15), and fear-avoidance (items 17 through 19). The scored-items are summed to provide a total score potentially ranging from 0 to 210, with higher scores indicating a higher risk of poor outcome.

Measurement method Self-report

Nature of variable Continuous

Units of measurement Individual items rated on a 0 to 10 scale

Measurement properties The ability of the OMPSQ to predict long-term pain, disability, and sick leave has been supported in previous studies, including a systematic review of 7 publications (5 discrete datasets).
SUBGROUPS FOR TARGETED TREATMENT BACK SCREENING TOOL

ICF Category Measurement of limitation in activities and participation - completing the daily routine; purposeful sensory experiences, specified as repetitive perception of non-injurious sensory stimuli; and interacting according to social rules.

Measurement of impairment of body function – pain in back; pain in lower limb; content of thought; and thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons; appropriateness of emotion (mental functions that produce congruence of feeling or affect with the situation, such as happiness at receiving good news); range of emotion (mental functions that produce the spectrum of experience of arousal of affect or feelings such as love, hate, anxiousness, sorrow, joy, fear and anger); and emotional functions, specified as the tendency to elaborate physical symptoms for emotional/affective reasons.

Description The Subgroups for Targeted Treatment (STarT) Back Screening Tool is a 9-item screening measure used to identify subgroups of patients with low back pain in primary care settings based on the presence of potentially modifiable prognostic factors which may be useful in matching patients with targeted interventions. The STarT contains items related to physical (items 2, 3, 5, 6) and psychosocial (items 1, 4, 7, 8, 9) factors that have been identified as strong independent predictors for persistent disabling LBP.

Measurement method Potential responses for the STarT are dichotomized (‘agree’ or ‘disagree’), with the exception of an item related to ‘bothersomeness’ which uses a 5-point Likert scale. Overall STarT scores (ranging from 0 to 9) are determined by summing all positive responses. Psychosocial subscale scores (ranging from 0 to 5) are determined by summing items related to bothersomeness, fear, catastrophizing, anxiety, and depression (i.e., items 1, 4, 7, 8, 9). Based on overall and psychosocial subscale scoring, the STarT categorizes patients as ‘high-risk’ (psychosocial subscale scores ≥4) in which high levels of psychosocial prognostic factors are present with or without physical factors present, ‘medium-risk’ (overall score >3; psychosocial subscale score <4) in which physical and psychosocial factors are present, but not a high level of psychosocial factors, or ‘low-risk’ (overall score 0-3) in which few prognostic factors are present.

Nature of variable Continuous subscale scores for function and psychosocial items & categorical subgroups.
Units of measurement

Individual items:
- Bothersomeness item: (5-point Likert scale)
- Remaining items: (dichotomous scale)

Subgroup scoring:
- High risk (psychosocial subscale scores ≥4)
- Medium risk (overall score >3; psychosocial subscale score <4)
- Low risk (overall score ≤3)

Measurement properties

The STarT overall (0.79, 95% CI: 0.73 – 0.95) and psychosocial subscale (0.76, 95% CI: 0.52 – 0.89) scores have been found to have acceptable test-retest reliability (weighted kappa values) in patients with stable symptoms. The STarT overall (0.79) and psychosocial subscale (0.74) scores suggest the STarT has demonstrated internal consistency. The predictive validity of the STarT has been reported in which subgroup cutoff scores were predictive of poor 6-month disability outcomes in low (16.7%), medium (53.2%), and high (78.4%) risk subgroups. The discriminant validity of the STarT scores (AUC range: 0.73 – 0.92) have been reported and suggest that overall scores best discriminate physical reference standards (e.g., disability and referred leg pain), while psychosocial subscale scores best discriminate psychosocial reference standards (e.g., catastrophizing, fear, and depression). The STarT has demonstrated concurrent validity in comparison to the Örebro Musculoskeletal Pain Screening Questionnaire, in which both instruments displayed similar subgroup characteristics and the ability to discriminate for disability, catastrophizing, fear, comorbid pain and time off work reference standards. Subgroup status has corresponded to initial pain intensity and disability scores in an ordinal manner for patients seeking care in outpatient physical therapy settings and longitudinal analyses indicated different patterns of change for clinical outcomes.
INTERVENTIONS

A variety of interventions have been described for the treatment of low back pain and it is not the intention of these clinical practice guidelines to exhaustively review all interventions. Instead these guidelines focus on approaches in which are available randomized, controlled trials and/or systematic reviews that have tested these interventions in environments that would match physical therapy application. In keeping with the overall theme of these guidelines we are focusing on the peer-review literature and making recommendations related to 1) treatment matched to subgroup responder categories, 2) treatments that have evidence to prevent recurrence, and 3) treatments that have evidence to influence the progression from acute to chronic low back pain and disability.

MANUAL THERAPY

Thrust and non-thrust mobilization/manipulation is a common intervention utilized for acute, sub acute, and chronic low back pain. Despite its popularity, recent systematic reviews have demonstrated marginal treatment effect across the heterogeneous group of patients with low back pain. Also, most trials have assessed the efficacy of mobilization/manipulation in isolation rather than in combination with active therapies. Recent research has demonstrated that spinal manipulative therapy is effective for subgroups of patients, and as a component of a comprehensive treatment plan, rather than in isolation.

Research has determined a subgroup of patients likely to have dramatic changes with application of thrust manipulation to the lumbar spine, advice to remain active, and mobility exercise. Flynn conducted an initial derivation study of patients most likely to benefit from a general lumbopelvic thrust manipulation. Five variables were determined to be predictors of rapid treatment success, defined as a 50% reduction in Oswestry Disability Index (ODI) score within two visits. These predictors included:

- Duration of symptoms < 16 days
- No symptoms distal to the knee
- Lumbar hypomobility
- At least one hip with >35 of internal rotation
- FABQ work score < 19

The presence of 4 or more predictors increased the probability of success with thrust manipulation from 45% to 95%.

This test item cluster was validated by Childs which demonstrated similar results with patients meeting four of the five predictors who received thrust manipulation (+LR 13.2, 95% CI=3.4, 52.1). These results remained significant at 6 month follow-up. A pragmatic rule has also been published to predict dramatic improvement looking at two factors:
• Duration < 16 days
• Not having symptoms distal to the knee

If these two factors were present patients had a moderate-large shift in probability of a successful outcome following application of thrust manipulation (+LR= 7.2, 95% CI: 3.2, 16.1)\(^93\)

This rule has been further validated by Cleland with similar results for patients fitting the clinical prediction rule with two different thrust techniques, the previously utilized general lumbopelvic technique and a sidelying rotational technique.\(^60\) The two groups receiving thrust manipulation fared significantly better than a group receiving non-thrust mobilization at one week, 4 weeks, and 6 months.

The Cleland trial demonstrated that patient outcomes are dependent on utilization of a thrust manipulation as those who received non-thrust techniques did not have dramatic improvement. This had previously been established by Hancock, et al.\(^124\) In a secondary analysis of patients who fit the clinical prediction rule that were treated primarily with non-thrust mobilization no difference was found from a control group who received placebo intervention. The findings of the Cleland and Hancock papers demonstrate that rapid improvements associated with patients fitting the clinical prediction rule are specific to patients receiving thrust manipulation.

Fritz, et al compared the effectiveness of a thrust manipulation and stabilization exercise intervention or stabilization intervention.\(^103\) The mean duration of symptoms for patients was 27 days (range, 1-594). Patients that were assessed to have lumbar hypomobility on physical examination demonstrated significant improvements with the manipulation and exercise intervention than stabilization alone. Seventy-four percent of patients with hypomobility who received manipulation were deemed successful as compared to 26% of patients with hypermobility that were treated with manipulation. These findings may suggest that assessment of hypomobility, in the absence of contraindications, is sufficient to consider use of thrust manipulation as a component of comprehensive treatment.

