ANTHONY DELITTO, PT, PhD • **STEVEN Z. GEORGE,** PT, PhD • **LINDA VAN DILLEN,** PT, PhD • **JULIE M. WHITMAN,** PT, DSc
GWENDOLYN SOWA, MD, PhD • **PAUL SHEKELLE,** MD, PhD • **THOMAS R. DENNINGER,** DPT • **JOSEPH J. GODGES,** DPT, MA

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

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CONTRIBUTORS: Jason M. Beneciuk, DPT • Mark D. Bishop, PT, PhD
Christopher D. Kramer, DPT • William Koch, DPT • Mark Shepherd, DPT

REVIEWERS: J. Haxby Abbott, MScPT, PhD • Roy D. Altman, MD • Matthew Briggs, DPT • David Butler, BPhty, GDAMT, MAppSc, EdD
Joseph P Farrell, DPT, MAppSci • Amanda Ferland, DPT • Helene Fearon, PT • Julie M. Fritz, PT, PhD • Joy MacDermid, PT, PhD
James W. Matheson, DPT • Philip McClure, PT, PhD • Stuart M. McGill, PhD • Leslie Torburn, DPT • Mark Werneke, PT, MS

For author, coordinator, contributor, and reviewer affiliations, see end of text. ©2012 Orthopaedic Section, American Physical Therapy Association (APTA), Inc, and the *Journal of Orthopaedic & Sports Physical Therapy*. The Orthopaedic Section, APTA, Inc, and the *Journal of Orthopaedic & Sports Physical Therapy* consent to reproducing and distributing this guideline for educational purposes. Address correspondence to: Joseph Godges, DPT, ICF Practice Guidelines Coordinator, Orthopaedic Section, APTA, Inc, 2920 East Avenue South, Suite 200, La Crosse, WI 54601. E-mail: icf@orthopt.org

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Recommendations*

RISK FACTORS: Current literature does not support a definitive cause for initial episodes of low back pain. Risk factors are multifactorial, population specific, and only weakly associated with the development of low back pain. (Recommendation based on moderate evidence.)

CLINICAL COURSE: The clinical course of low back pain can be described as acute, subacute, recurrent, or chronic. Given the high prevalence 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 clinical findings of (1) mobility impairment in the thoracic, lumbar, or sacroiliac regions, (2) referred or radiating pain into a lower extremity, and (3) generalized pain , is useful 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 or subacute low back pain with mobility deficits (b7101 Mobility of several joints)
- Acute, subacute, or chronic low back pain with movement coordination impairments (b7601 Control of complex voluntary movements)
- Acute low back pain with related (referred) lower extremity pain (b28015 Pain in lower limb)
- Acute, subacute, or chronic low back pain with radiating pain (b2804 Radiating pain in a segment or region)
- Acute or subacute 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 medical 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 these guidelines, or (3) 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.)

EXAMINATION – OUTCOME MEASURES: Clinicians should use validated self-report questionnaires, such as the Oswestry Disability Index and the Roland-Morris Disability Questionnaire. These tools are useful for identifying a patient's baseline status relative to pain, function, and disability and for monitoring a change in a 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 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 low back and back-related buttock or thigh pain. Thrust manipulative and nonthrust mobilization procedures can also be used to improve spine and hip mobility and reduce pain and disability in patients with subacute and chronic low back and back-related lower extremity 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-

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Recommendations *(continued)**

acute and chronic low back pain with movement coordination impairments and in patients post lumbar microdiscectomy. (Recommendation based on strong evidence.)

INTERVENTIONS – CENTRALIZATION AND DIRECTIONAL PREFERENCE EXERCISES AND PROCEDURES: Clinicians should consider utilizing repeated movements, exercises, or procedures to promote centralization to reduce symptoms in patients with acute low back pain with related (referred) lower extremity pain. Clinicians should consider using repeated exercises in a specific direction determined by treatment response to improve mobility and reduce symptoms in patients with acute, subacute, or chronic low back pain with mobility deficits. (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 subacute and chronic low back pain and radiating pain. (Recommendation based on weak evidence.)

INTERVENTIONS – TRACTION: There is conflicting evidence for the efficacy of intermittent lumbar traction for patients with low back pain. There is preliminary evidence that a subgroup of patients with signs of nerve root compression along with peripheralization of symptoms or a positive crossed straight leg raise will benefit from intermittent lumbar traction in the prone position. There is moderate evidence that clinicians should not utilize intermittent or static lumbar traction for reducing symptoms in patients with acute or subacute, nonradicular low back pain or patients with chronic low back pain. (Recommendation based on conflicting 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 specific cause of the patient's 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, submaximal 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 accepted for publication prior to January 2011.

Introduction

AIM OF THE GUIDELINES

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).[325]

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

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Introduction *(continued)*

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

The purpose of these low back pain clinical practice guidelines, in particular, is to describe the peer-reviewed literature and make recommendations related to (1) treatment matched to low back pain subgroup responder categories, (2) treatments that have evidence to prevent recurrence of low back pain, and (3) treatments that have evidence to influence the progression from acute to chronic low back pain and disability.

STATEMENT OF INTENT

These guidelines are not intended to be construed as 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 Related Health 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 these guidelines 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 (A.D.) 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 ensure that no studies of relevance were omitted. Additionally, when relevant articles

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Methods *(continued)*

were identified, their reference lists were hand-searched in an attempt to identify other articles that might have contributed to the content 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 with musculoskeletal conditions related to the low back region were included in these guidelines.

These guidelines were issued in 2012 based upon articles accepted for publication in the scientific literature prior to January 2011. These guidelines will be considered for review in 2017, or sooner if new evidence becomes available. Any updates to the guidelines 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 were graded according to criteria described by the Centre for Evidence-Based Medicine, Oxford, United Kingdom (http://www.cebm.net/index.aspx?o=1025) for diagnostic, prospective, and therapeutic studies.[238] 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.

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

GRADES OF EVIDENCE

The overall strength of the evidence supporting recommendations made in these guidelines will be graded according to guidelines described by Guyatt et al,[132] 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.

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

REVIEW PROCESS

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

- 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

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Methods *(continued)*

- Spinal biomechanics
- Sports physical therapy residency education
- Sports rehabilitation

Comments from these reviewers were utilized by the authors to edit these clinical practice guidelines prior to submitting them 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 the classification criteria summary of the ICF-based Neck Pain Clinical Practice Guidelines[49] was useful in linking data gathered during the patient's subjective and physical examinations to diagnostic classification and intervention. Thus, similar recommended classification criteria were included by the authors for these ICF-based Low Back Pain Clinical Practice Guidelines, which provide a summary of symptoms, impairment findings, and matched interventions for each diagnostic category. This summary is provided in the Recommended Low Back Pain Impairment/Function-based Classification Criteria with Recommended Interventions table.

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**, **M54.1 Lumbar radiculopathy**, **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**.[324] The corresponding ICD-9-CM codes and conditions, which are used in the United States, are **739.3 Nonallopathic lesion, lumbar region**, **846.0 Lumbosacral ligament sprain**, **724.3 Sciatica**, **724.4 Thoracic or lumbosacral neuritis or radiculitis, unspecified**, and **724.2 Lumbago**.

The primary ICF body-function codes associated with the above noted ICD-10 conditions are **b28013 Pain in back**, **b28018 Pain in body part, specified as pain in buttock, groin, and thigh**, **b28015 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**, and **d129 Purposeful sensory experiences, specified as repetitive perception of noninjurious sensory stimuli**.

The ICD-10 and ICF codes associated with low back pain are provided in the following table.

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ICD-10 and ICF Codes Associated With Low Back Pain

INTERNATIONAL STATISTICAL CLASSIFICATION OF DISEASES AND RELATED HEALTH PROBLEMS (ICD) CODES		
Acute and Subacute Low Back Pain with Mobility Deficits	M99.0	Lumbosacral segmental/somatic dysfunction
Acute, Subacute, and Chronic Low Back Pain with Movement Coordination Impairments	M53.2	Spinal instabilities
Acute Low Back Pain with Related (Referred) Lower Extremity Pain	M40.3	Flatback syndrome
	M51.2	Other specified intervertebral disc displacement (lumbago due to displacement of intervertebral disc)
Acute, Subacute, and Chronic Low Back Pain with Radiating Pain	M54.1	Lumbar radiculopathy (neuritis or radiculitis)
	M54.4	Lumbago with sciatica
Acute or Subacute 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
SUBACUTE 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

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Body structure (continued)	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
SUBACUTE AND 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 arm
	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
	e1151	Assistive products and technology for personal use in daily living
	e1351	Assistive products and technology for employment
	e1401	Assistive products and technology for culture, recreation, and sport
ACUTE LOW BACK PAIN WITH RELATED (REFERRED) LOWER EXTREMITY PAIN		
Body functions	b28013	Pain in back
	b28015	Pain in lower limb
	b7101	Mobility of several joints
Body structure	s76002	Lumbar vertebral column
Activities and participation	d4153	Maintaining a sitting position

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Activities and participation (continued)	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	b28013	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
SUBACUTE AND CHRONIC LOW BACK PAIN WITH RADIATING PAIN		
Body functions	b28013	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
ACUTE OR SUBACUTE 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
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	d2303	Completing the daily routine
	d5701	Managing diet and fitness
	d129	Purposeful sensory experiences, specified as repetitive perception of noninjurious sensory stimuli

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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	d2303	Completing the daily routine
	d5701	Managing diet and fitness
	d129	Purposeful sensory experiences, specified as repetitive perception of noninjurious sensory stimuli
	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)

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CLINICAL GUIDELINES

Impairment/Function-Based Diagnosis

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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 recent systematic review estimated the 1-year incidence of a first-ever episode of low back pain to range between 6.3% and 15.3%, while estimates of the 1-year incidence of any episode of low back pain range between 1.5% and 36%.[166] Low back pain is the leading cause of activity, limitation and work absence throughout much of the world and is associated with an enormous economic burden.[180,282,291] Also, individuals who have experienced activity-limiting low back pain often experience reoccurring episodes with estimates ranging between 24% and 33%.[280,309] Chronic low back pain has specifically demonstrated rapid increases. Freburger et al[101] demonstrated an increase in chronic low back pain from 3.9% (95% CI: 3.4, 4.4) in 1992 to 10.2% (95% CI: 9.3, 11.0) in 2006 in a telephone survey of North Carolina households.

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 such as sex, age, education, and occupation. Women tend to have a higher prevalence of low back pain than men, although the differences reported vary in magnitude.[21,239,240,262] An increase in age is also associated with higher prevalence of low back pain. The more severe forms of low back pain continue to increase with age[86] and the overall prevalence increases until ages 60 to 65.[193,201] Lower educational status is associated with increased prevalence of low back pain[86,88,166,254] as well as a longer episode duration and worse outcome.[88]

Occupational differences in low back pain prevalence have also been reported[166] with an association between higher physical demand and low back pain prevalence.[210] Material workers were reported to have a low back pain prevalence of 39%, whereas workers whose job responsibilities were classified as sedentary were reported to have a prevalence of 18.3%.[210] Although differences exist between different occupational groups, similar low back pain prevalence rates have been reported between working and nonworking groups.[240]

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 of low back pain. The 2 major categories of suspected risk factors for low back pain are individual and activity-related (work and leisure) factors. Individual factors include but are not limited to demographic, anthropometric, physical, and psychosocial factors.

II 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.[17] The link of heredity to development of nonspecific low back pain, however, remains questionable. A study by Battie et al[18] demonstrated that there appears to be some relation between genetics, body build, and early environmental influences in determining the degenerative changes of the spine frequently associated with aging. Degenerative changes on magnetic resonance imaging (MRI), myelography, and computer-assisted tomography (CAT), however, are not strongly related to low back pain symptoms.[31,161,319] There is some evidence that supports back pain associated with operating heavy equipment.[310] Cardiovascular hypertension and lifestyle (smoking, overweight, obesity) risk factors are associated with sciatica.[271] There is inconclusive evidence for a relationship between trunk muscle strength or mobility of the lumbar spine and the risk of low back pain.[139]

II Psychosocial factors appear to play a larger prognostic role than physical factors in low back pain. There are some reviews that question if changes in behavioral variables and reductions of disability that facilitate an improvement in function may be more important than physical performance factors for successful treatment of chronic low back pain.[315] There is some evidence to suggest that fear may play a role when pain has become persistent.[125,126] There is a growing consensus that distress/depression plays an important role at early stages, and clinicians should focus on these factors.[243] 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.[42]

II 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 of low back pain, job satisfaction, educational level, marital status, number of dependents, smoking, working more than 8-hour shifts, occupation, and size of industry or company does not influence duration of sick leave due to low back pain.[282] In addition, the clinical course for patients with comorbidities, who may seem more complicated at the start of treatment, is just as favorable as for those without such comorbidities.[213] Consistent evidence was found for one's own expectations of recovery as a predictor for the decision to return to work. Patients with higher expectations had less sickness absence at the moment of follow-up measurement.[188] Consistent evidence was found for the predictive value of pain intensity (more pain associated with worse outcome), several work-related parameters (eg, high satisfaction associated with better outcome), and coping style (active coping associated with better outcome).[297]

II In adolescents, the overall risk of low back pain is similar to adults, with prevalence rates as high as 70% to 80% by 20 years of age.[170] Similar to adults, girls appear to have a higher prevalence, with 1 study demonstrating that females have almost 3 times the risk of back pain as their male counterparts.[300] Anthropometrics (eg, height, weight, body mass index) do not appear to be strongly associated with low back pain in adolescents, nor does lumbar mobility[189] or trunk muscle weakness.[15] 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 appear to be mixed findings, with certain activities related to specific sports (eg, weightlifting, body building, rowing) associated with low back pain.[90,145,214] In cross-sectional studies, activity and prevalence of back pain take on a U-shaped function, with back pain increased at the sedentary and higher-activity ends.[290,311] However, in longitudinal studies, the relationship between modifying physical activity and back pain prevalence has not been well established.[172,261] 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.[171-173,311]

B Current literature does not support a definitive cause for initial episodes of low back pain. Risk factors are multifactorial, population specific, and only weakly associated with the development 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 structures includes the muscles, ligaments, dura mater and nerve roots, zygapophyseal joints, annulus fibrosis, thoracolumbar fascia, and vertebrae.[177,178,192] One might expect that improvement in the resolution of imaging technology has 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, individuals without low back pain showing abnormal findings. For example, evidence of herniated disc material is shown on computerized tomography (CT) scans,[319] MRI,[31] and myelography[161] in 20% to 76% of persons with no sciatica. Furthermore, Savage et al[264] reported that 32% of their asymptomatic subjects had "abnormal" lumbar spines (evidence of disc degeneration, disc bulging or protrusion, facet hypertrophy, or nerve root compression) and only 47% of their 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.[264] Boos et al[33] followed asymptomatic patients with a herniated disc for 5 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 with radiological findings must be considered cautiously. Further, even when abnormalities are present, establishing a direct cause and effect between the pathological finding and the patient condition has proven to be elusive and most often does not assist greatly in patient management.

