

State of Oregon Evidence-based Clinical Guidelines Project

Advanced Imaging for Low Back Pain

A Clinical Practice Guideline Based on the Joint Practice Guideline of
the American College of Physicians and the American Pain Society
(Diagnosis and Treatment of Low Back Pain)

April 2012



Guideline Development Group

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This document was prepared by the Center for Evidence-based Policy at Oregon Health & Science University (the Center) on behalf of the Guideline Development Group and the Office for Oregon Health Policy & Research. This document is intended to help providers, consumers and purchasers of health care in Oregon make informed decisions about health care services. The document is intended as a reference and is provided with the understanding that neither the Center nor the Guideline Development Group are engaged in rendering any clinical, legal, business or other professional advice.

These guidelines should not be construed as dictating an exclusive course of treatment or procedure. Variations in practice may be warranted based on the needs of the individual patient, resources, and limitations unique to the institution or type of practice.

The statements in this document do not represent official policy positions of the Center, the Guideline Development Group, or the Office for Oregon Health Policy and Research. Researchers and authors involved in preparing this document have no affiliations or financial involvement that conflict with material presented in this document.

Objective:

This guideline was developed by a collaborative group of public and private partners to provide up-to-date evidence-based guidance on the role of advanced imaging in low back pain. The guideline offers recommendations for the use of advanced imaging for evaluation of low back pain of any duration. The aim of the guideline is to identify evidence-based, appropriate indications for imaging of non-pregnant adults with low back pain. This guideline can then be used to create practice standards and coverage guidelines for use across public and private payers. Additional evidence concerning other elements of evaluation as well as recommendations for management of low back pain can be found in the State of Oregon Evidence-based Clinical Guidelines:

- Evaluation and Management of Low Back Pain¹ and
- Percutaneous Interventions for Low Back Pain².

Background to the Oregon Evidence-based Clinical Guidelines Project:

In June 2009, the Oregon legislature passed health reform legislation, HB 2009, which created the Oregon Health Policy Board and charged it with creating a comprehensive health reform plan for our state. In December 2010, the Board released *Oregon's Action Plan for Health*, which lays out “strategies that reflect the urgency of the health care crisis and a timeline for actions that will lead Oregon to a more affordable, world-class health care system.” They outlined eight foundational strategies, one of which is to “set standards for safe and effective care.” To accomplish this, the plan directs the state to “Identify and develop 10 sets of Oregon-based best practice guidelines and standards that can be uniformly applied across public and private health care to drive down costs and reduce unnecessary care. This work will be conducted by the Health Services Commission and Health Resources Commission in close collaboration with providers, the Center for Evidence-Based Practice, and other key stakeholders.”³

Development of this guideline:

This guideline was developed by a Guideline Development Group (GDG) consisting of representatives from the State’s Health Authority with support from clinical evidence specialists from the Center for Evidence-based Policy. The Center provided expertise in the process of guideline development and undertook analysis and appraisal to support the development of this guideline.

Methods:

The GDG developed this guideline using the ADAPTÉ⁴ framework which is a systematic approach to the endorsement or modification of guideline(s) produced in one cultural context or organizational setting for application in another context or setting. Guideline adaptation is used as an alternative to wholly

¹ Livingston, C., King, V., Little, A., Pettinari, C., Thielke, A., & Gordon, C. (2012). *State of Oregon Evidence-based Clinical Guidelines Project. Evaluation and management of low back pain: A clinical practice guideline based on the joint practice guideline of the American College of Physicians and the American Pain Society (Diagnosis and treatment of low back pain)*. Salem: Office for Oregon Health Policy and Research.

² Livingston, C., Little, A., King, V., Pettinari, C., Thielke, A., Pensa, M., Vandegriff, S., & Gordon, C. (2012). *State of Oregon Evidence-based Clinical Guidelines Project. Percutaneous interventions for low back pain: A clinical practice guideline based on the 2009 American Pain Society Guideline (Interventional Therapies, Surgery, and Interdisciplinary Rehabilitation for Low Back Pain)*. Salem: Office for Oregon Health Policy and Research.

³ Effective January 1, 2012, House Bill 2100 (2011) terminates the Health Services Commission and Health Resources Commission and transfers their duties related to evidence-based guideline development to a new Health Evidence Review Commission.

⁴ <http://www.adapte.org/www/>

new guideline development, which can be time consuming, expensive and an inefficient use of resources, when existing quality guidelines are available.

The process for developing this guideline began by searching 17 different databases and other sources for guidelines related to Imaging for Low Back Pain (see appendix A). Candidate guidelines were required to satisfy the following requirements:

- To be evidence-based, that is, guideline recommendations are based on systematic reviews of the literature,
- to address the use of advanced imaging in adults with low back pain,
- to be published in English and,
- to be freely available to the public.

The GDG required that evidence-based recommendations be made on the basis of both the quality and strength of the underlying data from the guideline's systematic reviews.