Beyond the success associated with the usage of thrust manipulation in acute low back pain patients who fit the clinical prediction rule, there is evidence for the use of thrust manipulation in other patients experiencing low back pain. Aure and colleagues\(^8\) have demonstrated superior reductions in pain and disability in patients with chronic low back pain when compared to an exercise intervention. More recently, Cecchi et al conducted a randomized controlled trial (n=210) in patients with low back pain.\(^42\) Subjects were randomized to receive thrust manipulation, back school intervention, or individualized physiotherapy intervention. Reductions in disability were significantly higher for the manipulation group at discharge and twelve months. Long term pain relief, recurrences of low back pain, and drug usage also favored the manipulation group.
Whitman, et al\textsuperscript{278, 279} demonstrated that for patients with lumbar spinal stenosis a comprehensive treatment plan including thrust and non-thrust mobilization/manipulation directed at the lumbopelvic region is effective at decreasing pain and disability. In the randomized control trial, 58 patients were randomized to receive a comprehensive manual therapy approach, gluteal retraining, and body weight supported treadmill training or lumbar flexion exercises and traditional treadmill training.\textsuperscript{278} Seventy eight percent of patients receiving manual treatments met the threshold for success compared to 41\% of the flexion based exercise group. At long term follow-up all outcomes favored the manual therapy group. Manual therapy was delivered in a pragmatic impairment-based approach; specifically, 100\% of patients received non-thrust mobilization to the lumbar spine, 50\% received thrust manipulation to the lumbar spine, and nine of the twenty nine patients received lumbopelvic manipulation.\textsuperscript{9}

Murphy et al\textsuperscript{192} published a prospective cohort study of 57 consecutive patients with lumbar spinal stenosis. Patients were treated with lumbar thrust manipulation, nerve mobilization procedures, and exercise. The mean improvement in disability as measured by the Roland Morris score was 5.1 points from baseline to discharge, and 5.2 points from baseline to long term follow-up, satisfying the criteria for minimally clinical important difference. Pain at worst was also reduced by a mean of 3.1 points. Reiman et al,\textsuperscript{217} in a recent systematic review based off of the Whitman trial and several lower quality studies, recommends manual therapy techniques including thrust and non-thrust mobilization/manipulation to the lumbopelvic region for patients with lumbar spinal stenosis.

The hip has been identified as a potential source of and contributor to low back dysfunction.\textsuperscript{16, 84, 218, 232, 284} Several authors have described characteristics of patients with low back pain who may benefit from interventions targeting the hip.\textsuperscript{33, 91, 192, 197, 217, 278, 279} It has been suggested that altered movements of the hip and spine may contribute to the development of low back pain as it may alter the loads placed on the lumbar facets and posterior spinal ligaments.\textsuperscript{1, 166} During normal lumbopelvic rhythm, the lumbar spine and hip will contribute to forward flexion equally where the lumbar spine is most predominate in the early stages of forward bending and the hip towards the end of motion. In addition, the hips are the predominate source of movement during trunk motion in the transverse plane (lumbar rotation).\textsuperscript{166, 284}

Wong and Lee\textsuperscript{284} found low back pain to be associated with decreases in the range of hip flexion during forward bending of the trunk. It has also been shown that patients with non specific low back pain who had greater external rotation than internal rotation were more likely to have low back pain.\textsuperscript{44, 53, 84} Mellin and colleagues\textsuperscript{184} studied 476 patients with low back pain and reported that limitations in hip flexion, hip extension, and hip internal rotation were significantly correlated with complaints of low back pain.. Limited hip mobility may be an underlying contributor to low back pain supporting the assumption that hip manipulation and mobilization procedures on improving hip mobility may reduce low back pain and disability.\textsuperscript{271}
A case series by Whitman and colleagues\textsuperscript{279} followed 3 patients with a clinical diagnosis of lumbar spinal stenosis. The patients were treated with manual therapy techniques involving posterior to anterior hip joint mobilizations and hip flexor stretching. Patients also received gluteal muscle retraining and body weight unsupported ambulation training. All three patients demonstrated substantial positive results at discharge that carried over at the 18-month follow-up. Except for one patient’s Symptom Severity score at 18 months, all the improvements in outcomes surpassed the MCID for the Spinal Stenosis Scale and the modified Oswestry. Furthermore, the patients all denoted an indicative or large patient-perceived change as measured by the global rating of change scale.

Whitman et al\textsuperscript{278} demonstrated improvements in a randomized controlled trial of patients with lumbar spinal stenosis when treated with a pragmatic manual therapy approach utilizing mobilization/manipulation to the hip region. Over fifty percent of patients received non-thrust mobilization to the hip region and almost one hundred percent receiving manual stretching of the hip complex.

Recently, Burns et al\textsuperscript{33} has demonstrated improvements in a patient with chronic low back pain receiving thrust and non-thrust techniques targeting the hip region in isolation. Technique selection was based off of patient presentation and techniques which demonstrated efficacy in previous literature.\textsuperscript{144, 176} Within three treatment sessions the patient demonstrated complete resolution of symptoms and full function as measured by the ODI, numeric pain rating scale, and patient specific functional scale. Improvements were maintained at 6 month follow-up.

Clinicians should consider utilizing thrust manipulative procedures to reduce pain and disability in patients with mobility deficits and acute (<16 days) low back and back-related buttock or thigh pain. Thrust and non-thrust mobilization procedures can also be used to improve hip mobility and reduce pain and disability in patients with sub acute and chronic low back and back-related limb pain.
TRUNK COORDINATION, STRENGTHENING, AND ENDURANCE EXERCISES

Lumbar strengthening and stabilization exercises are another commonly utilized treatment for LBP. These exercises are commonly prescribed for patients who have received the medical diagnosis of spinal instability.

In a Cochrane review on exercise therapy for the treatment of non-specific low back pain Hayden and colleagues examined the literature on exercise therapy for acute (11), sub acute (6) and chronic (43) patients with low back pain and reported that exercise therapy was effective in decreasing pain in the chronic population, graded activity improved absenteeism in the sub acute population, and exercise therapy is as effective as other conservative treatments or no treatments in the acute population. The larger criticism that the Cochrane reviewers found with the current literature was that the outcome tools were heterogeneous and the reporting was poor and inconsistent with the possibility of publication bias.

In a systematic review of 14 RCTs examining the effectiveness of motor control exercises for nonspecific LBP, Macedo, et al concluded that motor control when used in isolation or with additional interventions is effective at decreasing pain and disability related to nonspecific LBP. However, there was insufficient evidence to find motor control exercises were superior to manual therapy or other exercise interventions. The authors were unable to provide recommendations regarding the best strategies for implementing motor control exercise into clinical practice.

A preliminary clinical prediction rule for the stabilization classification has been proposed to assist clinicians with accurately identifying patients that appear to be appropriate for a stabilization focused exercise program. The clinical prediction rule for stabilization classification was developed using similar methodology for the manipulation rule. First, multiple examination variables were considered in a univariate setting, and then variables that significantly predicted a 50% improvement in disability from LBP at 4-weeks in a multivariate setting were retained for the clinical prediction rule. Four examination findings:

- Age <40 years
- Positive prone instability test
- Presence of aberrant movements with motion testing
- SLR > 91 degrees
were identified and a positive clinical prediction rule for stabilization was defined as presence of at least 3 of the findings (+LR = 4.0, 95% CI = 1.6, 10.0), while a negative clinical prediction rule was presence of fewer than 2 of the findings (-LR = 0.20, 95% CI = 0.03, 1.4).

Costa et al used a placebo-controlled RCT to examine the use of motor control exercises in 154 patients with chronic LBP. Interventions consisted of either specific motor control exercises directed to the multifidus and transverse
abdominis or non-therapeutic modalities. Short term outcomes demonstrated small but significant improvements in favor of the motor control group for both patient activity tolerance and global impression of recovery. The exercise interventions failed to reduce pain greater than non-therapeutic modalities over the same period.

A randomized clinically controlled trial was performed by Rasmussen-Bar et al.\textsuperscript{216} in which they compared a graded exercise program, which emphasized stabilization exercises to a general walking program in the treatment of low back pain lasting greater than 8 weeks. At both the 12 months and the 36 months follow up the stabilization group outperformed the walking group with 55% of the stabilization group and only 26% of the walking group meeting the predetermined criteria for success. This research demonstrates that a graded exercise intervention emphasizing stabilizing exercises seems to improve perceived disability and health parameters in short and long terms in patients with recurrent LBP.

Choi and colleagues\textsuperscript{48} performed a review of randomized clinically controlled trials that examined the effectiveness of exercise in the prevention of low back pain recurrence. This was published in a Cochrane review. Treatments were defined as exercise including strengthening, endurance, and aerobic that occurred during the patient's episode of care with a healthcare practitioner as well as those that occurred also following discharge from a healthcare practitioner. Specific types of exercise were not assessed individually. The group found 9 studies that met their criteria for inclusion. There was moderate quality evidence that the number of recurrences was significantly reduced in two studies (Mean Difference -0.35; 95\% CI -0.60 to -0.10) at one-half to two years follow-up. There was very low quality evidence that the days on sick leave were reduced in patients who continued to perform low back exercises following discharge (Mean Difference -4.37; 95\% CI -7.74 to -0.99) at one-half to two years follow-up. In summary, there was moderate quality evidence that post-discharge exercise programs can prevent recurrences of back pain.

In a randomized controlled trial, Hides, et al.\textsuperscript{135} compared a 4 week specific exercise training program to a control group consisting of advice and medication in a group of patients with first episode LBP. The specific exercise group performed co-contraction exercises believed to facilitate training of the lumbar multifidus and transverse abdominis muscle groups. The specific exercise group reported recurrence rates of 30\% at one year and 35\% at 3 years compared to 84\% at 1 year and 75\% at 3 years for the control group.