CLINICAL COURSE

Classically, the course of low back pain has been described to consist of acute, subacute, and chronic phases, with temporal definitions typically associated with each phase. While different operational definitions have been reported in the literature, commonly accepted definitions for the acute, subacute, and chronic phases are, respectively, less than 1 month, between 2 and 3 months, and greater than 3 months since the onset of the episode of low back pain.

II Because low back pain is often recurrent in nature, exclusive use of temporal definitions to describe its course has been challenged in the literature.[302,304] The primary argument is that when low back pain is recurrent, the time to improvement from a single episode does not

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accurately describe outcomes. 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.[23] In that same study, 2 months was the median time to another episode of low back pain and 60 days was the median total duration of low back pain in the year. Other studies have reported lower, but still substantial, recurrence rates ranging from 20% to 35% over a period of 6 to 22 months[41] and 45% over 3 years.[8]

II When these other factors are considered, the prognosis for low back pain becomes less favorable and more variable. At the 1-year follow-up of patients with low back pain followed by primary care practitioners, 69% of patients with recent onset (within the past 6 months) of low back pain reported having pain in the last month.[303] Only 21% of these patients were pain free at 1 year, with 55% reporting low disability and low pain intensity, 10% reporting low disability and high pain intensity, and 14% reporting high disability with varying amounts of pain intensity.[303] Similar trends were noted for the 82% of patients with persistent (onset longer than the past 6 months) low back pain who reported having pain in the last month.[303] At 1-year follow-up, only 12% were pain free, with 52% reporting low disability and low pain intensity, 16% reporting low disability and high pain intensity, and 20% reporting high disability with varying amounts of pain intensity.[303]

Clinicians should also consider screening for and addressing factors that increase the probability of developing recurrent or chronic low back pain. Prognostic factors for development of recurrent pain include (1) history of previous episodes,[280,304] (2) excessive spine mobility,[139,191] and (3) excessive mobility in other joints.[218,224] Prognostic factors for development of chronic pain include (1) presence of symptoms below the knee,[48,175] (2) psychological distress or depression,[48,243,249] (3) fear of pain, movement, and reinjury or low expectations of recovery,[123,125,126,175,188,282] (4) pain of high intensity,[175] and (5) a passive coping style.[170,249,297]

E The clinical course of low back pain can be described as acute, subacute, recurrent, or chronic. Given the high prevalence 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

I Attempts to identify effective interventions for individuals with low back pain have been largely unsuccessful, with most interventions being found to be ineffective or having only marginal effect sizes. Most intervention 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 subgrouping methods. The utility of subgrouping based on pathoanatomy is limited by an inability to identify a pathological mechanism for most patients. Emphasis in the development of subgrouping methods for conservative care has therefore been placed on patterns of signs and symptoms from the clinical examination.[276] The development of classification systems has been identified as a priority among researchers in the primary care management of patients with low back pain.[34] This challenge has been taken on largely by researchers who have focused on nonsurgical interventions with the goal of identifying subgroups of patients in whom tailored interventions can be administered with the goal of more rapid recovery.[35,51,78,79,107,108,141,152,202,293]

I 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 when studied in people with heterogeneous, nonspecific low back pain,[83] recent reports in the literature suggest that interventions based on subgroup classification have the potential to enhance effect sizes over studies where the identical interventions were administered in a one-size-fits-all approach.[35,51,108,124,204]

There are a variety of low back pain classification systems described in the literature.[27,256] 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 these guidelines provide a synthesis of these classification approaches by highlighting particular subgroups of patients with low back pain that have high levels of evidence supporting their identification and management.

I The treatment-based classification system[107,110] 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,[108] utilizing a randomized clinical trial of 78 patients with acute, work-related low back pain, reported that patients who received interventions matched with their examination findings had better outcomes than

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patients who received interventions that were not matched with their examination findings.

The classification system described in these practice guidelines, linked to the ICF, parallels the treatment-based classification system[107] with 3 noteworthy differences. The first difference is that the categories in these clinical practice guidelines 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 the low back pain with "related cognitive or affective tendencies" and "generalized pain" categories to provide a classification for patients with pain who, in addition to movement-related impairments of body function, have impairments of mental functioning (appropriateness of emotion, content of thought) and impairments of sensory function (generalized pain). The third difference is the addition of the patient's level of acuity to this ICF-based classification system, with the level of acuity defined in terms of (1) time since onset of symptoms and (2) movement/pain relations.

These ICF-based clinical practice guidelines will expand on the work of others[260,283] and 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 link 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 acute, subacute, or chronic. In addition to the temporal definitions typically associated with the acute, subacute, 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. The authors of these guidelines propose that the recurring nature of low back pain requires clinicians to expand beyond the time frames traditionally used for acute (less than 1 month), subacute (between 2 and 3 months), and chronic (greater than 3 months) low back pain categorization. For example, clinicians frequently are required to assist patients with managing acute exacerbations of "chronic" low back pain conditions. For patients who have had low back pain for more than 3 months and/or for patients who have recurring low back pain, these clinical guidelines promote categorizing acute, subacute, and chronic low back pain based on movement/pain relations rather than solely using time since the patient's initial onset of low back pain. Movement/pain relations are commonly used in physical therapy for classifying patients into treatment categories that respond best to matched intervention strategies,[35,89,103,105,107,108] as well as to guide dosing of manual therapy, therapeutic exercise, and patient education interventions.[176] The dosing of interventions based upon movement/pain relations is consistent with the concept of tissue irritability and is important for guiding clinical decisions regarding treatment frequency, intensity, duration, and type with the goal of matching the optimal dosage of treatment to the status of the tissue being treated. Irritability is a term used by rehabilitation practitioners to reflect the tissue's ability to handle physical stress[222] and is presumably related to its physical status and the extent of inflammatory activity present, which is relevant for the mobility deficit, movement coordination impairments, and radiating pain diagnostic classifications used in these clinical guidelines.

ICF Impairment of Body Functions Terminology and Characteristics

For **acute low back pain with mobility deficits**, the distinguishing movement/pain characteristic is that the patient demonstrates restricted spinal range of motion and segmental mobility, and that the patient's low back and low back–related lower extremity symptoms are reproduced with provocation of the involved segments, with intervention strategies focused on reducing pain and improving mobility of the involved spinal segments.

For **acute low back pain with movement coordination impairments** and **acute low back pain with radiating pain**, the distinguishing movement/pain characteristic is pain that occurs with initial to mid-ranges of active or passive motions, with intervention strategies focused on movements that limit pain or increase the pain-free movement in the mid-ranges.

For **subacute low back pain with mobility deficits**, **subacute low back pain with movement coordination impairments**, and **subacute low back pain with radiating pain**, the distinguishing movement/pain characteristic is pain that occurs with mid- to end-ranges of active or passive motions, with intervention strategies focused on movements that increase movement tolerances in the mid- to end-ranges of motions.

For **chronic low back pain with movement coordination impairments** and **chronic low back pain with radiating pain**, the distinguishing movement/pain characteristic is pain that occurs with sustained end-range movements or positions, with intervention strategies focused on move-

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ments that increase movement tolerances in the end ranges of motion.

Another acute pain category, **acute low back pain with related (referred) lower extremity pain**, is a condition with high irritability but, in contrast to the above mentioned acute low back pain categories, the intervention strategy is focused on centralizing or abolishing the patient's symptoms.

For the **acute and subacute low back pain with related cognitive and affective tendencies** and **chronic low back pain with generalized pain** categories, the low back pain does not follow the initial, mid-range, or end-range movement/pain relations reflective of tissue stress, inflammation, and irritability. Hence, the intervention strategies for these pain categories are not focused on normalizing movement/pain relations but rather on addressing the relevant cognitive and affective tendencies and pain behaviors with patient education and counseling.

I In the randomized clinical trials suggesting that interventions based on impairment-based classifications are an effective strategy for management of low back pain,[35,79,108] the subjects in the impairment-based classification groups were re-evaluated 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 adjust the treatment program on the basis of changes in physical examination findings and to consider that the most relevant impairments of body function, primary intervention strategy, and the associated ICF-based classification will often change during the patient's episode of care. In addition, when using impairment-based classification approaches, patients with low back pain often fit more than 1 ICF-based classification, or do not definitively fit a single classification category,[279] and thus the expectation is to classify the majority of patients, not all of them. In addition, overlap may exist between the ICF-based classification system used in these clinical guidelines and other published classification systems.[102,312]

Impairment/Function-Based Classification Criteria

I The ICD diagnosis of *lumbosacral segmental/somatic dysfunction* and the associated ICF diagnosis of **acute low back pain with mobility deficits** are made with a reasonable level of certainty when the patient presents with the following clinical findings[35,51,108,116]:

- Acute low back, buttock, or thigh pain (duration of 1 month or less)
- 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

I The ICD diagnosis of *lumbosacral segmental/somatic dysfunction* and the associated ICF diagnosis of **subacute low back pain with mobility deficits** are made with a reasonable level of certainty when the patient presents with the following clinical findings[35,116]:

- Subacute, 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

II The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **acute low back pain with movement coordination impairments** are made with a reasonable level of certainty when the patient presents with the following clinical findings[35,108]:

- Acute exacerbation of recurring low back pain that is commonly associated with 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

II The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **subacute low back pain with movement coordination impairments** are made with a reasonable level of certainty when the patient presents with the following clinical findings[116,152]:

- Subacute exacerbation of recurring low back pain that is commonly associated with 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

II The ICD diagnosis of *spinal instabilities* and the associated ICF diagnosis of **chronic low back pain with movement coordination impairments** are made with a reasonable level of certainty when the patient

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presents with the following clinical findings[78,141,293]:

- Chronic, recurring low back pain that is commonly associated with referred lower extremity pain
- Presence of 1 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

I 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 (referred) lower extremity pain** are made with a reasonable level of certainty when the patient presents with the following clinical findings[35,89,94,108,204]:

- Low back pain, commonly associated with referred buttock, thigh, or leg pain, that worsens with flexion activities and sitting
- Low back and lower extremity pain that can be centralized and diminished with positioning, manual procedures, and/or repeated movements
- Lateral trunk shift, reduced lumbar lordosis, limited lumbar extension mobility, and clinical findings associated with the subacute or chronic low back pain with movement coordination impairments category are commonly present

II The ICD diagnosis of *lumbago with sciatica* and the associated ICF diagnosis of **acute low back pain with radiating pain** are made with a reasonable level of certainty when the patient presents with the following clinical findings[114]:

- 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 (sensory, strength, or reflex deficits) 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 (referred) lower extremity pain**.