O’Sullivan et al.\textsuperscript{196} completed a randomized controlled trial involving subjects with radiologically confirmed spondylolysis or spondylolisthesis. A specific exercise group received weekly interventions directed at specific training to promote isolation and co-contraction of the deep abdominal muscles and the lumbar multifidus. A control group received usual care typically consisting of aerobic exercise, rectus abdominis training and modalities. At the conclusion of the 10 week program, the specific exercise group demonstrated statistically
significant improvements in both pain intensity and functional disability. These gains were maintained at a 30 month follow up.

Yilmaz and colleagues\textsuperscript{287} investigated the efficacy of a dynamic lumbar stabilization exercise program in patients with a recent lumbar microdiscectomy. In a randomized study they found that lumbar spinal stabilization exercises under the direction of a physical therapist was superior to performing a general exercise program independently at home and to a control group of no prescribed exercises at 3 months. This study had a small sample size with 14 in each group and did not describe any loss to follow up.

Kulig et al\textsuperscript{162} performed a randomized clinically controlled trial comparing an intensive 12-week exercise program and education to education alone and to usual physical therapy care post microdiscectomy. In the 2-group analyses, exercise and education resulted in a greater reduction in ODI scores and a greater improvement in distance walked. In the 3-group analyses, post hoc comparisons showed a significantly greater reduction in ODI scores following exercise and education compared with the education-only and usual physical therapy groups. Limitations of this study included lack of adherence to group assignments and a disproportionate therapist contact time.

Clinicians should consider utilizing trunk coordination, strengthening, and endurance exercises to reduce low back pain and disability in patients with sub acute and chronic low back pain with movement coordination impairments and in patients post lumbar microdiscectomy.
CENTRALIZATION PROCEDURES AND EXERCISES

A systematic review by Clare, et al.\textsuperscript{56} reviewed 6 randomized/quasi-randomized controlled trials investigating the efficacy of McKenzie therapy in the treatment of spinal pain. The authors concluded that the studies suggest that McKenzie therapy is more effective than comparison treatments (NSAIDS, educational booklet, strengthening, etc.) at short-term follow-up. It should be noted that the studies in this review excluded trials where co-interventions were permitted and may not be generalizable to clinical practice. A second systematic review from Aina et al.\textsuperscript{2} examined centralization of spinal symptoms. They reported centralization is a commonly encountered subgroup of low back pain, with good reliability during examination. Their meta-analysis resulted in a prevalence rate for centralization of 70% with sub-acute low back pain and 52% in chronic low back pain. The presence of centralization was associated with good outcomes and lack of centralization with poor outcome.

Long, et al.\textsuperscript{171} included 230 acute, sub-acute, and chronic low back pain patients assessed via the McKenzie method in order to elicit a directional preference or no directional preference. Three directions were characteristic of a directional preference: extension (83%), flexion (7%), and lateral responders (10%). Subjects were randomized into groups of: 1) Directional exercises matching the patient’s directional preference, 2) Directional exercises opposite the patient’s directional preference, or 3) Non-directional exercises. Outcome measures ranged from pain intensity and disability to depression and work interference. Of the 230 participants, 74% had a directional preference. Results showed significant change in the directional exercise group when matched to their directional preference. One-third of the patients in the non-concordant exercise group dropped out because they were either not improving or worsening. The authors suggest that this study “adds further validity by demonstrating that a subject-specific treatment is superior to others in creating good outcomes for this subgroup.”\textsuperscript{168} One limitation of this study was the potential bias introduced as treatment was provided by therapists with advanced training in the McKenzie system.

Long and colleagues\textsuperscript{172} conducted a secondary analysis of a previous RCT examining a range of factors that predict a favorable outcome where patients were subgrouped based on the presence or absence of directional preference. The authors concluded from the analyses that those subjects with a directional preference/centralization who received matched treatment had a 7.8 times greater likelihood of a good outcome (defined as a minimal reduction of 30% on the RMI).

A multicenter randomized control trial by Browder et al.\textsuperscript{31} looked to examine the effectiveness of an extension-oriented treatment approach in patients with low back pain. The authors included a homogenous subgroup of patients that centralized with extension movements. Forty-eight patients were randomly allocated to receive either exercise/mobilization promoting lumbar spine
extension or lumbopelvic strengthening. Subjects in both groups attended 8 physical therapy treatments and were given a home exercise program. The patients who received the extension-oriented treatment approach experienced greater improvements in disability compared to those subjects who received lumbopelvic strengthening exercises at 1 week, 4 weeks, and 6 months. The authors suggest that those patients that centralize with lumbar extension movements may preferentially benefit from an extension-oriented treatment approach. In contrast to the Long et al study, the therapists participating in this study had no advanced training or certification in the McKenzie methodology.

Werneke and colleagues performed a prospective, longitudinal cohort aiming to determine baseline prevalence of directional preference or no directional preference in 584 patients with non-specific low back pain who centralize, did not centralize, or could not be classified. The authors also sought to determine if these classifications predicted functional status and pain intensity at discharge. Therapists skilled in the use of the McKenzie methodology participated in the study. The authors found that the overall prevalence of directional preference and centralization was 60% and 41%, respectively. Results indicate that patients whose symptoms showed directional preference with centralization at intake reported better functional status and less pain compared to patients whose symptoms did not centralize and showed no directional preference. The overall implication of the study stated that the patient response criteria regarding directional preference and centralization should be considered as independent variables when analyzing patient outcomes.

In a randomized controlled trial, Peterson et al compared thrust manipulation plus advice to McKenzie method plus advice in 350 patients with 6 week history of LBP. In addition to advice, the thrust group received thrust and non-thrust manipulation as well as trigger point massage at the discretion of the treating clinician but they were not allowed to perform exercises in the patients directional preference. In addition to advice, the McKenzie method group received interventions consistent with the McKenzie method (centralization and directional preference) at the discretion of the treating clinician but were not allowed to use mobilization/manipulation interventions. Improvements favored the McKenzie method group with a number needed to treat of 8 at the study conclusion and 7 at the 2 month follow up. One limitation of this study was that all McKenzie interventions using centralization and directional preference were performed by credentialed McKenzie practitioners thus generalizability to non-credentialed clinicians may be questionable.

Clinicians should consider utilizing specific repeated movements, exercises, or procedures to promote centralization to reduce symptoms in patients with acute low back pain with related lower extremity pain.
FLEXION EXERCISES

Flexion based exercises, also called Williams flexion exercises, have long been considered a standard treatment for patients with lumbar spinal stenosis. It has been reported that flexion specific-exercise classification appears to be less common and most often occurs in patients who are older, often with a medical diagnosis of lumbar spinal stenosis. Current guidelines detailing conservative intervention for stenosis detail repeated flexion exercises in the supine, seated, and standing position. A recent review article by Backstom et al notes that flexion based exercises have long been utilized to relatively open the foraminal canals and potentially relieve mechanical compression of the lumbar nerve roots, improve spinal flexibility, and improve hemodynamics.

A multicenter randomized, controlled trial by Whitman et al compared two physical therapy programs for patients with lumbar spinal stenosis. The authors randomized 85 patients with lumbar spinal stenosis to one of two 6-week physical therapy programs: 1) a manual therapy, exercise, and body weight supported treadmill walking group; and 2) a lumbar flexion exercise, treadmill walking, and walking program group. Patients in the manual therapy group reported recovery at 6 weeks with a number needed to treat of 2.6. At 1 year, 62% of the manual therapy group continued to have successful outcomes as compared to 41% in the flexion based exercise group.

A cohort study by Murphy utilized flexion based exercises as a component of a treatment program also utilizing long axis distraction manipulation and nerve mobilization procedures. Patients were instructed in a quadruped exercise emphasizing lumbar flexion and alternate extension in order to improve overall joint mobility. The mean improvement in disability as measured by the Roland Morris score was 5.1 points from baseline to discharge, and 5.2 points from baseline to long term follow-up, satisfying the criteria for minimally clinical import difference. Pain at worst was also reduced by a mean of 3.1 points.

Simotas, et al performed a prospective cohort study following forty nine patients with radiographic lumbar spinal stenosis for a mean of 33 months with treatment consisting of daily flexion based exercises. At three year follow-up 9 patients had undergone surgical intervention. Of the 40 patients who did not undergo surgery, 5 reported worsening of symptoms, 12 reported no change, 11 reports mild improvement, and 12 reported sustained improvement. Twelve of the 40 unoperated patients reported having none or only mild pain.

Numerous other case studies have utilized flexion based exercises as a component of care for patients with lumbar spinal stenosis. Creighton, et al combined repeated flexion with a translatory manipulation in the management of six patients with stenosis. All six subjects demonstrated improvements in treadmill walking prior to onset of neurogenic claudication, ODI, and McGill Pain Questionnaire score. Whitman, et al demonstrated clinically meaningful improvements in three patients managed with a treatment program including flexion based exercises.

Clinicians can consider flexion exercises, combined with other interventions such as manual therapy, strengthening exercises, nerve mobilization procedures, and progressive walking for reducing pain and disability in older patients with chronic low back pain with radiating pain.
LOWER QUARTER NERVE MOBILIZATION PROCEDURES

George\textsuperscript{105} published a case series of six patients with sub acute low back pain and leg symptoms who 1) were unable to improve or worsen their symptoms with lumbar flexion and extension motions, and 2) had a positive slump test. All patients were treated with end-range nerve mobilization (passive slump and straight leg raise stretching) procedures. All patients demonstrated reductions in numeric pain rating. Five of six patients reported a reduction or elimination of their thigh, lower leg, or foot symptoms, in which two of the patients no longer had symptoms and three of the patients reported the location of his/her symptoms to be in a more proximal location at discharge. These five patients had an average of 8 treatment sessions each.

Cleland, et al\textsuperscript{59} completed a randomized controlled trial (n=30) using the same eligibility criteria as the George\textsuperscript{105} case series. Patients with low back complaints, who’s symptoms referred distal to the buttocks, had reproduction of symptoms with the slump test, and no change in symptoms with lumbar flexion or extension were randomized to receive non-thrust mobilization of the lumbar spine and exercise or slump stretching and exercise. Patients were treated for six sessions. At discharge the slump stretching group exhibited significantly improved disability, overall perceived pain, and reduction of their thigh, lower leg, or foot symptoms.

Additionally, Murphy\textsuperscript{192} utilized nerve mobilization procedures in a cohort of 55 consecutive patients with lumbar spinal stenosis as part of a treatment protocol and reported a mean improvement of 5.1 using the RMI. Hall, and colleagues\textsuperscript{121}, \textsuperscript{122} has demonstrated an increase in straight leg raise range of motion in treating using end-range nerve mobilization (straight leg raising combined with manual lower limb traction) in a cohort of patients with neurogenic lower extremity complaints.

A randomized controlled trial completed by Scrimshaw\textsuperscript{231} compared standard care to standard care plus active and passive lower limb mobilization procedures in patients status-post lumbar spine surgery (discectomy, laminectomy, or fusion). In addition to baseline measures, follow up data for pain and disability was collected at 6 weeks, 6 months and 12 months after surgery. The results showed no statistically significant differences between the groups for any of the outcomes at any point in time. Due to the heterogeneity of patient population and treatment, results must be interpreted with caution, however, presently no other data suggest that nerve mobilization procedures are more effective than standard care for patients post lumbar surgery.

Numerous other case studies have described utilization of lower extremity nerve mobilization procedures for lower limb symptoms reported to be due to diagnoses other than low back pain and radiating pain, such as hamstring strain and complex regional pain syndrome.\textsuperscript{58, 61, 106, 158, 253}

Clinicians should consider utilizing lower quarter nerve mobilization procedures to reduce pain and disability in patients with sub acute and chronic low back pain and radiating pain.
TRACTION

A systematic review by Clark and colleagues\textsuperscript{57} investigated the use of traction compared to reference treatments, placebo/sham traction, or no treatment for patients with low back pain. The authors included 25 randomized controlled trials (RCT’s) that included patients with acute, sub-acute or chronic low back pain, with or without sciatica. Of the 25 selected RCT’s, only 5 trials were considered high quality. Based on the available evidence, there is moderate evidence showing no statistical significant differences in short or long-term outcomes between traction as a single treatment when compared to placebo, sham, or no treatment. The investigators concluded that intermittent or continuous traction as a single treatment for low back pain cannot be recommended for heterogeneous groups of patients suffering from low back pain with or without sciatica.

Several randomized controlled trials have compared traction to a sham traction intervention with no significant differences found between the groups. Beurskens et al.\textsuperscript{19} randomized 151 subjects with 6 week history of non-specific low back pain to receive either traction (35-50\% of body weight) or sham traction (maximum 20\% body weight) for twelve 20 minute sessions over 5 weeks. Follow up measures for pain, disability and impression of perceived recovery were completed at 12 weeks and 6 moths with no statistically significant differences between the groups at either point. Schimmel et al.\textsuperscript{228} compared decompression via the Intervertebral Differential Dynamics Therapy device (50\% body weight + 10 pounds force) to sham intervention in the same device (10 pounds force) in subjects with a history of greater than 3 months of nonspecific low back and leg pain. Subjects received 20 visits over 6 weeks, with pain, disability and quality of life measured at 2, 6 and 14 weeks. Both treatment regimens showed significant improvement versus baseline in all measures at 14 weeks. However, no between group differences was present at follow up.

In a randomized clinical trial, Fritz et al\textsuperscript{102} aimed to investigate whether there is a subgroup of low back pain patients that benefit from mechanical traction along with extension-oriented exercise. Sixty-four patients with low back pain with radicular symptoms were assigned to receive either an extension-oriented treatment approach or an extension-oriented treatment approach with mechanical traction for a total of 6 weeks. The results showed a greater reduction in disability and fear-avoidance beliefs for subjects in the traction group at the 2-week follow up. However, at 6-weeks, there was no statistical difference. Furthermore, the authors identified two variables that may help identify a subgroup of patients that can benefit from mechanical traction. Those patients that experience peripheralization of symptoms with extension movement and have a positive crossed SLR test had a better likelihood of success. Of these subjects, 84.6\% in the traction group had a successful outcome as compared to 45.5\% that allocated to the extension group. Although this subgroup of low back pain patients is likely small, the authors conclude that this subgroup is characterized by the presence of sciatica, signs of nerve root compression, and
either peripheralization with extension movements or a positive crossed SLR test.

Cai et al\textsuperscript{37} developed a clinical prediction rule through a multiple regression analysis that identifies patients likely to respond to mechanical traction. The authors identified four variables that predicted a positive outcome: FABQW score less than 21, no neurological deficit involvement, age older than 30, and non-manual work job status. The presence of 4 of these predictors increased the probability of success with mechanical traction from 20\% to 69\%. It should be noted that this study included a small sample size (129 subjects) and an even smaller number of responders (25 subjects) to traction.

Beattie et al\textsuperscript{14} performed a prospective, longitudinal case series study involving 296 patients with low back pain and evidence of a degenerative and/or herniated intervertebral disk at one or more levels of the lumbar spine. Each patient received prone lumbar traction using the vertebral axial decompression (VAX-D) system for 8 weeks. The numeric pain rating scale and the RMI were completed at pre-intervention, discharge, and at 30 days and 180 days after discharge. A total of 250 (84.4\%) subjects completed the treatment protocol, so an intention-to-treat analysis was performed to account for the loss to follow-up. The authors found that patients reported significantly improved pain and RMI scores after 16 to 24 visits of prone traction at discharge, and at 30 days and 180 days post discharge. It should be noted that there was no control group and that there were large variations in the magnitude of change in the outcome measures used.

There are conflicting opinions regarding 1) the best use of intermittent or static lumbar traction for reducing acute and sub-acute low back pain with radiating pain, 2) the subgroup of patients that respond best to traction, and 3) the frequency, intensity, duration or type of traction for achieving the best outcomes.

Clinicians should not utilize intermittent or static lumbar traction for reducing symptoms in patients with acute or sub acute, non-radicular low back pain or for patients with chronic low back pain.
PATIENT EDUCATION AND COUNSELING

Education and advice have been traditional interventions given to patients with acute, sub-acute, and chronic low back pain. Research in patient education and counseling strategies has focused on three main approaches, 1) general education and advice in acute and sub-acute populations, 2) behavioral education; including cognitive-behavioral theory, graded activity, and graded exposure, in a variety of populations, and 3) education of patients on the physiology of pain.

Patient education has long been considered a standard of care for the treatment of patients with acute low back pain. Guidelines generally recommend clinicians to counsel their patients to 1) remain active, 2) avoid bed rest, and 3) acknowledge the positive natural history of acute low back pain. For example, the joint guidelines for the Diagnosis and Treatment of Low Back Pain from the American College of Physicians and the American Pain Society state “Clinicians should provide patients with evidence-based information on low back pain with regard to their expected course, advise patients to remain active, and provide information about effective self-care options (strong recommendation, moderate-quality evidence).” Several other systematic reviews have demonstrated moderate evidence that advice given to patients with low back pain to remain active compared to bed rest results in benefits in pain relief and functional improvements.

In 2007 Liddle, et al published a systematic review on advice for the management of low back pain. Major findings stated that generally advice to remain active is sufficient for patients with acute low back pain. More involved education relating to appropriate exercise and functional activities to promote active self-management is effective in patients with sub-acute and chronic low back pain.