II The ICD diagnosis of *lumbago with sciatica* and the associated ICF diagnosis of **subacute low back pain with radiating pain** are made with a reasonable level of certainty when the patient presents with the following clinical findings[35,65,120]:

- Subacute, 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 nerve tension/straight leg raising and/or slump tests

III The ICD diagnosis of *lumbago with sciatica* and the associated ICF diagnosis of **chronic low back pain with radiating pain** are made with a reasonable level of certainty when the patient presents with the following clinical findings[65,121]:

- 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 nerve tension/straight leg raise and/or slump tests

I The ICD diagnosis of *low back pain/low back strain/lumbago* and the associated ICF diagnosis of **acute or subacute low back pain with related cognitive or affective tendencies** are made with a reasonable level of certainty when the patient presents with the following clinical findings[112,124,136,183,318]:

- Acute or subacute low back and/or low back–related lower extremity pain
- Presence of 1 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

I The ICD diagnosis of *low back pain/low back strain/lumbago* and the associated ICF diagnosis of **chronic low back pain with related generalized**

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pain are made with a reasonable level of certainty when the patient presents with the following clinical findings[12,75,136,183]:

- Low back and/or low back–related lower extremity pain with symptom duration of more than 3 months
- Generalized pain not consistent with other impairment-based classification criteria presented in these clinical guidelines
- Presence of depression, fear-avoidance beliefs, and/or pain catastrophizing

B Low back pain, without symptoms or signs of serious medical or psychological conditions, associated with clinical findings of (1) mobility impairment in the thoracic, lumbar, or sacroiliac regions, (2) referred or radiating pain into a lower extremity, and (3) generalized pain, is useful 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 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 or subacute low back pain with mobility deficits (b7101 Mobility of several joints)
- Acute, subacute, or chronic low back pain with movement coordination impairments (b7601 Control of complex voluntary movements)
- Acute low back pain with related (referred) lower extremity pain (b28015 Pain in lower limb)
- Acute, subacute, or chronic low back pain with radiating pain (b2804 Radiating pain in a segment or region)
- Acute or subacute 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

III 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. In the vast majority of patients with low back pain, symptoms can be attributed to nonspecific mechanical factors. However, in a much smaller percentage of patients, the cause of back pain may be something more serious, such as cancer,[82,84,148] cauda equina syndrome,[74,84] spinal infection,[307] spinal compression fractures,[149] spinal stress fractures,[150] ankylosing spondylitis,[130] or aneurysm.[97] Clinical findings that increase the level of suspicion that there is a serious medical condition presenting as common, nonserious, musculoskeletal conditions, are commonly described as red flags. The table below lists serious medical conditions that can cause low back pain and their associated red flags, including tumors, cauda equina syndrome, infection, compression fracture, and abdominal aortic aneurysm.

V Clinicians must be aware of the key signs and symptoms associated with serious medical conditions that cause low back pain and develop a system to continually screen for the presence of these conditions. Such screening may include administering medical screening questionnaires that query 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. In addition, a neurological status examination should be included for patients with low back pain. For example, patients presenting with leg paresthesias (eg, tingling), sensory changes (eg, numbness), complaints of weakness (eg, foot drop), or signs of central nervous system disorders (eg, excessive muscle tone/clonus) should receive a thorough neurological examination including assessment of sensation, reflexes, muscle power, motor control, and movement coordination. When a potentially serious medical condition is suspected, clinicians should initiate referral to the appropriate medical practitioner.

III Failure to improve with conservative care can also be a sign of a serious medical condition[26] or misdiagnosis. As a general guideline, failure of a patient to demonstrate improvement in a period of time no longer than 30 days can be interpreted as a red flag.[84]

I Recent research is available investigating low back pain and 1 serious medical condition: spinal fractures. Henschke et al,[149] in a systematic review of 12 studies, reported that the 5 factors most helpful in identifying spinal fractures were age greater than 50 years (positive likelihood ratio [+LR] = 2.2, negative likelihood ratio [−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 a co-occurring, distracting/painful injury (+LR = 1.7, −LR = 0.78). In a follow-up study involving an inception cohort of patients seeking primary

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care treatment for low back pain, the rate of serious pathology was quite low (0.9%), with most of the identified red flag cases, 8 of 11, being spinal fractures.[150] Because most patients had at least 1 red flag, Henschke et al[150] have cautioned against use of isolated red flags because of poor diagnostic accuracy. To improve diagnostic accuracy, a diagnostic prediction rule for identifying spinal fracture, which included being female, older than 70 years, significant trauma, and prolonged use of corticosteroids, was developed.[149]

I 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 from an acute condition to a chronic, disabling condition. Researchers have shown that psychosocial factors are an important prognostic indicator of prolonged disability.[315]

V The term "yellow flags" is commonly used in the literature to differentiate psychosocial risk factors for persistent pain from medical red flags. Identification of psychological factors is assisted with the use of standard questionnaires described in the Measures section of these clinical guidelines. 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 these clinical guidelines. In addition, there should be standard processes so that clinicians screening for severe psychiatric disturbances (eg, clinical depression) have a clear indication of when referral for appropriate care is expected in a given clinical setting. An example of such a process can be made with the Primary Care Evaluation of Mental Disorders tool that has been described for depressive symptom screening in physical therapy settings.[136] A patient with a positive screening result for major or severe depressive symptoms should receive a focused clinical interview and should complete a full-length depressive symptom questionnaire (eg, Patient Health Questionnaire or Beck Depression Inventory). A referral to a mental healthcare provider is indicated to confirm a depression diagnosis if the results of the interview and questionnaire provide further indication that major or severe depressive symptoms are present and the patient is unaware of this. An immediate assessment by a medical and/or mental health professional is indicated for safety reasons if the patient had a plan to harm himself/herself or others. A similar process could be used for clinicians who screen for other psychopathology (eg, anxiety). The authors of these clinical guidelines acknowledge that this is a general description for a rather important process. However, there are no absolute guidelines for the levels of psychological symptoms that indicate referral. Therefore, clinicians will have to work within their own clinical environments, using available resources, to ensure this screening is handled appropriately.

A Clinicians should consider diagnostic classifications associated with serious medical 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 these guidelines, or (3) the patient's symptoms are not resolving with interventions aimed at normalization of the patient's impairments of body function.

RED FLAGS FOR THE LOW BACK REGION

Condition	History and Physical Examination Data	Sensitivity	Specificity	+LR (95% CI)	−LR (95% CI)	Odds Ratio (95% CI)
Back-related tumor[82,84,148]	Constant pain not affected by position or activity; worse with weight bearing, worse at night	...	...	...	...	...
	Age over 50	0.84	0.69	2.2 (1.8, 2.7)	0.34 (0.17, 0.68)	...
	History of cancer	0.55	0.98	23.7 (11.3, 49.4)	0.25 (0.01, 9.19)	...
	Failure of conservative intervention (failure to improve within 30 days)	0.29	0.90	3.0 (1.4, 6.3)	0.79 (−0.58, 1.07)	...
	Unexplained weight loss	0.15	0.94	3.0 (1.0, 9.3)	0.87 (0.68, 1.12)	...
	No relief with bed-rest	1.00	0.46	1.7 (1.2, 2.2)	0.22 (0.02, 3.02)	...

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Condition	History and Physical Examination Data	Sensitivity	Specificity	+LR (95% CI)	–LR (95% CI)	Odds Ratio (95% CI)
Cauda equina syndrome [74,84]	Urine retention	0.90	0.95	18.0	0.11	...
	Fecal incontinence	...	...	...	...	...
	Saddle anesthesia	0.75	...	...	...	...
	Sensory or motor deficits in the feet (L4, L5, S1 areas)	0.80	...	...	...	...
Back-related infection [84 307]	Recent infection (eg, urinary tract or skin), intravenous drug user/abuser	0.40	...	...	...	...
	Concurrent immunosuppressive disorder	...	...	...	...	...
	Deep constant pain, increases with weight bearing	...	...	...	...	...
	Fever, malaise, and swelling	...	...	...	...	...
	Spine rigidity; accessory mobility may be limited	...	...	...	...	...
	Fever: tuberculosis osteomyelitis	0.27	0.98	13.5	0.75	...
	Fever: pyogenic osteomyelitis	0.50	0.98	25.0	0.51	...
	Fever: spinal epidural abscess	0.83	0.98	41.5	0.17	...
Spinal compression fracture [149]	History of major trauma, such as vehicular accident, fall from a height, or direct blow to the spine	0.30	0.85	12.8 (8.3, 18.7)	0.37 (0.20, 0.57)	...
	Age over 50	0.79	0.64	2.2 (1.4, 2.8)	0.34 (0.12, 0.75)	...
	Age over 75	0.59	0.84	3.7 (2.9, 4.5)	0.49 (0.37, 0.62)	...
	Prolonged use of corticosteroids	...	...	...	...	...
	Point tenderness over site of fracture	...	...	...	...	...
	Increased pain with weight bearing	...	...	...	...	...
Abdominal aneurysm (≥4 cm) [97]	Back, abdominal, or groin pain	...	...	...	...	...
	Presence of peripheral vascular disease or coronary artery disease and associated risk factors (age over 50, smoker, hypertension, diabetes mellitus)	...	...	...	...	...
	Smoking history	...	...	...	...	5.07 (4.13, 6.21)
	Family history	...	...	...	...	1.94 (1.63, 2.32)
	Age over 70	...	...	...	...	1.71 (1.61, 1.82)
	Non-Caucasian	...	...	...	...	1.02 (0.77, 1.35)
	Female	...	...	...	...	0.18 (0.07, 0.48)
	Symptoms not related to movement stresses associated with somatic low back pain	...	...	...	...	...
	Abdominal girth <100 cm	0.91	0.64	2.5	0.14	...
	Presence of a bruit in the central epigastric area upon auscultation	...	...	...	...	...
	Palpation of abnormal aortic pulse	0.88	0.56	2.0	0.22	...
	Aortic pulse 4 cm or greater	0.72	...	...	...	...
	Aortic pulse 5 cm or greater	0.82	...	...	...	...

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IMAGING STUDIES

Imaging modalities have frequent false positive and negative results, limiting their utility in identification of active anatomic pain generators. Therefore, the primary utility of imaging lies in interventional and/or surgical planning or in determining the presence of serious medical conditions. 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[43] or alter outcomes.[54] In chronic low back pain, the role of routine diagnostic imaging is even less 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.[55]

Low Back Pain With Mobility Deficits

As this is described as acute symptoms, lasting 1 month or less, in the absence of red flag signs, no imaging is indicated.[56]

Low Back Pain With Movement Coordination Impairments

Poor trunk muscle function has been associated with back pain,[194] 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 muscles involved with optimal trunk control/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.[157] In addition, functional activity of lumbar muscles assessed by MRI demonstrated differences in usage and signal intensity in patients with low back pain.[98] Similarly, cross-sectional area changes in the multifidus with different postures demonstrate altered patterns in patients with low back pain.[196] 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 (odds ratio [OR], 9.2) and low back pain within the last year (OR, 4.1).[182] Similarly, an 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.[155] The potential exists for imaging modalities to detect muscular control impairments and ultimately guide treatment decisions; however, this has not been extensively explored in common clinical practice.

Low Back Pain With Related (Referred) 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.[154]

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.[85,292] 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.[56] In the absence of these findings, there is no evidence that routine imaging affects treatment decisions or outcomes in these patients.[217]

Low Back Pain With Related Generalized Pain

Evidence exists that in addition to having no additional prognostic utility, knowledge of changes on routine imaging in patients with low back pain is associated with a lesser sense of well-being.[217] This is particularly relevant in patients with generalized pain disorders, suggesting that nonindicated imaging should be strongly discouraged.

While not currently being used clinically, functional MRI 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.[16] 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.

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CLINICAL GUIDELINES

Examination

These clinical guidelines will describe a core set of examination tests and measures, with the best available evidence, that enable a clinician to determine (1) the presence of clinical findings associated with an impairment/function-based diagnostic category, and (2) changes in impairments of body function, activity limitations, and participation restrictions over the course of a patient's episode of care. Clinicians are expected to choose the most relevant outcome, activity limitation, and/or impairment measures to utilize based upon the patient's presentation, needs, or goals. This is especially true within the section for Mental Impairment Measures. For example, clinicians should decide which instruments are appropriate to utilize for a given patient based upon that patient's presentation in regard to depression, anxiety, or fear.

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.[32,81] The most often used generic health status index is the Medical Outcomes Survey Short-Form-36 (SF-36), in particular, the physical functioning domain.[80] The SF-36 has the distinct advantage of being more comprehensive in capturing these domains and has been reasonably responsive in trials of comparative and cost-effectiveness studies. However, generic measures also have the disadvantage of lacking region specificity and sensitivity to change in specific patient populations.

To optimize responsiveness and ease of administration, region-specific measures are commonly used in low back pain treatment and research. The Oswestry Disability Index is a commonly utilized outcome measure to capture perceived disability in patients with low back pain.[113,118] Originally described by Fairbank et al,[96] there are also modified versions widely reported in the literature.[113,118] This index contains 10 items: 8 related to activities of daily living and 2 related to pain. Each item is scored from 0 to 5 and the total score is expressed as a percentage, with higher scores corresponding to greater disability. The Oswestry Disability Index has long-standing recognition as an acceptable standard, with numerous studies that establish its reliability, validity, and responsiveness. Multiple studies have been undertaken to determine the error associated with the measure and the minimally important change, with the most recent international consensus conference determining that the minimally important change was 10 points (out of 100) or 30% from the baseline score.[233]

The Roland-Morris Disability Questionnaire is a practical alternative to the Oswestry Disability Index. Originally described by Roland and Morris,[257] 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 Roland-Morris Disability Questionnaire asks patients to gauge whether each of the 24 items is possible to accomplish. The activities are led by the stem, "Because of my back pain," thus allowing it to be region specific. Like the Oswestry Disability Index, the Roland-Morris Disability Questionnaire has excellent psychometrics, is easy to administer, and has been shown to be responsive in clinical trials. Ostelo et al[233] reported from a consensus conference a minimally important change of 5 points (out of 24) or 30% from the baseline score.