Burton, et al completed a randomized controlled trial (n=162) exploring the efficacy of a novel educational booklet compared with a traditional booklet in patients with low back pain being seen in a primary care setting. Traditional information and advice about back pain has been based on a biomedical model with emphasis on anatomy, biomechanics, and pathology. The novel education booklet deemphasized education on pathology and disease processes, provided reassurance regarding the likelihood of recovery, and promoted positive attitudes. The novel education booklet resulted insignificant greater early improvement in beliefs that were maintained at 1 year. For patients that had elevated fear avoidance beliefs there was a clinically important improvement in the RMI at 3 months.

Coudeyre, et al in 2007 demonstrated in a large non-randomized controlled trial that utilization of pamphlet education was effective in reducing persistent low back pain and increasing patient satisfaction. Days of work missed were similar between groups as was between group disability as measured by Quebec Disability Scale.
Albaladejo, et al\textsuperscript{4} completed a three armed, clustered, randomized trial comparing three educational packages to 348 patients with low back pain, of which 265 (79.8\%) had chronic low back pain. All patients received usual care administered by primary care physicians. One group received a booklet and brief education on health education that focused on nutrition. The two other groups received a booklet and brief education on active managements of low back pain. A third group also received four sessions of physiotherapy for an establishment of a home exercise program. At the 6 month follow-up both groups receiving the active management education had small but statistically significant reduced disability and pain, and improved quality of life and mental quality of life scores. Scores in the education and exercise group at the 6 month follow-up were consistently better than the education alone group but the differences were not significant.

Uderman and colleagues\textsuperscript{254} completed a prospective trial of the effect of an educational booklet on a sample of patients with chronic low back pain (mean 10.4 years). Patients were given educational literature on how to manage their back pain and completed a one week follow-up test on content and beliefs. At nine and 18 months there were statistically significant reductions in pain and frequency of low back pain episodes. Due to the study design it is impossible to conclude the observed effects are as a result of the intervention, however, given the chronic nature of the patient population, it is less likely results are due to natural history of the disorder.

George, et al\textsuperscript{110} assessed the effect of administering pamphlet education in a primary prevention manner to military personnel. Subjects were assessed with the Back Beliefs Questionnaire which assesses inevitable consequences of and the ability to cope with low back pain. Twelve weeks post administering education there were significant improvements in BBQ score for soldiers receiving education as compared to control group. Although this research does not directly measure the effect of education on preventing or treating low back pain, changes in soldier belief may have a potentially important effect on future development and disability.

Behavioral education, also known as cognitive behavioral theory, encompasses many aspects of patient education and counseling for patients with low back pain,\textsuperscript{32,31} including:

- Activity pacing
- Attention diversion
- Cognitive restructuring
- Goal setting
- Graded exposure
- Motivational enhancement therapy
- Maintenance strategies
- Problem-solving strategies
Several aspects of behavioral education and counseling are utilized in physical therapy practice. Henschke et al., in a recent Cochrane Review concluded there is moderate quality evidence that operant therapy and behavioral therapy are more effective than waiting list or usual care for short term pain relief in patients with chronic low back pain, but no specific type of behavioral therapy is superior than another. In the intermediate to long term, there is no established difference between behavioral therapy and group exercise for management of pain or depressive symptoms in patients with chronic low back pain.

George, et al. completed a randomized controlled trial (n=66) of patients with low back pain of less than 8 weeks duration. Patients were randomized to receive fear-avoidance-based physical therapy or standard care physical therapy. Patients receiving standard care were administered general educational information and treatment based classification intervention. Patients in the FABQ group utilized an alternative education based on de-emphasizing pathoanatomical discussions, encouraging active roles in recovery, and treating low back pain as a common condition. All patients were progressed through exercise in a graded activity fashion utilizing pre-determined quotas. At 4 weeks and 6 months both groups had significant improvements in pain and disability. Those patients who were assessed to have elevated fear-avoidance beliefs benefitted more from fear-avoidance based intervention, including a positive shift in fear-avoidance beliefs, while patients who had lower fear-avoidance scores developed more disability when receiving fear-avoidance-based intervention when compared to those receiving standard care physical therapy. In addition, physical therapy supplemented with fear-avoidance-based principles contributed to a positive shift in fear-avoidance beliefs. This study demonstrates effectiveness for fear-avoidance directed patient education and emphasizes the importance of matching intervention to appropriate patients.

Godges, et al. completed a controlled trial specifically looking at the treatment of 36 patients with occupational related acute low back pain with elevated fear avoidance beliefs. All subjects received standard physical therapy including strengthening and ergonomic exercise, with half of the workers additionally receiving ongoing education and counseling emphasizing the positive natural history of low back pain and that activity helps to decrease the duration of complaints. Results demonstrated that all workers in the education group returned to work within 45 days compared to the control group in which one third of workers did not return to work at the 45 day mark. This study provides further evidence for the effectiveness of education and counseling for patients with low back pain with elevated fear avoidance beliefs.

Smeets, et al. completed a randomized controlled trial of 212 patients who received varied behavioral interventions for chronic low back pain. Participants were randomized into active therapy focusing on aerobic endurance and strength, cognitive behavioral therapy emphasizing graded activity for predetermined quotas and problem-solving training, and combined treatment. Experimental groups were also compared to a control group of waiting list patients. Following treatment all experimental groups demonstrated significant improvements
compared to control group. Between group differences did not reach statistical significance.

Motivational enhancement therapy is another aspect of behavioral therapy that utilizes counseling and goal directed communication during the patient-clinician interactions. Vong, et al\textsuperscript{267} recently completed a randomized controlled trial (n=76) comparing conventional therapy, defined as interferential electrical stimulation and back exercise, and conventional therapy with motivational enhancement treatment delivered by the treating physiotherapist. Cognitive measures of pain self-efficacy, treatment expectancy, and working alliance favored the motivational training group throughout treatment and at 1 month follow-up. Similar results were demonstrated for pain and lifting assessment. RMI scores improved in both intervention groups.

Graded exposure treatment includes operant conditioning principles to gradually condition patients to perceived harmful situations or activities. Leeuw, et al\textsuperscript{167} demonstrated similar results for graded exposure and graded activity in patients with chronic low back pain. Effectiveness was maintained at short and long-term follow-up. George, et al\textsuperscript{112} also found similar outcomes when comparing graded activity and graded exposure in patients with acute and sub-acute low back pain. Behavioral therapy when combined with treatment based classification intervention was not superior to treatment based classification treatment alone, potentially demonstrating again the importance of matching behavioral therapy to patients with increased psychosocial risk factors. George, et al\textsuperscript{111} also found similar results between graded exercise and graded exposure in a sample of patients with chronic low back pain treated in a multidisciplinary pain clinic. Results demonstrated similar improvements in pain intensity and disability. Similar results for intensive behavioral therapy have consistently been shown in patients with chronic low back pain.\textsuperscript{79, 178, 187, 258}

Another patient education and counseling model that has been presented in the literature is based on the philosophy of helping a patient to understand their symptoms. In this patient education model there is a distinction between an anatomy lecture (on spinal structures) versus the neurophysiologic processes involved in the perception of back pain.

Moseley\textsuperscript{190} demonstrated combined effectiveness of manual therapy, exercise, and pain physiology education in a randomized controlled trial of patients with chronic low back pain. Results demonstrated significant reductions in numerical pain rating and RMI scores. Results were maintained at one year. Moseley\textsuperscript{191} additionally demonstrated greater efficacy in individual pain education and exercise than education delivered in a group setting.

Moseley, et al\textsuperscript{189} assessed the efficacy of pain education against traditional back anatomy and physiology education. Subjects were randomized to treatment groups and assessed fifteen days post intervention. At follow-up, the pain physiology group demonstrated statistically significant improvements in disability, pain catastrophization, pain beliefs, straight leg raise, and forward...
bending as compared to control. Similar results were demonstrated by Moseley in a shorter follow-up of immediately following education interventions.\textsuperscript{188} Changes in physical function as assessed by the straight leg raise and forward bending were found to be highly correlated changes in pain beliefs.

Clinicians should \textit{not} utilize patient education and counseling strategies that either directly or indirectly increase the perceived threat or fear associated with low back pain, such as education and counseling strategies that 1) promote extended bed-rest or 2) provide in-depth, pathoanatomical explanations for the causes of low back pain. Patient education and counseling strategies for patients with low back pain should emphasize 1) the promotion of the understanding of the anatomical/structural strength inherent in the human spine 2) the neuroscience that explains pain perception; 3) the overall favorable prognosis of low back pain, 4) the use of active pain coping strategies that decrease fear and catastrophizing, 5) the early resumption of normal or vocational activities, even when still experiencing pain, and 6) the importance of improvement in activity levels, not just pain relief.
PROGRESSIVE ENDURANCE EXERCISE AND FITNESS ACTIVITIES

Presently, most national guidelines for patients with chronic low back pain endorse progressive aerobic exercise with moderate to high recommendations. High intensity exercise has also been demonstrated to have a positive effect on patients with chronic low back pain. The samples of these studies included patients with long term duration of symptoms, that were primarily confined to the lumbopelvic region without generalized pain complaints.