Other self-report measures have been reported, including the Quebec Back Pain Disability Scale,[113,184] but they have failed to gather widespread adoption. In addition, the visual analog scale and numeric pain rating scale are commonly used 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 outcome in low back pain assessment. They do assess pain very specifically, though, and the minimally important change for the visual analog scale is 15 (using a 100-mm scale) and it is 2 (using a 0-10 self-report scale) for the numeric pain rating scale.[52,135]

The process of collecting patient-reported functional outcomes data has progressed substantially over the past 2 decades through the application of item response theory (IRT) and computer adaptive testing (CAT), with several proprietary options available (eg, PROMIS, FOTO, AM-PAC).[142,144,169,258] When compared to traditional self-report functional outcome assessment measures (eg, Oswestry Disability Index), IRT/CAT functional status outcome tools allow for the administration of fewer test items to individual patients to obtain equally accurate, precise, and reliable scores.[142,144,169,258] Consequently, one of the major advantages of IRT/CAT measures is efficiency with enhanced psychometric qualities. In addition, well-constructed IRT/

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CAT approaches to functional assessment theoretically allow for a test to more precisely depict functioning at the extremes of ability using the same outcome metric, though this assumes the IRT/CAT instrument has been subjected to rigorous testing, such as vetted item pool selection, accurate item calibration, and validated item-selection algorithms and scoring procedures. Future research is required to demonstrate further the advantages of IRT/CAT functional status outcomes measures versus more traditional self-report assessments.

Whether using traditional assessments or IRT/CAT instruments, regular and accurate outcome assessment becomes of paramount importance in determining cost-effectiveness of care. When integrated with electronic health records software, capturing process of care and outcomes becomes a powerful tool in determining the value of care delivery. Combining process of care and outcomes that are important to the patient (eg, patient-centered care) the foundation for comparative effectiveness studies designed to assess which treatments are associated with better outcomes for each patient.

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

ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES

III 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 (eg, return to work). There are a variety of tools used to assess functional capacity in a work setting. A systematic review was conducted by Gouttebarge and colleagues[129] on 4 commercially available Functional Capacity Evaluations: 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 Functional Capacity Evaluation methods.

III Schult and Ekholm[268] compared the ICF core data sets for chronic widespread pain and low back pain[58,59] with a work capacity assessment. They found that the work capacity assessment generally agreed with the comprehensive ICF core set representing body functions, body structures, activities and participation, and environmental factors. However, the authors concluded that both the work capacity assessment and ICF core data sets lacked the clinical analysis that could be obtained through an on-the-job site evaluation.[268]

It would appear that in some instances when activity limitation and participation restriction are an expectation (eg, 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.

F Clinicians should routinely assess activity limitation and participation restriction through validated 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 side-bending motion measured using an inclinometer.
Measurement method	Inclinometers placed at the thoracolumbar junction and on the sacrum are zeroed with the patient in neutral. The patient is asked to bend forward maximally and motion is recorded at the thoracolumbar junction (total flexion measure) and at the sacrum, which is presumed to be motion in the sacroiliac and hip joints. The difference in motion represents the lumbar flexion measure. The patient is then asked to bend backward and the difference in motion is the lumbar extension measure. A similar process is used for side bending with the inclinometer aligned in the frontal plane, and the patient is asked to bend to each side.
Nature of variable	Continuous

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Lumbar Active Range of Motion (continued)

Units of measurement	Degrees
Measurement properties	In a study by Saur et al,[263] this method approximated lumbar motion obtained with radiographic measures (r = 0.93 overall; r = 0.95 with flexion and r = 0.85 with extension). Interrater (physician and physiotherapist) reliability was r = 0.88 for flexion (standard error of measurement [SEM], 4.6°) and r = 0.42 for extension (SEM, 2.3°).
Instrument variations	Two methods utilizing inclinometers have been described. In 1 method, the placement of the inclinometer is identical to Saur et al's[263] 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[263] method. A second method has been described in which total flexion and extension are recorded. The inclinometer is placed and zeroed at the 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

ICF category	Measurement of impairment of body function – mobility of joint functions, specified as mobility in a vertebral segment
Description	With the patient prone, lower thoracic and lumbar spine segmental movement and pain response are assessed.
Measurement method	The patient is positioned in prone. The examiner contacts each lower thoracic and lumbar spinous process with the thumbs (or alternately with the hypothenar eminence just distal to the pisiform). The examiner should be directly over the contact area, keeping elbows extended, utilizing 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 also be directed lateral to the spinous process, in the region of the zygapophyseal joints, multifidi muscles, or transverse processes. 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 on the examiner's experience and perception of normal mobility.
Nature of variable	Categorical with various grades depending on the study
Units of measurement	Ordered or categorical
Measurement properties	Measures for determining mobility reported low reliability for ordered scales, with intraclass correlation coefficients (ICCs) of 0.25 in patient studies[28] and kappa coefficients showing poor to minimal agreement (κ = –0.2-0.26).[153] Reliability for presence of any hypomobility or hypermobility during intervertebral motion testing demonstrated moderate to good agreement (κ = 0.38-0.48).[115] Validity has been established with correlation of radiographic lumbar segmental instability[2] and with response to treatment.[116]
Instrument variations	Segmental motion can also be tested with the subject in sidelying, facing the clinician, with hips and knees flexed and the clinician grasping the knee and flexing and extending, rotating, and laterally flexing the hip, pelvis, and lumbar spine while palpating intersegmental motion.[1]

Pain Provocation With Segmental Mobility Testing

ICF category	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.
Description	Pain provocation during mobility testing.
Measurement method	The patient is positioned in prone. The examiner contacts each lower thoracic and lumbar spinous process with the thumbs (or alternately with the hypothenar eminence just distal to the pisiform). The examiner should be directly over the contact area keeping elbows extended, utilizing 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 also be directed lateral to the spinous process, in the region of the zygapophyseal joints, multifidi muscles, or transverse processes. After assessing baseline pain levels, the examiner inquires about pain provocation during the posterior-to-anterior pressure at each spinal level, and pain provocation is judged as present or absent.
Nature of variable	Categorical
Units of measurement	Present/absent
Measurement properties	Kappa values are reported to be moderate to good for pain provocation during spring testing of the lumbar vertebrae (κ = 0.25-0.55)[117,153]
Instrument variations	None

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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 require 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, in 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 which movement, if any, produces centralization of the patient's symptoms.
Nature of variable	Categorical
Units of measurement	Present/absent
Measurement properties	Kappa coefficients are reported to be 0.70 to 0.90 for novice and experienced physical therapists.[109,181]
Instrument variations	Techniques to improve the precision of these judgments have been described, including strategies to discriminate between centralization and directional preference responses.[314] However, the practicality of using these strategies has not been demonstrated.

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, 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	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. 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	Categorical
Units of measurement	Positive or negative
Diagnostic accuracy and measurement properties	Good to excellent agreement reported ($\kappa = 0.87$)[153] for 3 pairs of physical therapy raters evaluating 63 consecutive subjects currently experiencing low back pain and with a previous history of low back pain. As an independent test the Prone Instability Test has limited diagnostic use (+LR = 1.7 [95% CI: 1.1, 2.8]; –LR = 0.48 [95% CI: 0.22, 1.1])[152]; however, it may be most useful as a component of a cluster of tests to predict response to motor control exercises.[152]

Judgments of the Presence of Aberrant Movement

ICF category	Measurement of impairment of body function – pain in back; pain in lower limb; mobility of several joints; and control of complex voluntary movements.
Description	"Aberrant movement" includes the presence of any of the following: painful arc with flexion or return from flexion, instability catch, Gower sign, and reversal of lumbopelvic rhythm.
Measurement method	Painful arc with flexion or return from flexion is positive if the 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 "thigh climbing" on return from flexion, specifically, 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 the hips, shifting pelvis anteriorly, as he/she returns to the standing position.

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Judgments of the Presence of Aberrant Movement (continued)

Nature of variable	Categorical
Units of measurement	Present/absent
Measurement properties	Observation of aberrant movements has demonstrated moderate to good reliability (κ = 0.60) for aberrant movement and variable reliability for individual tests (κ = 0-0.69), with painful arcs being most reliable (κ = 0.61-0.69)[153] in 3 pairs of physical therapy raters evaluating 63 consecutive subjects currently experiencing low back pain and with a previous history of low back pain.

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	The patient is supine and the therapist passively raises the lower extremity, flexing the hip with an extended knee. A positive test is obtained with reproduction of lower extremity radiating/radicular pain.
Nature of variable	Categorical
Units of measurement	Positive/negative
Measurement properties	In a population of patients with a new episode of pain radiating below the gluteal fold, the straight leg raise test has demonstrated good reliability (κ = 0.68) for identifying pain in a dermatomal distribution and moderate reliability for identifying patients with symptoms for angles below 45° (κ = 0.43).[305]
Instrument variations	None

Slump Test

ICF category	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
Description	Clinician judges whether symptom reproduction occurs in response to different positions of the cervical spine, thoracic spine, lumbar spine, and lower extremities.
Measurement method	The patient is asked to sit in a slumped position with knees flexed over table. Cervical flexion, knee extension, and ankle dorsiflexion are sequentially added up to the onset of patient lower extremity symptoms. Judgments are made with regard to a reproduction of symptoms in this position, and relief of symptoms when the cervical spine component is extended or nerve tension is relieved from 1 or more of the lower-limb components, such as ankle plantar flexion or knee flexion.
Nature of variable	Categorical
Units of measurement	Positive/negative
Measurement properties	Reported kappa was from 0.83 to 0.89 for 6 pairs of physical therapists of varying experience testing 93 patients receiving treatment for low back and/or leg pain.[237]

Trunk Muscle Power and Endurance

ICF category	Measurement of impairment of body function – pain in back; pain in lower limb; control of complex voluntary movements
Description	Clinician assesses the performance of trunk flexors, trunk extensors, lateral abdominals, transversus abdominis, hip abductors, and hip extensors.
Measurement method	Trunk Flexors The patient is positioned in supine; the examiner elevates both of the patient's fully extended legs to the point at which the sacrum begins to rise off the table. The patient is instructed to maintain contact of the low back with the table while slowly lowering extended legs to the table without assistance. The examiner observes and measures when the lower back loses contact with the tabletop due to anterior pelvic tilt. *(continued)*

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Trunk Muscle Power and Endurance (continued)

Measurement method (continued)	Trunk Extensors The patient is positioned in prone, with hands behind the back or by the sides. The patient is instructed to extend at the lumbar spine and raise the chest off the table to approximately 30° and hold the position. The test is timed until the patient can no longer hold the position. Lateral Abdominals The patient is positioned in sidelying with hips in neutral, knees flexed to 90°, and resting the upper body on the elbow. The patient is asked to lift the pelvis off the table and to straighten the curve of the spine without rolling forward or backward. The position is held and timed until the patient can no longer maintain the position. Transversus Abdominis The patient is positioned in prone over a pressure biofeedback unit that is inflated to 70 mmHg. The patient is instructed to draw in the abdominal wall for 10 seconds without inducing pelvic motion while breathing normally. The maximal decrease in pressure is recorded. Hip Abductors The patient is positioned in sidelying with both legs fully extended, in neutral rotation and a relaxed arm position, with the top upper extremity resting on the ribcage and hand on abdomen.[226] The patient is instructed to keep the leg extended and raise the top thigh and leg toward the ceiling, keeping the limb in line with the body. Patients are graded on quality of movement. Hip Extensors The patient is positioned in supine with knees flexed to 90° and the soles of the feet on the table. The patient is instructed to raise the pelvis off the table to a point where the shoulders, hips, and knees are in a straight line. The position is held and timed until the position can no longer be maintained.
Nature of variable	Continuous, ordinal
Units of measurement	Seconds to hold position, muscle performance assessment, change in mmHg using a pressure biofeedback device
Measurement properties	The double-leg lowering assessment for trunk flexor strength has demonstrated discriminative properties in identifying patients with chronic low back pain.[128,187] If patients demonstrate anterior pelvic tilt with hip flexion greater than 50° in males and 60° in females, they are more likely to have chronic low back pain.[327] The assessment of trunk extensor strength has been highly correlated with the development and persistence of low back pain.[9,167,219] Males who are unable to maintain an isometric hold of 31 seconds (33 seconds for females) are significantly more likely to experience low back pain (+LR = 4.05-6.5; −LR = 0.24-0.02) with good reliability (ICC = 0.89-0.90).[9] Lateral abdominal strength has been measured in healthy controls and found reliable (ICC = 0.97).[95,212] Performance of the transversus abdominis has been evaluated in prone and found to be reliable (ICC = 0.58; 95% CI: 0.28, 0.78).[69,164,284] A 4-mmHg decrease in pressure is established as normal, whereas the inability to decrease the pressure biofeedback device measure by 2 mmHg is associated with incidence of low back pain.[164,174,255] The hip abduction test has demonstrated discriminative ability to predict patients who will develop pain with standing (+LR = 2.68-4.59).[226,227] Endurance assessment of the bridge position to assess gluteus maximus strength has demonstrated good reliability (ICC = 0.84).[266] Mean duration of hold for patients with low back pain is 76.7 seconds compared to 172.9 seconds in persons without low back pain.[266]
Instrument variations	There are numerous alternate test positions for all described muscle groups. For trunk flexion, test variations include bent double-leg lowering and sit-up tasks. For trunk extension, numerous variations have been described, including the Sorensen test and prone double straight leg raise.[9,167,219] The Sorensen test and modified versions of this test have been the subject of extensive research, and strong diagnostic utility values for the test make it a viable alternative to the previously described back extensor test.[219] Transversus abdominis performance has been described by a palpatory method.[69] Hip abduction and hip extension strength can both be assessed with manual muscle testing.[179] Clinician's selection of test may be dependent on patient's level of conditioning and symptom behavior.