Patients with low back pain and related generalized pain are believed to have increased neural sensitivity to afferent stimuli, including proprioception and movement. This sensitizing process has been termed central sensitivity. Along with underlying psychosocial factors, deficits in aerobic fitness and tissue deconditioning this sensitizing process is believed to impact a person’s functional status and pain perception. Aerobic fitness has been hypothesized to be an important component of reducing pain and improving/maintaining function of these patients.

Findings in patients with generalized pain complaints have demonstrated altered central pain processing, supporting that these patients should be managed at lower intensity levels of training. Endurance exercise has been demonstrated to have a positive effect on global well being (SMD 0.44, 95% CI 0.13-0.75), physical functioning (SMD 0.68 95% CI:0.41-0.95), and pain (SMD 0.94 95% CI:-0.15-2.03) associated with fibromyalgia syndrome. Excessively elevated levels of exercise intensity may be responsible for increased symptom complaints due to increases in immune activation with release of proinflammatory cytokines, blunted increases in muscular vascularity leading to widespread muscular ischemia, and inefficiencies in the endogenous opioid and adrenergic pain-inhibitory mechanism.

Clinicians should consider 1) moderate to high intensity exercise for patients with chronic low back pain without generalized pain, and 2) incorporating progressive, low intensity, sub-maximal fitness and endurance activities into the pain management and health promotion strategies for patients with chronic low back pain with generalized pain.
### Recommended Low Back Pain Impairment/Function-based Diagnosis, Examination and Intervention Recommended Classification Criteria*

Patients with low back pain often fit more than one impairment/function-based category and the most relevant impairments of body function, primary intervention strategy, and the associated impairment/function-based category(ies) are expected to change during the patient's episode of care.

<table>
<thead>
<tr>
<th>Impairment-based Category</th>
<th>Symptoms</th>
<th>Impairments of Body Function</th>
<th>Primary Intervention Strategies</th>
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<tbody>
<tr>
<td><strong>Acute Low Back Pain with Mobility Deficits</strong></td>
<td>o Acute low back, buttoc or thigh pain (duration &lt; 16 days)</td>
<td>o Lumbar range of motion limitations&lt;br&gt;o Restricted lower thoracic and lumbar segmental mobility&lt;br&gt;o Low back and low back-related lower extremity symptoms are reproduced with provocation of the involved lower thoracic, lumbar or sacroiliac segments</td>
<td>• Manual therapy procedures (thrust manipulation and other non-thrust mobilization techniques) to diminish pain and improve segmental spinal or lumbopelvic motion&lt;br&gt;• Therapeutic exercises to improve or maintain spinal mobility&lt;br&gt;• Patient education that encourages the patient to return to / or pursue an active lifestyle</td>
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<td>Lumbosacral segmental / somatic dysfunction</td>
<td>o Unilateral pain&lt;br&gt;o Onset of symptoms is often linked to a recent unguarded / awkward movement or position</td>
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<tr>
<td><strong>Sub Acute Low Back Pain with Mobility Deficits</strong></td>
<td>o Sub acute, unilateral, low back, buttoc or thigh pain</td>
<td>o Symptoms reproduced with end-range spinal motions&lt;br&gt;o Symptoms reproduced with provocation of the involved lower thoracic, lumbar or sacroiliac segments&lt;br&gt;o Presence of one or more of the following: - Restricted thoracic range of motion and associated segmental mobility - Restricted lumbar range of motion and associated segmental mobility - Restricted lumbopelvic or hip range of motion and associated accessory mobility</td>
<td>• Manual therapy procedures to improve segmental spinal, lumbopelvic, and hip mobility&lt;br&gt;• Therapeutic exercises to improve or maintain spinal and hip mobility&lt;br&gt;• Focus on preventing recurring LBP episodes through the use of (1) therapeutic exercises that addresses co-existing coordination impairments, strength deficits, and endurance deficits, and (2) education that encourages the patient to pursue or maintain an active lifestyle</td>
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<tr>
<td>Lumbosacral segmental / somatic dysfunction</td>
<td>o May report sensation of back stiffness</td>
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<tr>
<td><strong>Acute Low Back Pain with Movement Coordination Impairments</strong></td>
<td>o Acute exacerbation of recurring low back pain and associated (referred) lower extremity pain&lt;br&gt;o Symptoms often include numerous episodes of low back pain in recent years</td>
<td>o Low back and/or low back-related lower extremity pain at rest or produced with initial to mid-range spinal movements&lt;br&gt;o Low back and/or low back-related lower extremity pain reproduced with provocation of the involved lumbar segment(s)&lt;br&gt;o Movement coordination impairments of the lumbopelvic region with low back flexion and extension movements</td>
<td>• Neuromuscular reeducation to promote dynamic (muscular) stability to maintain the involved lumbosacral structures in less symptomatic, mid-range positions&lt;br&gt;• Consideration of temporary external devices to provide passive restraint to maintain the involved lumbosacral structures in less symptomatic, mid-range positions&lt;br&gt;• Self-care/home management training pertaining to (1) postures and motions that maintain the involved spinal structures in neutral, symptom alleviating positions, and (2) recommendations to pursue or maintain an active lifestyle</td>
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<tr>
<td>Spinal instabilities</td>
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active lifestyle
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<tr>
<th>Impairment-based Category (with ICD-10 associations)</th>
<th>Symptoms</th>
<th>Impairments of Body Function</th>
<th>Primary Intervention Strategies</th>
</tr>
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<tr>
<td><strong>Sub Acute Low Back Pain with Movement Coordination Impairments</strong>&lt;br&gt;Spinal instabilities</td>
<td>o Sub acute, recurring low back pain and associated (referred) lower extremity pain&lt;br&gt;o Symptoms often include numerous episodes of low back pain in recent years</td>
<td>o Lumbosacral pain with <em>mid-range</em> motions that <em>worsen with end-range</em> movements or positions&lt;br&gt;o Low back and low back-related lower extremity pain reproduced with provocation of the involved lumbar segment(s)&lt;br&gt;o Lumbar hypermobility with segmental mobility assessment may be present&lt;br&gt;o Mobility deficits of the thorax and/or lumbopelvic/hip regions&lt;br&gt;o Diminished trunk or pelvic region muscle strength and endurance&lt;br&gt;o Movement coordination impairments while performing self care/home management activities</td>
<td>• Neuromuscular reeducation to provide dynamic (muscular) stability to maintain the involved lumbosacral structures in less symptomatic, mid-range positions during <em>self care</em>-related functional activities&lt;br&gt;• Manual therapy procedures and therapeutic exercises to address identified thoracic spine, ribs, lumbopelvic, or hip mobility deficits&lt;br&gt;• Therapeutic exercises to address trunk and pelvic region muscle strength and endurance deficits&lt;br&gt;• Self-care/home management training in maintaining the involved structures in mid-range, less symptom producing positions&lt;br&gt;• Initiate community/work reintegration training in pain management strategies while returning to community/work activities</td>
</tr>
<tr>
<td><strong>Chronic Low Back Pain with Movement Coordination Impairments</strong>&lt;br&gt;Spinal instabilities</td>
<td>o Chronic, recurring low back pain and associated (referred) lower extremity pain</td>
<td>o Presence of one or more of the following:&lt;br&gt;o Low back and/or low back-related lower extremity pain that <em>worsens with sustained end-range</em> movements or positions&lt;br&gt;o Lumbar hypermobility with segmental motion assessment&lt;br&gt;o Mobility deficits of the thorax and lumbopelvic/hip regions&lt;br&gt;o Diminished trunk or pelvic region muscle strength and endurance&lt;br&gt;o Movement coordination impairments while performing community/work related recreational or occupational activities</td>
<td>• Neuromuscular reeducation to provide dynamic (muscular) stability to maintain the involved lumbosacral structures in a less symptomatic, mid-range positions during <em>household, occupational, or recreational</em> activities&lt;br&gt;• Manual therapy procedures and therapeutic exercises to address identified thoracic spine, ribs, lumbopelvic, or hip mobility deficits&lt;br&gt;• Therapeutic (strengthening) exercises to address trunk and pelvic region muscle strength and endurance deficits&lt;br&gt;• Community/work reintegration training in pain management strategies while returning to community/work activities</td>
</tr>
<tr>
<td>Impairment-based Category (with ICD-10 associations)</td>
<td>Symptoms</td>
<td>Impairments of Body Function</td>
<td>Primary Intervention Strategies</td>
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<tr>
<td><strong>Acute Low Back Pain with Related Lower Extremity Pain</strong>&lt;br&gt;Flatback syndrome&lt;br&gt;Lumbago due to displacement of intervertebral disc</td>
<td>o Acute low back pain and associated (referred) lower extremity pain&lt;br&gt;o Symptoms are often worsened with flexion activities and sitting</td>
<td>o Low back and lower extremity pain that can be centralized and diminished with specific postures and/or repeated movements&lt;br&gt;o Reduced lumbar lordosis&lt;br&gt;o Limited lumbar extension mobility&lt;br&gt;o Lateral trunk shift may be present&lt;br&gt;o Clinical findings consistent with sub acute or chronic low back pain with movement coordination impairments classification criteria</td>
<td>• Therapeutic exercises, manual therapy, or traction procedures that promote centralization and improve lumbar extension mobility&lt;br&gt;• Patient education in positions that promote centralization&lt;br&gt;• Progress to interventions consistent with the Sub Acute or Chronic Low Back Pain with Movement Coordination Impairments intervention strategies</td>
</tr>
<tr>
<td><strong>Acute Low Back Pain with Radiating Pain</strong>&lt;br&gt;Lumbago with sciatica</td>
<td>o Acute low back pain with associated radiating (narrow band of lancinating) pain in the involved lower extremity&lt;br&gt;o Lower extremity paresthesias, numbness, and weakness may be reported</td>
<td>o Lower extremity radicular symptoms that are present at rest or produced with initial to mid-range spinal mobility, lower limb tension tests/straight leg raising, and/or slump tests&lt;br&gt;o Signs of nerve root involvement may be present</td>
<td>• Patient education in positions that reduce strain or compression to the involved nerves root(s) or nerves&lt;br&gt;• Manual or mechanical traction&lt;br&gt;• Manual therapy to mobilize the articulations and soft tissues adjacent to the involved nerve root(s) or nerves that exhibit mobility deficits&lt;br&gt;• Nerve mobility exercises in the pain free, non-symptom producing ranges to improve the mobility of central (dural) and peripheral neural elements</td>
</tr>
<tr>
<td><strong>Sub Acute Low Back Pain with Radiating Pain</strong>&lt;br&gt;Lumbago with sciatica</td>
<td>o Sub acute, recurring, mid back and/or low back pain with associated radiating pain in the involved lower extremity&lt;br&gt;o Lower extremity paresthesias, numbness, and weakness may be reported</td>
<td>o Mid-back, low back and back-related radiating pain or paresthesia that are reproduced with mid-range and worsen with end range:&lt;br&gt;1. Lower limb tension testing/straight leg raising tests and/or -&lt;br&gt;2. Slump tests&lt;br&gt;o May have lower extremity sensory, strength, or reflex deficits associated with the involved nerve(s)</td>
<td>• Manual therapy to mobilize the articulations and soft tissues adjacent to the involved nerve root(s) or nerves that exhibit mobility deficits&lt;br&gt;• Manual or mechanical traction&lt;br&gt;• Nerve mobility and slump exercises in the mid to end ranges to improve the mobility of central (dural) and peripheral neural elements</td>
</tr>
<tr>
<td><strong>Chronic Low Back Pain with Radiating Pain</strong>&lt;br&gt;Lumbago with sciatica</td>
<td>o Chronic, recurring, mid and/or low back pain with associated radiating pain in the involved lower extremity&lt;br&gt;o Lower extremity paresthesias, numbness, and weakness may be reported</td>
<td>o Mid back, low back, or lower extremity pain or paresthesias that are reproduced with sustained end-range lower limb tension tests and/or slump tests&lt;br&gt;o Signs of nerve root involvement may be present</td>
<td>• Manual therapy and therapeutic exercises to address thoracolumbar and lower quarter nerve mobility deficits.&lt;br&gt;• Patient education pain management strategies</td>
</tr>
<tr>
<td>Impairment/Function-based Category (with ICD-10 associations)</td>
<td>Symptoms</td>
<td>Impairments of Body Function</td>
<td>Primary Intervention Strategies</td>
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| **Acute or Sub Acute Low Back Pain with Related Cognitive or Affective Tendencies**  
Low back pain  
Disorder of central nervous system, specified as central nervous system sensitivity to pain | o Acute or sub acute low back and/or low back-related lower extremity pain | One or more of the following:  
o Two positive responses to Primary Care Evaluation of Mental Disorders screen and affect consistent with an individual who is depressed  
o High scores on the Fear-Avoidance Beliefs Questionnaire and behavioral processes consistent with an individual who has excessive anxiety or fear  
o High scores on the Pain Catastrophizing Scale and cognitive process consistent with rumination, pessimism, or helplessness | • Patient education and counseling to addressing specific classification exhibited by the patient (ie, depression, fear-avoidance, pain catastrophizing) |
| **Chronic Low Back Pain with Related Generalized Pain**  
Low back pain  
Disorder of central nervous system  
Persistent somatoform pain disorder | o Low back and/or low back-related lower extremity pain with symptom duration for > 3 months  
o Generalized pain not consistent with other impairment-based classification criteria presented in this clinical guideline | One or more of the following:  
o Two positive responses to Primary Care Evaluation of Mental Disorders screen and affect consistent with an individual who is depressed  
o High scores on the Fear-Avoidance Beliefs Questionnaire and behavioral processes consistent with an individual who has excessive anxiety and fear  
o High scores on the Pain Catastrophizing Scale and cognitive process consistent with rumination, pessimism, or helplessness | • Patient education and counseling to addressing specific classification exhibited by the patient (ie, depression, fear-avoidance, pain catastrophizing)  
• Low intensity, prolonged (aerobic) exercise activities |