Passive Hip Internal Rotation, External Rotation, Flexion, and Extension

ICF category	Measurement of impairment of body function – mobility of a single joint
Description	The amount of passive hip rotation, flexion, and extension
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° of abduction, and the contralateral hip is placed in about 30° of abduction. The reference knee is flexed to 90°, 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 range of motion or when pelvic movement is necessary for additional movement of the leg. The inclinometer is aligned along the shaft of the tibia, just proximal to the medial malleolus, for both medial and lateral rotation range-of-motion measurements. Hip Flexion With the patient supine, the examiner passively flexes the hip to 90° and zeroes an inclinometer at the apex of the knee. The hip is then flexed until the opposite thigh begins to rise off the table. *(continued)*

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Passive Hip Internal Rotation, External Rotation, Flexion, and Extension (continued)

Measurement method (continued)	Hip Extension With the patient supine at the edge of a plinth with the lower legs hanging free off the end of the plinth, the examiner flexes both hips and knees so that the patient's lumbar region is flat against the tabletop. One limb is held in this position, maintaining the knee and hip in flexion, the pelvis in approximately 10° of posterior tilt, and the lumbar region flush against the tabletop, while the ipsilateral thigh and leg are lowered toward the table in a manner to keep the hip in 0° of hip abduction and adduction. The patient is instructed to relax and allow gravity to lower the leg and thigh toward the floor. The angle of the femur of this lowered leg to the line of the trunk (and tabletop) is measured. The amount of knee flexion is also monitored to assess the relative flexibility of the rectus femoris muscle.
Nature of variable	Continuous
Units of measurement	Degrees
Measurement properties	Intrarater reliability for passive hip internal and external rotation range-of-motion measures is reported to be excellent (ICCs from 0.96 to 0.99).[92] The intrarater reliability for hip flexion measurements is also excellent (ICC = 0.94).[67] The intrarater reliability for hip extension measurements using the modified Thomas test position is reported to be moderate to excellent, with ICCs between 0.70 and 0.89,[298] between 0.71 and 0.95,[128] between 0.91 and 0.93,[60] and 0.98.[321] Pua et al[245] reported good intratester reliability with hip flexion and extension range of motion (ICC = 0.97 and 0.86, respectively), with SEMs of 3.5° and 4.7°, respectively, in patients with hip osteoarthritis.
Instrument variations	Alternate positions for the testing of hip internal rotation, external rotation, flexion, and extension have been described in both short sitting and supine, with the hip and knee in 90° of flexion for the rotation measures.[7,25,29,57,211,251] Hip extension range-of-motion assessment has also been described as being assessed in prone.[76,211,251]

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.[242] Depression is commonly experienced in the general population, but it appears to be more commonly experienced in conjunction with chronic low back pain.[12,75,136] Depressive symptoms are associated with increased pain intensity, disability, medication use, and unemployment for patients with low back pain.[286] Based on this epidemiological information, routine screening for depression should be part of the clinical examination of low back pain.

Effective screening for depression involves more than just generating a clinical impression that the patient is depressed. Separate studies involving spine surgeons[131] and physical therapists[136] have demonstrated that clinical impressions are not sensitive enough to detect depression in patients with low back pain. 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.[136,318] 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 to 2. If a patient responds "no" to both questions, depression is highly unlikely, with a –LR of 0.07. Answering "yes" to 1 or both questions should raise suspicion of depressive symptoms.[318]

Fear-avoidance beliefs are a composite measure of the patient's fear related to low back pain and how these beliefs may affect physical activity and work.[197,301,306] Prospective studies suggest fear-avoidance beliefs are predictive of the development of chronic low back pain.[111,112,183,272] As a result, identification of elevated fear-avoidance beliefs has been suggested to be 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 low back pain and has physical activity (FABQ-PA) and work (FABQ-W) scales.[306] Several studies indicate that the FABQ is a reliable and valid measure,[126,165,236,306] 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.[287] Pain catastrophizing is believed to be a multidimensional construct comprising rumination, helplessness, and pessimism.[287] Pain catastrophizing has also been linked to the development and maintenance of chronic pain syndromes.

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Frequent pain catastrophizing during acute low back pain was predictive of self-reported disability 6 months[241] and 1 year later,[39] 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 extent of catastrophic cognitions a patient experiences while in pain.[285]

In addition to assessing psychological constructs, clinicians also have the option to screen for psychosocial distress. One example is the Örebro 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.[163] Another example of a questionnaire to screen for psychosocial distress is the Subgroups for Targeted Treatment (STarT) Back Screening Tool. The STarT Back Screening Tool was originally developed for use in primary care settings, where it has demonstrated sound measurement properties,[159] and recently the STarT Back Screening Tool demonstrated potential for its use in physical therapy settings.[104] Finally, there is a 5-item clinical prediction tool developed in primary care to identify patients with low back pain who are at risk for long-term functional limitations. Patients responding positively to the following items: feeling everything is an effort, trouble getting breath, hot/cold spells, numbness/tingling in parts of body, and pain in heart/chest were at elevated risk for poorer 2-year outcomes.[87]

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, and 15, with higher scores indicating higher levels of fear-avoidance beliefs for both FABQ scales.[306] Patients rate their agreement with statements related to either physical activity or work on a 7-point Likert scale (0 is "completely disagree," 6 is "completely agree").[306]
Measurement method	Self-report
Nature of variable	Continuous
Units of measurement	Individual items: 7-point Likert scale (0 is "completely disagree," 6 is "completely agree")
Measurement properties	The FABQ scales have been found to have acceptable reliability.[168,236,278,306] Test-retest reliability has been reported for the FABQ-PA (Pearson r = 0.84-0.88) and FABQ-W (Pearson r = 0.88-0.91).[278,306] Cronbach 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.[186,278,288,289,306] The FABQ-W has demonstrated predictive validity for disability and work loss in patients with low back pain.[111,112,278] A suggested FABQ-W cutoff score of greater than 29 has been suggested as an indicator of poor return to work status in patients receiving physical therapy for acute occupational low back pain[111] and a cutoff score of greater than 22 has been suggested in nonworking populations.[125] An FABQ-PA cutoff score of greater than 14, based on a median-split of the FABQ, has been suggested as an indicator of poor treatment outcomes in patients with low back pain seeking care from primary care or osteopathic physicians.[124] Data from 2 separate physical therapy intervention clinical trials indicated that the FABQ-W cutoff score (greater than 29) was a better predictor of self-reported disability at 6 months in comparison to the FABQ-PA cutoff score (greater than 14).[125] Another psychometric analysis indicated that single items of the FABQ-PA and FABQ-W were able to accurately identify those with elevated (above median) or not elevated (below median) total FABQ-PA and FABQ-W scores.[143]

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 extent of catastrophic cognitions due to low back pain.[285] Pain catastrophizing has been broadly defined as an exaggerated negative orientation toward actual or anticipated pain experiences.[285] 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).[285,296] Patients rate their agreement with statements related to thoughts and feelings when experiencing pain on a 5-point Likert scale (0 is "not at all," 4 is "all the time").[285]

(continued)

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Pain Catastrophizing Scale (continued)

Measurement method	Self-report
Nature of variable	Continuous
Units of measurement	Individual items: 5-point Likert scale (0 is "not at all," 4 is "all the time")
Measurement properties	Test-retest reliability at 6 (r = 0.75) and 10 weeks (r = 0.70) has been reported for the PCS.[285] Cronbach alpha estimates ranging from .85 to .92 suggest the PCS is internally consistent,[72,73,232] and similar findings have been found for items related to rumination (.85), magnification (.75), and helplessness (.86).[232] The PCS has been found to demonstrate several different types of validity.[72,73,232,285]

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 noninjurious 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).[199] 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,[207] including a systematic review of 7 publications (5 discrete data sets).[163]

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 noninjurious 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 that may be useful in matching patients with targeted interventions.[159] 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 of persistent disabling low back pain.
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 (ie, items 1, 4, 7, 8, 9). Based on overall and psychosocial subscale scoring, the STarT categorizes patients as "*high-risk*" (psychosocial subscale scores $\geq$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.[146]
Nature of variable	Continuous subscale scores for function and psychosocial items and categorical subgroups
Units of measurement	Individual items: Bothersomeness item: 5-point Likert scale Remaining items: dichotomous scale

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Subgroups for Targeted Treatment Back Screening Tool (continued)

Units of measurement (continued)	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.[159] Cronbach alpha estimates for overall (.79) and psychosocial subscale (.74) scores suggest the STarT demonstrates internal consistency.[159] The predictive validity of the STarT has been reported in which subgrouping cutoff scores were predictive of poor 6-month disability outcomes in low (16.7%), medium (53.2%), and high-risk (78.4%) subgroups.[159] The discriminant validity of the STarT scores (area under the curve [AUC] range: 0.73 - 0.92) has been reported and suggests that overall scores best discriminate physical reference standards (eg, disability and referred leg pain), while psychosocial subscale scores best discriminate psychosocial reference standards (eg, catastrophizing, fear, and depression).[159] 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.[160] Subgroup status 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.[104]

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CLINICAL GUIDELINES

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 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-reviewed 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.

It is believed that early physical therapy intervention can help reduce the risk of conversion of patients with acute low back pain to patients with chronic symptoms. A study by Linton et al[200] demonstrated that early active physical therapy intervention for patients with the first episode of acute musculoskeletal pain significantly decreased the incidence of chronic pain. This study represented a cohort study comparing patients who received early versus delayed or no physical therapy intervention for occupational-related injury. At 12-month follow-up, the group that received early active physical therapy had significant reductions in amount of work time lost. Only 2% of patients who received early intervention went on to develop chronic symptoms, compared to 15% of the delayed treatment group.[200] These findings have been supported numerous times.[119,133,230,244,308] Recently, Gellhorn et al[120] demonstrated that those with early referral to physical therapy (less than 4 weeks), as compared to those referred after 3 months, were significantly less likely to receive lumbosacral injection (OR = 0.46; 95% CI: 0.44, 0.49) and frequent physician visits (OR = 0.47; 95% CI: 0.44, 0.50) in Medicare patients.

The order of the interventions presented in this section is based upon categories and intervention strategies presented in the Recommended Low Back Pain Impairment/Function-based Classification Criteria with Recommended Interventions table.

MANUAL THERAPY

I Thrust and nonthrust mobilization/manipulation is a common intervention utilized for acute, subacute, and chronic low back pain. Despite its popularity, recent systematic reviews have demonstrated marginal treatment effects across heterogeneous groups of patients with low back pain.[10,11] 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.

II 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 et al[99] 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% or greater reduction in Oswestry Disability Index scores within 2 visits. These predictors included:

- Duration of symptoms of less than 16 days
- No symptoms distal to the knee
- Lumbar hypomobility
- At least 1 hip with greater than 35° of internal rotation
- FABQ-W score less than 19

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

I This test-item cluster was validated by Childs et al,[51] who demonstrated similar results with patients meeting 4 of the 5 predictors who received thrust manipulation (+LR = 13.2; 95% CI: 3.4, 52.1). Patients were randomized to receive either spinal manipulation or trunk strengthening exercises. Patients meeting the rule who received manipulation had greater reductions in disability than all other subjects. These results remained significant at 6-month follow-up. A pragmatic rule has also been published to predict dramatic improvement based on only 2 factors:

- Duration less than 16 days
- Not having symptoms distal to the knee

If these 2 factors were present, patients had a moderate-to-large shift in probability of a successful outcome following application of thrust manipulation (+LR = 7.2; 95% CI: 3.2, 16.1).[106]

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Patients in the study by Childs et al[51] who received manipulation and exercise demonstrated less risk of worsening disability than those who received only exercise.[50] Patients who received only exercise were 8 (95% CI: 1.1, 63.5) times more likely to experience a worsening of disability. The number needed to treat (NNT) with manipulation to prevent 1 additional patient from experiencing a worsening in disability was 9.9 (95% CI: 4.9, 65.3).[50]

I This rule has been further examined by Cleland et al[66] with similar results for patients fitting the clinical prediction rule treated with 2 different thrust techniques, the previously utilized general lumbopelvic technique and a sidelying rotational technique. The 2 groups receiving thrust manipulation fared significantly better than a group receiving nonthrust mobilization at 1 week, 4 weeks, and 6 months.

I The Cleland et al[66] trial demonstrated that patient outcomes are dependent on utilization of a thrust manipulation, as those who received nonthrust techniques did not have dramatic improvement. This had previously been established by Hancock et al[140] in a secondary analysis of patients who fit the clinical prediction rule and were treated primarily with nonthrust mobilization, where no differences were found in a control group that received placebo intervention. The findings of the Cleland et al[66] and Hancock et al[140] papers demonstrate that rapid improvements associated with patients fitting the clinical prediction rule are specific to patients receiving thrust manipulation.

I A secondary analysis by Fritz et al[116] examined the relationship between judgments of passive accessory mobility assessments and clinical outcomes after 2 different interventions, stabilization exercise alone or thrust manipulation followed by stabilization exercise. The mean duration of symptoms for patients included in the analysis was 27 days (range, 1-594). Patients who were assessed to have lumbar hypomobility on physical examination demonstrated more significant improvements with the thrust manipulation and exercise intervention than with stabilization alone. Seventy-four percent of patients with hypomobility who received manipulation were deemed successful as compared to 26% of patients with hypermobility who 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.

I Beyond the success associated with the use of thrust manipulation in patients with acute low back pain 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[13] demonstrated superior reductions in pain and disability in patients with chronic low back pain who received thrust manipulations when compared to an exercise intervention. More recently, Cecchi et al[45] conducted a randomized controlled trial (n = 210) in patients with subacute and chronic low back pain. 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 12 months. Long-term pain relief, reoccurrences of low back pain, and drug usage also favored the manipulation group.

I Whitman et al[316,317] demonstrated that, for patients with clinical and imaging findings consistent with lumbar central spinal stenosis, a comprehensive treatment plan including thrust and nonthrust mobilization/manipulation directed at the lumbopelvic region is effective at improving patient recovery. In the randomized control trial, 58 patients were randomized to receive a comprehensive manual therapy approach, abdominal retraining, and body weight–supported treadmill training compared to lumbar flexion exercises and traditional treadmill training.[316] Seventy-eight percent of patients receiving manual treatments met the threshold for success compared to 41% of the flexion-based exercise group at 6 weeks. At long-term follow-up, all outcomes favored the experimental group, although these differences were not statistically significant. Manual therapy was delivered in a pragmatic impairment-based approach; specifically, 100% of patients received nonthrust mobilization to the lumbar spine, 50% of patients received thrust manipulation to the lumbar spine, and 31% of patients received lumbopelvic manipulation.[14] Patients also received manual therapy interventions to other regions of the lower quarter and thoracic spine as deemed important by the treating therapists.[14] This study supports the use of a comprehensive treatment program that includes manual therapy interventions in the management of patients with lumbar spinal stenosis.

III Murphy et al[223] published a prospective cohort study of 57 consecutive patients with central, lateral, or combined central and lateral 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 Disability Questionnaire, 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,[252] in a recent systematic review, recommended manual therapy techniques including thrust and nonthrust mobilization/manipulation to the lumbopelvic region for patients with lumbar spinal stenosis.

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IV The hip has long been identified as a potential source of and contributor to low back dysfunction, and impairments in hip mobility have been found to be associated with the presence of low back pain.[22,92,253,270,323] It has been suggested that altered movements of the hip and spine may contribute to the development of low back pain, as they may alter the loads placed on the lumbar facets and posterior spinal ligaments.[3,195] Several authors have described restricted hip mobility in patients with low back pain as an indicator of positive response to interventions targeting the hip.[38,100,215,231,252] Some early evidence demonstrates successful incorporation of interventions targeting the hip into a more comprehensive treatment program for patients with lumbar spinal stenosis.[316,317] Though research in this area is developing, clinicians may consider including examination of the hip and interventions targeting identified hip impairments for patients with low back pain.

A Clinicians should consider utilizing thrust manipulative procedures to reduce pain and disability in patients with mobility deficits and acute low back and back-related buttock or thigh pain. Thrust manipulative and nonthrust mobilization procedures can also be used to improve spine and hip mobility and reduce pain and disability in patients with subacute and chronic low back and back-related lower extremity pain.

TRUNK COORDINATION, STRENGTHENING, AND ENDURANCE EXERCISES

Lumbar coordination, strengthening, and endurance exercises are another commonly utilized treatment for patients with low back pain. These exercises are also described in the literature as motor control exercises, transversus abdominis training, lumbar multifidus training, and dynamic lumbar stabilization exercises. In addition, these exercises are commonly prescribed for patients who have received the medical diagnosis of spinal instability.

I In a Cochrane review on exercise therapy for the treatment of nonspecific low back pain, Hayden and colleagues[147] examined the literature on exercise therapy for patients with acute (11 randomized clinical trials), subacute (6 randomized clinical trials), and chronic (43 randomized clinical trials) low back pain and reported that exercise therapy was effective in decreasing pain in the chronic population, graded activity improved absenteeism in the subacute population, and exercise therapy was 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.

I In a systematic review of 14 randomized controlled trials examining the effectiveness of motor control exercises for nonspecific low back pain, Macedo et al[205] concluded that motor control, when used in isolation or with additional interventions, is effective at decreasing pain and disability related to nonspecific low back pain. However, there was insufficient evidence to find motor control exercises 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.

II A preliminary clinical prediction rule for the stabilization classification has been proposed to assist clinicians with accurately identifying patients who appear to be appropriate for a stabilization-focused exercise program.[152] The clinical prediction rule for stabilization classification was developed using similar methodology as for the manipulation rule. Variables that significantly predicted a 50% improvement in disability from low back pain at 4 weeks in a multivariate analysis were retained for the clinical prediction rule.[152] Four examination findings were identified:

- Age less than 40 years
- Positive prone instability test
- Presence of aberrant movements with motion testing
- Straight leg raise greater than 91°

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).[152] Validation of this test-item cluster is required before it can be recommended for widespread clinical use.

I Costa et al[70] used a placebo-controlled randomized controlled trial to examine the use of motor-control exercises in 154 patients with chronic low back pain. Interventions consisted of either specific motor-control exercises directed to the multifidus and transversus abdominis or nontherapeutic 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 nontherapeutic modalities over the same period.

I A randomized controlled trial was performed by Rasmussen-Barr et al[250] that compared a graded exercise program that emphasized stabilization exercises to a general walking program in the treatment of low back pain lasting greater than 8 weeks. At both the 12-month

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and the 36-month 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 at short and long terms in patients with recurrent low back pain.

I Choi and colleagues[53] performed a review of randomized 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 activity that occurred during the patient's episode of care with a healthcare practitioner as well as those that occurred 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 2 studies (mean difference, −0.35; 95% CI: −0.60, −0.10) at 0.5 to 2 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, −0.99) at 0.5 to 2 years' follow-up. In summary, there was moderate-quality evidence that postdischarge exercise programs can prevent recurrences of low back pain.

I In a randomized controlled trial, Hides et al[156] compared a 4-week specific exercise training program to advice and medication in a group of patients with first-episode low back pain. The specific exercise group performed cocontraction exercises believed to facilitate training of the lumbar multifidus and transversus abdominis muscle groups. The specific exercise group reported recurrence rates of 30% at 1 year and 35% at 3 years, compared to 84% at 1 year and 75% at 3 years for the advice and medication control group.

I O'Sullivan et al[234] completed a randomized controlled trial involving subjects with radiologically confirmed spondylolysis or spondylolisthesis. A specific exercise group received weekly interventions directed at training to promote isolation and cocontraction 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.

I Yilmaz and colleagues[326] investigated the efficacy of a dynamic lumbar stabilization exercise program in patients with a recent lumbar microdiscectomy. The results of their randomized trial indicated that lumbar spinal stabilization exercises under the direction of a physical therapist were 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 subjects in each group and did not describe any loss to follow-up.

I Kulig et al[190] performed a randomized clinical controlled trial comparing an intensive 12-week exercise program and education to education alone and to usual physical therapy care postmicrodiscectomy. In the 2-group analyses, exercise and education resulted in a greater reduction in Oswestry Disability Index scores and a greater improvement in distance walked compared to education alone. In the 3-group analyses, post hoc comparisons showed a significantly greater reduction in Oswestry Disability Index 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.

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

CENTRALIZATION AND DIRECTIONAL PREFERENCE EXERCISES AND PROCEDURES

I A systematic review by Clare et al[61] included 6 randomized/quasi-randomized controlled trials investigating the efficacy of centralization and directional preference exercises, also commonly described as McKenzie therapy, in the treatment of spinal pain. The authors concluded that the reviewed studies suggested that McKenzie therapy is more effective than comparison treatments (nonsteroidal anti-inflammatory drugs, educational booklet, strengthening, etc) at short-term follow-up. It should be noted that the studies in this review excluded trials where cointerventions were permitted and may not be generalizable to clinical practice. A second systematic review from Aina et al[4] examined centralization of spinal symptoms. They reported that 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 subacute low back pain and 52% with chronic low back pain. The presence of centralization

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was associated with good outcomes and lack of centralization with poor outcomes. Machado et al[206] performed a systematic review and meta-analysis of 11 trials utilizing the McKenzie treatment approach. Short-term results demonstrated improved outcomes compared to passive treatments. Long-term follow-up at 12 weeks favored advice to remain active over McKenzie exercise, raising questions on the long-term clinical effectiveness of the McKenzie methods for management of patients with low back pain.[206]

I Long and colleagues[202] investigated whether a McKenzie examination and follow-up on 312 patients with acute, subacute, and chronic low back pain would elicit a directional preference in these patients. Directional preference in this investigation was described as an immediate, lasting improvement in pain from performing repeated lumbar flexion, extension, or side glide/rotation spinal movements. Of the 312 patients, 230 participants (74%) had a directional preference, characterized as: extension (83%), flexion (7%), and lateral responders (10%). These patients 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) nondirectional exercises. Significant reductions in pain, pain medication use, and disability occurred in the directional exercise group that was matched to their directional preference. One-third of the patients in the nonconcordant 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."[202] One limitation of this study was that it only followed participants for 2 weeks postintervention, thus providing little insight into the long-term effects of directional preference–driven exercises.

III Long and colleagues[203] conducted a secondary analysis of a previous randomized controlled trial 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 who exhibited a directional preference or centralization response who then received a matched treatment had a 7.8-times-greater likelihood of a good outcome at 2 weeks, which was defined as a minimal reduction of 30% on the Roland-Morris Disability Questionnaire.

I A multicenter randomized controlled trial by Browder et al[36] looked to examine the effectiveness of an extension-oriented treatment approach in patients with low back pain. The authors included a homogeneous subgroup of patients who responded with centralization to 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 reductions in disability compared to those subjects who received lumbopelvic strengthening exercises at 1 week, 4 weeks, and 6 months. The authors concluded that those patients who centralize with lumbar extension movements preferentially benefit from an extension-oriented treatment approach.

III Werneke and colleagues[313] performed a prospective, longitudinal cohort study aiming to determine baseline prevalence of directional preference or no directional preference in 584 patients with nonspecific low back pain who centralized, 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 indicated 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. One key implication of this study is that the patient response criteria regarding directional preference and centralization should be considered as independent variables when analyzing patient outcomes.

I In a randomized controlled trial, Petersen et al[235] compared thrust manipulation along with general patient education to the McKenzie method along with general patient education in 350 patients who reported symptoms of low back pain for a duration of more than 6 weeks and who presented with centralization or peripheralization of symptoms, with or without signs of nerve root involvement. In addition to the patient education, the manipulation group received thrust and nonthrust manipulation as well as trigger-point massage at the discretion of the treating clinician, but they were not allowed to perform exercises or movements demonstrated to centralize the patient's symptoms. In addition to the patient education, the McKenzie method groups received interventions consistent with the McKenzie method (centralization exercises and procedures) at the discretion of the treating clinician but were not allowed to use mobilization/manipulation interventions. At 2 months' follow-up, the McKenzie treatment was superior to manipulation with respect to the number of patients who reported success after treatment (71% and 59%, respec-

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tively). The McKenzie group showed improvement in level of disability compared to the manipulation group, reaching a statistical significance at 2 and 12 months' follow-up.

A Clinicians should consider utilizing repeated movements, exercises, or procedures to promote centralization to reduce symptoms in patients with acute low back pain with related (referred) lower extremity pain. Clinicians should consider using repeated exercises in a specific direction determined by treatment response to improve mobility and reduce symptoms in patients with acute, subacute, or chronic low back pain with mobility deficits.

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.[107] Current guidelines detailing conservative intervention for stenosis recommend repeated flexion exercises in the supine, seated, and standing positions.[30] A recent review article by Backstrom et al[14] note that flexion-based exercises have long been utilized to theoretically open or expand the cross-sectional area of the foraminal canals and central spinal canal, thus potentially relieving mechanical compression of the lumbar nerve roots, improving spinal flexibility, and improving hemodynamics.

II A multicenter randomized controlled trial by Whitman et al[316] compared 2 physical therapy programs for patients with both imaging studies and clinical presentation consistent with central lumbar spinal stenosis. The authors randomized 58 patients with lumbar spinal stenosis to 1 of 2 six-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 greater 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.

III A cohort study by Murphy et al[223] utilized flexion-based exercises as a component of a treatment program also utilizing long-axis distraction manipulation and nerve mobilization procedures in a population of patients with both clinical findings and imaging findings of central, lateral, or combined central and lateral lumbar spinal stenosis. Patients were instructed in a quadruped exercise emphasizing lumbar flexion and extension to improve overall joint mobility. The mean improvement in disability as measured by the Roland-Morris Disability Index score was 5.1 points from baseline to discharge, and 5.2 points from baseline to long-term follow-up, satisfying the criterion for minimum clinically important difference. Pain at worst was also reduced by a mean of 3.1 points using the 0-10 numeric pain rating scale.