(*recommendation for classification criteria based on ____________ evidence)
SUMMARY OF RECOMMENDATIONS

Clinical Course
The clinical course of low back pain can be described as acute, sub acute, transient, recurrent, or chronic. Given preponderance of recurrent and chronic low back pain and the associated costs, clinicians should place high priority on interventions that prevent (1) recurrences and (2) the transition to chronic low back pain.

Diagnosis/Classification
Low back pain, without symptoms or signs of serious medical or psychological conditions, associated with 1) mobility impairment in the thoracic, lumbar, or sacroiliac regions, 2) referred or radiating pain into a lower extremity, and 3) generalized pain are useful clinical findings for classifying a patient with low back pain into the following International Statistical Classification of Diseases and Related Health Problems (ICD) categories: low back pain, lumbago, lumbosacral segmental/somatic dysfunction, low back strain, spinal instabilities, flatback syndrome, lumbago due to displacement of intervertebral disc, lumbago with sciatica, and the associated International Classification of Functioning, Disability, and Health (ICF) impairment-based category of low back pain (b28013 Pain in back, b28018 Pain in body part, specified as pain in buttock, groin, and thigh) and the following, corresponding impairments of body function:

- **Acute low back pain with mobility deficits** (b7101 Mobility of several joints)
- **Sub acute low back pain with mobility deficits** (b7101 Mobility of several joints)
- **Acute low back pain with movement coordination impairments** (b7601 Control of complex voluntary movements)
- **Sub acute low back pain with movement coordination impairments** (b7601 Control of complex voluntary movements)
- **Chronic low back pain with movement coordination impairments** (Control of complex voluntary movements)
- **Acute low back pain with related lower extremity pain** (28015 Pain in lower limb)
- **Acute low back pain with radiating pain** (b2804 Radiating pain in a segment or region)
- **Sub acute low back pain with radiating pain** (b2804 Radiating pain in a segment or region)
- **Chronic low back pain with radiating pain** (b2804 Radiating pain in a segment or region)
- **Acute or sub acute low back pain with related cognitive or affective tendencies** (b2703 Sensitivity to a noxious stimulus, b1522 Range of emotion, b1608 Thought functions, specified as the tendency to elaborate physical symptoms for cognitive/ideational reasons, b1528 Emotional functions, specified as the tendency to elaborate physical symptoms for emotional/affective reasons)
- **Chronic low back pain with related generalized pain** (b2800 Generalized pain, b1520 Appropriateness of emotion, b1602 Content of thought)
Patients with low back pain often fit more than one impairment/function-based category and the most relevant impairments of body function, primary intervention strategy, and the associated impairment/function-based category(ies) are expected to change during the patient's episode of care.

The ICD diagnosis of *lumbosacral segmental/somatic dysfunction* and the associated ICF diagnosis of **acute low back pain with mobility deficits** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Acute low back, buttock or thigh pain (duration < 16 days)
- Restricted lumbar range of motion and segmental mobility
- Low back and low back-related lower extremity symptoms reproduced with provocation of the involved lower thoracic, lumbar or sacroiliac segments

The ICD diagnosis of *lumbosacral segmental/somatic dysfunction* and the associated ICF diagnosis of **sub acute low back pain with mobility deficits** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Sub acute, unilateral, low back, buttock or thigh pain
- Symptoms reproduced with *end-range* spinal motions and provocation of the involved lower thoracic, lumbar or sacroiliac segments
- Presence of thoracic, lumbar, pelvic girdle, or hip active, segmental, or accessory mobility deficits

The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **acute low back pain with movement coordination impairments** is made with a reasonable level of certainty when the patient presents with the following clinical findings.