III Simotas et al[273] performed a prospective cohort study following 49 patients with radiographic central canal lumbar spinal stenosis for a mean of 33 months, with treatment consisting of daily flexion-based exercises. At 3-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 reported mild improvement, and 12 reported sustained improvement. Twelve of these 40 patients who did not undergo surgery reported having no pain or only mild pain.

C 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

IV George[121] published a case series of 6 patients with subacute 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 6 patients reported a reduction or elimination of their thigh, lower-leg, or foot symptoms, in which 2 patients no longer had symptoms and 3 patients reported the location of symptoms to be in a more proximal location at discharge. These 5 patients had an average of 8 treatment sessions each.

II Cleland et al[65] completed a randomized controlled trial (n = 30) using the same eligibility criteria as the George[121] case series. Patients with low back complaints, with symptoms distal to the buttocks, who had reproduction of symptoms with the slump test and had no change in symptoms with lumbar flexion or extension were randomized to receive nonthrust mobilization of the lumbar spine and exercise or slump stretching and exercise. Patients were treated for 6 sessions. At discharge, the slump-stretching group exhibited significantly reduced disability; overall

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perceived pain; and thigh, lower-leg, or foot symptoms.

III Additionally, Murphy et al[223] 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 Roland-Morris Disability Questionnaire. Hall and colleagues[137,138] demonstrated an increase in straight leg raise range of motion following treatment using end-range nerve mobilization (straight leg raising combined with manual lower-limb traction) in a cohort of patients with neurogenic lower extremity complaints.

II A randomized controlled trial (n = 81) completed by Scrimshaw and Maher[269] compared standard care to standard care plus active and passive lower-limb mobilization procedures in patient status post–lumbar spine surgery (discectomy, laminectomy, or fusion). In addition to baseline measures, follow-up data for pain and disability were 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.

IV Numerous other case studies have described utilization of lower extremity nerve mobilization procedures for lower-limb symptoms.[63,64,122,185,294] Diagnoses utilized in these reports included hamstring strain and complex regional pain syndrome.

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

TRACTION

I A systematic review by Clarke and colleagues[62] 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 that included patients with acute, subacute, or chronic low back pain, with or without sciatica. Of the 25 selected randomized controlled trials, only 5 trials were considered high quality. Based on the available evidence, there is moderate evidence showing no statistically significant differences in short- or long-term outcomes between traction as a single treatment and a placebo, sham, or no treatment. The authors concluded that intermittent or continuous mechanical 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.

I Several randomized controlled trials have compared traction to a sham traction intervention, with no significant differences found between groups. Beurskens et al[24] randomized 151 subjects with a 6-week history of nonspecific 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 months, with no statistically significant differences between the groups at either point. Schimmel et al[267] compared traction via the Intervertebral Differential Dynamics Therapy device (50% body weight + 10 lb of force) to sham intervention with the same device (10 lb of 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 significant between-group differences were present at follow-up.

II In a randomized clinical trial, Fritz et al[114] aimed to investigate whether there is a subgroup of patients with low back pain who 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. But the investigators identified 2 variables that may help identify a subgroup of patients who can benefit from mechanical traction. Those patients who experienced peripheralization of symptoms with extension movement and had a positive crossed straight leg raise test had a better likelihood of success. Of these patients, 84.6% in the traction group had a successful outcome as compared to 45.5% of those allocated to the extension group. Although this subgroup of patients with low back pain 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 straight leg raise test.

III Beattie et al[19] performed a prospective, longitudinal case series study involving 296 patients with low back pain and evidence of a degenerative and/or

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herniated intervertebral disc at 1 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 Roland-Morris Disability Questionnaire were completed at preintervention, at 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 investigators found that patients reported significantly improved pain and Roland-Morris Disability Questionnaire scores after 16 to 24 visits of prone traction at discharge, and at 30 days and 180 days postdischarge. 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.

D There is conflicting evidence for the efficacy of intermittent lumbar traction for patients with low back pain. There is preliminary evidence that a subgroup of patients with signs of nerve root compression along with peripheralization of symptoms or a positive crossed straight leg raise will benefit from intermittent lumbar traction in the prone position. There is moderate evidence that clinicians should not utilize intermittent or static lumbar traction for reducing symptoms in patients with acute or subacute, nonradicular low back pain or in patients with chronic low back pain.

PATIENT EDUCATION AND COUNSELING

V Education and advice have been traditional interventions given to patients with acute, subacute, and chronic low back pain. A survey of recognized clinical specialists in orthopaedic physical therapy identified that patient education strategies consisting of "Educate patient in home care treatment program" and "Recommends strategies to prevent recurrent problems" ranked as the highest 2 out of a list of 12 intervention strategies.[216] In addition, "Functional movement training/re-education" was ranked as a "very important strategy" for therapists to implement in their plan of care for patients.[216] For patients with low back pain, this commonly involves identifying movements that are associated with low back pain, such as excessive flexion of the lumbar spine when rising from a chair instead of utilizing flexion of the hip for executing the movement, then providing cuing and education on movement options that enable the activity to be performed with fewer, or no, symptoms.

Research in patient education and counseling strategies has focused on 3 main approaches: (1) general education and advice in acute and subacute 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.

I Previous clinical practice 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)."[56] Several other systematic reviews have demonstrated moderate evidence for advising patients to remain active, as compared to bed-rest, for the best opportunity for pain reduction and functional improvements.[77,134,158]

I In 2007, Liddle et al[198] published a systematic review on advice for the management of low back pain. Major findings stated that general instructions to remain active are 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 subacute and chronic low back pain.

I Burton et al[39] 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 have been based on a biomedical model with emphasis on anatomy, biomechanics, and pathology. The novel education booklet de-emphasized education on pathology and disease processes, provided reassurance regarding the likelihood of recovery, and promoted positive attitudes. The novel education booklet resulted in significantly greater early improvement in beliefs that were maintained at 1 year. For patients who had elevated fear-avoidance beliefs, there was a clinically important improvement in the Roland-Morris Disability Questionnaire at 3 months.

III Coudeyre et al[71] demonstrated in a large, nonrandomized controlled trial that utilization of pamphlet education was effective in reducing persistent low back pain and increasing patient satisfaction. Days of work missed, disability as measured by the Quebec Disability Scale, and fear-avoidance beliefs did not differ between the groups who received or did not receive the educational pamphlet.

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II Albaladejo et al[6] completed a 3-group, clustered, randomized trial comparing 3 educational packages provided 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 2 other groups received a booklet and brief education on active managements of low back pain. A third group also received 4 sessions of physiotherapy to establish a home exercise program. At the 6-month follow-up, both groups receiving the active management education had small but statistically significant reductions in 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.

III Udermann and colleagues[295] completed a prospective trial of the effect of an educational booklet on a sample of patients with chronic low back pain (mean duration of 10.4 years). Patients were given educational literature on how to manage their back pain and completed a 1-week follow-up test on content and beliefs. At 9 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 that the observed effects were a result of the intervention; however, given the chronic nature of the patient population, it is less likely that results were due to natural history of the disorder.

Behavioral education, also known as cognitive behavioral theory, encompasses many aspects of patient education and counseling for patients with low back pain,[37] including:

- Activity pacing
- Attention diversion
- Cognitive restructuring
- Goal setting
- Graded exposure
- Motivational enhancement therapy
- Maintenance strategies
- Problem-solving strategies

I Several aspects of behavioral education and counseling are utilized in physical therapy practice.[259] Henschke et al,[151] 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 to 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.

II Godges et al[127] 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.

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

III Moseley et al[221] assessed the efficacy of pain education against traditional back anatomy and physiology education. Subjects (n = 58) were randomized to treatment groups and assessed 15 days postintervention. 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 controls. Similar results were demonstrated by Moseley[220] in a study with shorter follow-up immediately following education interventions. Changes in physical function as assessed by the straight leg raise and forward bending were found to be highly correlated to changes in pain beliefs.

B 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 specific cause of the patient's 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,

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even when still experiencing pain, and (6) the importance of improvement in activity levels, not just pain relief.

PROGRESSIVE ENDURANCE EXERCISE AND FITNESS ACTIVITIES

I Presently, most national guidelines for patients with chronic low back pain endorse progressive aerobic exercise with moderate to high levels of evidence.[5,20,46,56,265] High-intensity exercise has also been demonstrated to have a positive effect on patients with chronic low back pain.[47,68,225,246-248,275,277] 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 sensitization*.[44,229,320] Along with underlying psychosocial factors, deficits in aerobic fitness,[91,162,274,299,322] 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.

I 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.[228,229] Endurance exercise has been demonstrated to have a positive effect on global well-being (standardized mean difference [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.[40] Excessively elevated levels of exercise intensity may be responsible for increased symptom complaints due to increases in immune activation with release of proinflammatory cytokines,[208] blunted increases in muscular vascularity leading to widespread muscular ischemia,[93] and inefficiencies in the endogenous opioid and adrenergic pain-inhibitory mechanism.[281]

A 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, submaximal 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 CLASSIFICATION CRITERIA WITH RECOMMENDED INTERVENTIONS*

Patients with low back pain often fit more than 1 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.

ICF-Based Category (With ICD-10 Associations)	Symptoms	Impairments of Body Function	Primary Intervention Strategies
***Acute* Low Back Pain with Mobility Deficits** Lumbosacral segmental/somatic dysfunction	• Acute low back, buttock, or thigh pain (duration 1 month or less) • Unilateral pain • Onset of symptoms is often linked to a recent unguarded/awkward movement or position	• Lumbar range of motion limitations • Restricted lower thoracic and lumbar segmental mobility • Low back and low back–related lower extremity symptoms are reproduced with provocation of the involved lower thoracic, lumbar, or sacroiliac segments	• Manual therapy procedures (thrust manipulation and other nonthrust mobilization techniques) to diminish pain and improve segmental spinal or lumbopelvic motion • Therapeutic exercises to improve or maintain spinal mobility • Patient education that encourages the patient to return to or pursue an active lifestyle
***Subacute* Low Back Pain with Mobility Deficits** Lumbosacral segmental/somatic dysfunction	• Subacute, unilateral, low back, buttock, or thigh pain • May report sensation of back stiffness	• Symptoms reproduced with *end-range* spinal motions • Symptoms reproduced with provocation of the involved lower thoracic, lumbar, or sacroiliac segments	• Manual therapy procedures to improve segmental spinal, lumbopelvic, and hip mobility • Therapeutic exercises to improve or maintain spinal and hip mobility

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ICF-Based Category (With ICD-10 Associations)	Symptoms	Impairments of Body Function	Primary Intervention Strategies
***Subacute* Low Back Pain with Mobility Deficits** Lumbosacral segmental/somatic dysfunction (continued)		• Presence of 1 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	• Focus on preventing recurring low back pain episodes through the use of (1) therapeutic exercises that address coexisting coordination impairments, strength deficits, and endurance deficits, and (2) education that encourages the patient to pursue or maintain an active lifestyle
***Acute* Low Back Pain with Movement Coordination Impairments** Spinal instabilities	• Acute exacerbation of recurring low back pain that is commonly associated with referred lower extremity pain • Symptoms often include numerous episodes of low back and/or low back–related lower extremity pain in recent years	• Low back and/or low back–related lower extremity pain at rest or produced with *initial to mid-range* spinal movements • Low back and/or low back–related lower extremity pain reproduced with provocation of the involved lumbar segment(s) • Movement coordination impairments of the lumbopelvic region with low back flexion and extension movements	• Neuromuscular re-education to promote dynamic (muscular) stability to maintain the involved lumbosacral structures in less symptomatic, mid-range positions • Consider the use of temporary external devices to provide passive restraint to maintain the involved lumbosacral structures in less symptomatic, mid-range positions • 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
***Subacute* Low Back Pain with Movement Coordination Impairments** Spinal instabilities	• Subacute, recurring low back pain that is commonly associated with referred lower extremity pain • Symptoms often include numerous episodes of low back and/or low back–related lower extremity pain in recent years	• Lumbosacral pain with *mid-range* motions that *worsen with end-range* movements or positions • Low back and low back–related lower extremity pain reproduced with provocation of the involved lumbar segment(s) • Lumbar hypermobility with segmental mobility assessment may be present • Mobility deficits of the thorax and/or lumbopelvic/hip regions • Diminished trunk or pelvic-region muscle strength and endurance • Movement coordination impairments while performing self-care/home management activities	• Neuromuscular re-education to provide dynamic (muscular) stability to maintain the involved lumbosacral structures in less symptomatic, mid-range positions during *self–care*-related functional activities • Manual therapy procedures and therapeutic exercises to address identified thoracic spine, ribs, lumbopelvic, or hip mobility deficits • Therapeutic exercises to address trunk and pelvic-region muscle strength and endurance deficits • Self-care/home management training in maintaining the involved structures in mid-range, less symptom-producing positions • Initiate community/work reintegration training in pain management strategies while returning to community/work activities