- Acute exacerbation of recurring low back pain and associated (referred) lower extremity pain
- Symptoms produced with *initial* to *mid-range* spinal movements and provocation of the involved lumbar segment(s)
- Movement coordination impairments of the lumbopelvic region with low back flexion and extension movements

The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **sub acute low back pain with movement coordination impairments** is made with a reasonable level of certainty when the patient presents with the following clinical findings.

- Sub acute exacerbation of recurring low back pain and associated (referred) lower extremity pain
- Symptoms produced with *mid-range* motions that *worsen with end range* movements or positions and provocation of the involved lumbar segment(s)
- Lumbar segmental hypermobility may be present
- Mobility deficits of the thorax and pelvic/hip regions may be present
- Diminished trunk or pelvic region muscle strength and endurance
- Movement coordination impairments while performing self care/home management activities
The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **chronic low back pain with movement coordination impairments** is made with a reasonable level of certainty when the patient presents with the following clinical findings.

- Chronic, recurring low back pain and associated (referred) lower extremity pain
- Presence of one or more of the following:
  - Low back and/or low back-related lower extremity pain that *worsens with sustained end-range* movements or positions
  - Lumbar hypermobility with segmental motion assessment
  - Mobility deficits of the thorax and lumbopelvic/hip regions
- Diminished trunk or pelvic region muscle strength and endurance

  Movement coordination impairments while performing community/work related recreational or occupational activities

The ICD diagnosis of *flatback syndrome, or lumbago due to displacement of intervertebral disc,* and the associated ICF diagnosis of **acute low back pain with related lower extremity pain** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Low back pain and associated (referred) lower extremity pain that worsens with flexion activities and sitting
- Low back and lower extremity pain that can be centralized and diminished with specific postures and/or repeated movements
- Lateral trunk shift, reduced lumbar lordosis, limited lumbar extension mobility, and clinical findings associated with the Sub Acute or Chronic Low Back Pain with Movement Coordination Impairments category are commonly present

The ICD diagnosis of *lumbago with sciatica* and the associated ICF diagnosis of **acute low back pain with radiating pain** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Acute low back pain with associated radiating pain in the involved lower extremity
- Lower extremity paresthesias, numbness, and weakness may be reported
- Symptoms are reproduced or aggravated with *initial to mid-range* spinal mobility, lower limb tension/straight leg raising, and/or slump tests
- Signs of nerve root involvement may be present

It is common for the symptoms and impairments of body function in patients who have **acute low back pain with radiating pain** to also be present in patients who have **acute low back pain with related lower extremity pain**

The ICD diagnosis of *lumbago with sciatica* and the associated ICF diagnosis of **sub acute low back pain with radiating pain** is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Sub acute, recurring, mid-back and/or low back pain with associated radiating pain and potential sensory, strength, or reflex deficits in the involved lower
extremity

- Symptoms are reproduced or aggravated with *mid-range* and *worsen with end range* lower limb tension/straight leg raising and/or slump tests

The ICD diagnosis of *lumbago with sciatica* and the associated ICF diagnosis of *chronic low back pain with radiating pain* is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Chronic, recurring, mid back and/or low back pain with associated radiating pain and potential sensory, strength, or reflex deficits in the involved lower extremity
- Symptoms are reproduced or aggravated with *sustained end-range* lower limb tension/straight leg raising and/or slump tests

The ICD diagnosis of *low back pain/low back strain/lumbago* and the associated ICF diagnosis of *acute or sub acute low back pain with related cognitive or affective tendencies* is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Acute or sub acute low back and/or low back-related lower extremity pain
- Presence of one or more of the following:
  - Two positive responses to Primary Care Evaluation of Mental Disorders for depressive symptoms
  - High scores on the Fear-Avoidance Beliefs Questionnaire and behavior consistent with an individual who has excessive anxiety or fear
  - High scores on the Pain Catastrophizing Scale and cognitive processes consistent with individuals with high helplessness, rumination, or pessimism about low back pain

The ICD diagnosis of *low back pain/low back strain/lumbago* and the associated ICF diagnosis of *chronic low back pain with related generalized pain* is made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Low back and/or low back-related lower extremity pain with symptom duration for > 3 months
- Generalized pain not consistent with other impairment-based classification criteria presented in this clinical guideline
- Presence of depression, fear-avoidance beliefs, and/or pain catastrophizing

Differential Diagnosis

Clinicians should consider diagnostic classifications associated with serious pathological conditions or psychosocial factors and initiate referral to the appropriate medical practitioner when (1) the patient's clinical findings are suggestive of serious medical or psychological pathology, (2) the reported activity limitations or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or (3) when the patient’s symptoms are not resolving with interventions aimed at normalization of the patient’s impairments of body function.

Risk Factors
Clinicians should consider screening for factors that increase the probability of developing recurrent or chronic low back pain. Risk factors for development of recurrent pain include 1) history of previous episodes, 2) excessive mobility in spine, and 3) excessive mobility in other joints. Risk factors for development of chronic pain include 1) presence of symptoms below knee, 2) psychological distress or depression, 2) fear of pain, movement, and re-injury or low expectations of recovery, 3) pain of high intensity, and 4) a passive coping style.

**Examination – Outcome Measures**

Clinicians should use validated self-report questionnaires, such as the Modified Oswestry Low Back Disability Index and the Roland Morris Disability Index. These tools are useful for identifying a patient’s baseline status relative to pain, function, and disability and for monitoring a change in patient’s status throughout the course of treatment.

**Examination – Activity Limitation and Participation Restriction Measures**

Clinicians should routinely assess activity limitation and participation restriction through validated self-report or performance based measures. Changes in the patient’s level of activity limitation and participation restriction should be monitored with these same measures over the course of treatment.

**Interventions – Manual Therapy**

Clinicians should consider utilizing thrust manipulative procedures to reduce pain and disability in patients with mobility deficits and acute (<16 days) low back and back-related buttock or thigh pain. Thrust and non-thrust mobilization procedures can also be used to improve hip mobility and reduce pain and disability in patients with sub acute and chronic low back and back-related limb pain.

**Interventions – Trunk Coordination, Strengthening and Endurance Exercises**

Clinicians should consider utilizing trunk coordination, strengthening, and endurance exercises to reduce low back pain and disability in patients with sub acute and chronic low back pain with movement coordination impairments and in patients post lumbar microdiscectomy.

**Interventions – Centralization Procedures and Exercises**

Clinicians should consider utilizing specific repeated movements, exercises, or procedures to promote centralization to reduce symptoms in patients with acute low back pain with related lower extremity pain.

**Interventions – Flexion Exercises**

Clinicians can consider flexion exercises, combined with other interventions such as manual therapy, strengthening exercises, nerve mobilization procedures, and progressive walking for reducing pain and disability in older patients with chronic low back pain with radiating pain.

**Interventions – Lower Quarter Nerve Mobilization Procedures**

Clinicians should consider utilizing lower quarter nerve mobilization procedures to reduce pain and disability in patients with sub acute and chronic low back pain and radiating pain.

**Interventions – Traction**

There are conflicting opinions regarding 1) the best use of intermittent or static lumbar traction for reducing acute and sub-acute low back pain with radiating pain, 2) the subgroup of patients that respond best to traction, and 3) the frequency, intensity, duration or type of traction for achieving the best outcomes.
Clinicians should not utilize intermittent or static lumbar traction for reducing symptoms in patients with acute or sub acute, non-radicular low back pain or for patients with chronic low back pain.

**Interventions – Patient Education and Counseling**

Clinicians should *not* utilize patient education and counseling strategies that either directly or indirectly increase the perceived threat or fear associated with low back pain, such as education and counseling strategies that 1) promote extended bed-rest or 2) provide in-depth, pathoanatomical explanations for the causes of low back pain. Patient education and counseling strategies for patients with low back pain should emphasize 1) the promotion of the understanding of the anatomical/structural strength inherent in the human spine 2) the neuroscience that explains pain perception; 3) the overall favorable prognosis of low back pain, 4) the use of active pain coping strategies that decrease fear and catastrophizing, 5) the early resumption of normal or vocational activities, even when still experiencing pain, and 6) the importance of improvement in activity levels, not just pain relief.

**Interventions – Progressive Endurance Exercise and Fitness Activities**

Clinicians should consider 1) moderate to high intensity exercise for patients with chronic low back pain without generalized pain, and 2) incorporating progressive, low intensity, sub-maximal fitness and endurance activities into the pain management and health promotion strategies for patients with chronic low back pain with generalized pain.
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