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ICF-Based Category (With ICD-10 Associations)	Symptoms	Impairments of Body Function	Primary Intervention Strategies
***Chronic* Low Back Pain with Movement Coordination Impairments** Spinal instabilities	• Chronic, recurring low back pain and associated (referred) lower extremity pain	Presence of 1 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	• Neuromuscular re-education to provide dynamic (muscular) stability to maintain the involved lumbosacral structures in less symptomatic, mid-range positions during *household, occupational, or recreational* activities • Manual therapy procedures and therapeutic exercises to address identified thoracic spine, ribs, lumbopelvic, or hip mobility deficits • Therapeutic (strengthening) exercises to address trunk and pelvic-region muscle strength and endurance deficits • Community/work reintegration training in pain management strategies while returning to community/work activities
***Acute* Low Back Pain with Related (Referred) Lower Extremity Pain** Flatback syndrome Lumbago due to displacement of intervertebral disc	• Acute low back pain that is commonly associated with referred buttock, thigh, or leg pain • Symptoms are often worsened with flexion activities and sitting	• Low back and lower extremity pain that can be centralized and diminished with specific postures and/or repeated movements • Reduced lumbar lordosis • Limited lumbar extension mobility • Lateral trunk shift may be present • Clinical findings consistent with **subacute** or **chronic low back pain with movement coordination impairments** classification criteria	• Therapeutic exercises, manual therapy, or traction procedures that promote centralization and improve lumbar extension mobility • Patient education in positions that promote centralization • Progress to interventions consistent with the Subacute or Chronic Low Back Pain with Movement Coordination Impairments intervention strategies
***Acute* Low Back Pain with Radiating Pain** Lumbago with sciatica	• Acute low back pain with associated radiating (narrow band of lancinating) pain in the involved lower extremity • Lower extremity paresthesias, numbness, and weakness may be reported	• 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 • 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 (referred) lower extremity pain**	• Patient education in positions that reduce strain or compression to the involved nerve root(s) or nerves • Manual or mechanical traction • Manual therapy to mobilize the articulations and soft tissues adjacent to the involved nerve root(s) or nerves that exhibit mobility deficits • Nerve mobility exercises in the pain-free, non–symptom-producing ranges to improve the mobility of central (dural) and peripheral neural elements
***Subacute* Low Back Pain with Radiating Pain** Lumbago with sciatica	• Subacute, recurring, mid-back and/or low back pain with associated radiating pain in the involved lower extremity • Lower extremity paresthesias, numbness, and weakness may be reported	• Mid-back, low back, and back-related radiating pain or paresthesia that are reproduced with *mid-range* and worsen with *end range*: 1. Lower limb tension testing/straight leg raising tests, and/or... 2. Slump tests • May have lower extremity sensory, strength, or reflex deficits associated with the involved nerve(s)	• Manual therapy to mobilize the articulations and soft tissues adjacent to the involved nerve root(s) or nerves that exhibit mobility deficits • Manual or mechanical traction • Nerve mobility and slump exercises in the mid- to end ranges to improve the mobility of central (dural) and peripheral neural elements

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ICF-Based Category (With ICD-10 Associations)	Symptoms	Impairments of Body Function	Primary Intervention Strategies
***Chronic* Low Back Pain with Radiating Pain** Lumbago with sciatica	• Chronic, recurring, mid- and/or low back pain with associated radiating pain in the involved lower extremity • Lower extremity paresthesias, numbness, and weakness may be reported	• 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 • Signs of nerve root involvement may be present	• Manual therapy and therapeutic exercises to address thoracolumbar and lower-quarter nerve mobility deficits • Patient education pain management strategies
***Acute* or *Subacute* 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	• Acute or subacute low back and/or low back–related lower extremity pain	One or more of the following: • Two positive responses to Primary Care Evaluation of Mental Disorders screen and affect consistent with an individual who is depressed • High scores on the Fear-Avoidance Beliefs Questionnaire and behavioral processes consistent with an individual who has excessive anxiety or fear • High scores on the Pain Catastrophizing Scale and cognitive process consistent with rumination, pessimism, or helplessness	• Patient education and counseling to address 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	• Low back and/or low back–related lower extremity pain with symptom duration for longer than 3 months • Generalized pain not consistent with other impairment-based classification criteria presented in these clinical guidelines	One or more of the following: • Two positive responses to Primary Care Evaluation of Mental Disorders screen and affect consistent with an individual who is depressed • High scores on the Fear-Avoidance Beliefs Questionnaire and behavioral processes consistent with an individual who has excessive anxiety and fear • High scores on the Pain Catastrophizing Scale and cognitive process consistent with rumination, pessimism, or helplessness	• Patient education and counseling to address specific classification exhibited by the patient (ie, depression, fear-avoidance, pain catastrophizing) • Low-intensity, prolonged (aerobic) exercise activities

**Recommendation for classification criteria based on moderate evidence.*

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CLINICAL GUIDELINES

Summary of Recommendations

B RISK FACTORS

Current literature does not support a definitive cause for initial episodes of low back pain. Risk factors are multifactorial, population specific, and only weakly associated with the development of low back pain.

E CLINICAL COURSE

The clinical course of low back pain can be described as acute, subacute, recurrent, or chronic. Given the high prevalence 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.

B DIAGNOSIS/CLASSIFICATION

Low back pain, without symptoms or signs of serious medical or psychological conditions, associated with clinical findings of (1) mobility impairment in the thoracic, lumbar, or sacroiliac regions, (2) referred or radiating pain into a lower extremity, and (3) generalized pain, is useful 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 or subacute low back pain with mobility deficits (b7101 Mobility of several joints)
- Acute, subacute, or chronic low back pain with movement coordination impairments (b7601 Control of complex voluntary movements)
- Acute low back pain with related (referred) lower extremity pain (b28015 Pain in lower limb)
- Acute, subacute, or chronic low back pain with radiating pain (b2804 Radiating pain in a segment or region)
- Acute or subacute 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)

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

- Acute low back, buttock, or thigh pain (duration of 1 month or less)
- 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 **subacute low back pain with mobility deficits** are made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Subacute, 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** are 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 **subacute low back pain with movement coordination impairments** are made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Subacute 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 diag-

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nosis of **chronic low back pain with movement coordination impairments** are 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 1 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 (referred) lower extremity pain** are made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Low back pain, commonly associated with referred buttock, thigh, or leg pain, that worsens with flexion activities and sitting
- Low back and lower extremity pain that can be centralized and diminished with positioning, manual procedures, and/or repeated movements
- Lateral trunk shift, reduced lumbar lordosis, limited lumbar extension mobility, and clinical findings associated with the subacute 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** are 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 (sensory, strength, or reflex deficits) 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 (referred) lower extremity pain**.

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

- Subacute, 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** are 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 subacute low back pain with related cognitive or affective tendencies** are made with a reasonable level of certainty when the patient presents with the following clinical findings:

- Acute or subacute low back and/or low back–related lower extremity pain
- Presence of 1 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** are 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 longer than 3 months
- Generalized pain not consistent with other impairment-based classification criteria presented in these clinical guidelines
- Presence of depression, fear-avoidance beliefs, and/or pain catastrophizing

A DIFFERENTIAL DIAGNOSIS

Clinicians should consider diagnostic classifications associated with serious medical 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 these guidelines, or (3) the patient's symptoms are not resolving with interventions aimed at normalization of the patient's impairments of body function.

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A **EXAMINATION – OUTCOME MEASURES**

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

F **EXAMINATION – ACTIVITY LIMITATION AND PARTICIPATION RESTRICTION MEASURES**

Clinicians should routinely assess activity limitation and participation restriction through validated 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.

A **INTERVENTIONS – MANUAL THERAPY**

Clinicians should consider utilizing thrust manipulative procedures to reduce pain and disability in patients with mobility deficits and acute low back and back-related buttock or thigh pain. Thrust manipulative and nonthrust mobilization procedures can also be used to improve spine and hip mobility and reduce pain and disability in patients with subacute and chronic low back and back-related lower extremity pain.

A **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 subacute and chronic low back pain with movement coordination impairments and in patients post–lumbar microdiscectomy.

A **INTERVENTIONS – CENTRALIZATION AND DIRECTIONAL PREFERENCE EXERCISES AND PROCEDURES**

Clinicians should consider utilizing repeated movements, exercises, or procedures to promote centralization to reduce symptoms in patients with acute low back pain with related (referred) lower extremity pain. Clinicians should consider using repeated exercises in a specific direction determined by treatment response to improve mobility and reduce symptoms in patients with acute, subacute, or chronic low back pain with mobility deficits.

C **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.

C **INTERVENTIONS – LOWER-QUARTER NERVE MOBILIZATION PROCEDURES**

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

D **INTERVENTIONS – TRACTION**

There is conflicting evidence for the efficacy of intermittent lumbar traction for patients with low back pain. There is preliminary evidence that a subgroup of patients with signs of nerve root compression along with peripheralization of symptoms or a positive crossed straight leg raise will benefit from intermittent lumbar traction in the prone position. There is moderate evidence that clinicians should not utilize intermittent or static lumbar traction for reducing symptoms in patients with acute or subacute, nonradicular low back pain or in patients with chronic low back pain.

B **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 specific cause of the patient's 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.

A **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, submaximal 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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AFFILIATIONS AND CONTACTS

AUTHORS

Anthony Delitto, PT, PhD
Professor and Chair
School of Health & Rehabilitation Sciences
University of Pittsburgh
Pittsburgh, Pennsylvania
delitto@pitt.edu

Steven Z. George, PT, PhD
Associate Professor
Assistant Department Chair
Department of Physical Therapy
Center for Pain Research and Behavioral Health
University of Florida
Gainesville, Florida
szgeorge@phhp.ufl.edu

Linda Van Dillen, PT, PhD
Associate Professor in Physical Therapy and Orthopaedic Surgery
Associate Director of Musculoskeletal Research
Program in Physical Therapy
School of Medicine
Washington University
St Louis, Missouri
vandillenl@wustl.edu

Julie M. Whitman, PT, DSc
Manual Physical Therapy Fellowship Director
Transition DPT Director
Evidence In Motion
Louisville, Kentucky
julie@eimpt.com

Gwendolyn A. Sowa, MD, PhD
Assistant Professor
Department of Physical Medicine and Rehabilitation
Co-Director, Ferguson Laboratory for Orthopaedic and Spine Research
Department of Orthopaedic
University of Pittsburgh
Pittsburgh, PA

Paul Shekelle, MD, PhD
Director
Southern California Evidence-Based Practice Center
RAND Corporation
Santa Monica, California
shekelle@rand.org

Thomas R. Denninger, DPT
Proaxis Therapy
Greenville, South Carolina
tom.denninger@proaxistherapy.com

Joseph J. Godges, DPT, MA
ICF Practice Guidelines Coordinator
Orthopaedic Section, APTA, Inc
La Crosse, Wisconsin
icf@orthopt.org

REVIEWERS

J. Haxby Abbott, MScPT, PhD
University of Otago
Dunedin School of Medicine
Dunedin, New Zealand
haxby.abbott@otago.ac.nz

Roy D. Altman, MD
Professor of Medicine
Division of Rheumatology and Immunology
David Geffen School of Medicine at UCLA
Los Angeles, CA
journals@royaltman.com

Matthew Briggs, DPT
Coordinator, Sports Physical Therapy Residency
The Ohio State University
Columbus, Ohio
matt.briggs@osumc.edu

David Butler, PT, GDAMT, M SPP SC
Director
Neuro Orthopaedic Institute
Senior Lecturer
Division of Health Sciences
University of South Australia
Adelaide, Australia
david@noigroup.com

Joseph P. Farrell, DPT, M App Sci
Senior Clinical Faculty
PT Fellowship in Advanced Orthopedic Manual Therapy
Kaiser Permanente
Hayward, California
jfarrell235@gmail.com

Amanda Ferland, DPT
Clinic Director
MVP Physical Therapy
Federal Way, Washington
aferland@mvppt.com

Helene Fearon, PT
Fearon & Levine Consulting
Phoenix, Arizona
helenefearon@fearonlevine.com

Julie M. Fritz, PT, PhD
Associate Professor
University of Utah
Clinical Outcomes Research Scientist
Intermountain Healthcare
Salt Lake City, Utah
julie.fritz@hsc.utah.edu

Joy MacDermid, PT, PhD
Associate Professor
School of Rehabilitation Science
McMaster University
Hamilton, Ontario, Canada
macderj@mcmaster.ca

James W. Matheson, DPT
Larsen Sports Medicine and Physical Therapy
Hudson, Wisconsin
jw@eipconsulting.com

Philip McClure, PT, PhD
Professor
Department of Physical Therapy
Arcadia University
Glenside, Pennsylvania
mcclure@arcadia.edu

Stuart M. McGill, PhD
Professor
Department of Kinesiology
Director, Spine Biomechanics Laboratory
University of Waterloo
Waterloo, Ontario, Canada
mcgill@uwaterloo.ca

Leslie Torburn, DPT
Principal and Consultant
Silhouette Consulting, Inc.
San Carlos, California
torburn@yahoo.com

Mark Werneke, PT, MS
Spine Rehabilitation
CentraState Medical Center
Freehold, New Jersey
mwerneke@centrastate.com

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