The initial search identified nine guidelines which met the above stated criteria (Appendix B). Of the nine original candidate guidelines, three were rated as poor quality during the development of a previous State of Oregon guideline⁵ and one was not sufficiently comprehensive (did not address the use of MRI or CT scanning) to warrant further assessment. The five remaining guidelines were then assessed for methodological quality using a modified AGREE II⁶ (Appraisal of Guidelines Research and Evaluation) instrument (Appendix C). Assessments were conducted by two guideline quality assessors from the Center for Evidence-based Policy and discordant ratings were reconciled through further review and consensus. Two of the five guidelines were rated good quality, and the other three were rated fair quality. The two good quality guidelines were then examined further for scope and clarity of presentation.

After considering guideline scope and specific imaging modalities addressed, the GDG selected the American College of Physicians/ American Pain Society (ACP/APS) guideline as the base guideline, primarily because it had recommendations concerning the use of CT scanning, thermography and electrophysiology testing which were lacking in the National Institute for Clinical Excellence (NICE) guideline. Neither guideline addressed myelography. The ACP/APS guideline in its entirety can be found at the following link: <http://www.annals.org/content/147/7/478.long>. The ACP/APS guideline is accompanied by a full systematic review on imaging strategies for low back pain (<http://www.annals.org/content/147/7/492.full.pdf+html>).

The ACP/APS guideline used the ACP's guideline grading system that was adapted from the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) working group⁷. Guideline recommendations were rated as either strong or weak. Strong recommendations were required to have clear evidence of benefit or harm. Weak recommendations were based on finely balanced benefits, risks and burdens. The overall strength of evidence for each intervention was rated based on factors such as the quality, quantity, consistency, generalizability and directness of the evidence. The ACP/APS guideline

⁵ Evaluation and Management of Low Back Pain: A Clinical Practice Guideline Based on the Joint Practice Guideline of the American College of Physicians and the American Pain Society (Diagnosis and Treatment of Low Back Pain) (2011).

⁶ <http://www.agreecollaboration.org/>

⁷ <http://www.gradeworkinggroup.org/>

panel considered interventions to have “proven” benefit if there was at least fair quality evidence of moderate or substantial benefit (or of small benefit with no significant harms, costs or burdens).

Updating:

The ACP/APS guideline was published in 2007. The authors of the guideline were contacted in March 2011 and stated that there had been no new published evidence which would change the recommendations of the guideline and that it was considered current. The GDG recommends that this guideline be reevaluated if the ACP/APS issues an updated guideline and at least every two years for currency if the original guideline is not updated.

Recommendations

Below are the recommendations of the ACP/APS clinical practice guideline, followed by discussion of each recommendation. These recommendations are further supported by a systematic review and meta-analysis of imaging strategies published in 2009⁸, as well as Best Practice Advice from the American College of Physicians published in 2011⁹.

Table A: State of Oregon Evidence-based Clinical Guideline Recommendations for Advanced Imaging for Evaluation of Low Back Pain

Recommendations		
Recommendation	Content	Strength of Recommendation & Evidence Grade
1. Routine Imaging for non-specific pain (X-ray, CT, MRI)	Clinicians should not routinely obtain imaging in patients with nonspecific low back pain.	Recommendation: Strong Grade: Moderate-quality evidence
2. Imaging for underlying conditions present or suspected (X-ray, CT, MRI)	Clinicians should perform diagnostic imaging and testing for patients with low back pain when severe or progressive neurologic deficits are present or when serious underlying conditions are suspected on the basis of history and physical examination. (See Table B for a list of potentially serious conditions)	Recommendation: Strong Grade: Moderate-quality evidence
3. Advanced Imaging* (CT, MRI)	Clinicians should evaluate patients with persistent low back pain and signs or symptoms of radiculopathy or spinal stenosis with magnetic resonance imaging (preferred) or computed tomography only if they are potential candidates for surgery or epidural steroid injection (for suspected radiculopathy).	Recommendation: Strong Grade: Moderate-quality evidence

*This guideline does not address the appropriate use of myelography or other advanced imaging other than CT and MRI

⁸ Chou, R, Fu, R, Carrino, J & Deyo, R. (2009). Imaging strategies for low-back pain: systematic review and meta-analysis. *The Lancet*, 373(9662): 463-72.

⁹ Chou, R, Qaseem, A, Owens, D, Shekelle, P for the Clinical Guidelines Committee of the American College of Physicians. (2011). Diagnostic imaging for low back pain: Advice for high-value health care from the American College of Physicians. *Annals of Internal Medicine*, 154(3), 181-189.

Recommendation #1¹⁰:

There is no evidence that routine plain radiography in patients with nonspecific low back pain is associated with a greater improvement in patient outcomes than selective imaging (Deyo 1987, Kendrick 2001, Kerry 2002). In addition, exposure to unnecessary ionizing radiation should be avoided. This issue is of particular concern in young women because the amount of gonadal radiation from obtaining a two view radiographic exam of the lumbar spine is equivalent to being exposed to a daily chest radiograph for more than one year (Jarvik 2003a). Routine advanced imaging (computed tomography [CT] or magnetic resonance imaging [MRI]) is also not associated with improved patient outcomes (Gilbert 2004) and identifies many radiographic abnormalities that are poorly correlated with symptoms (Jarvik 2002) but could lead to additional, possibly unnecessary interventions (Jarvik 2003b, Lurie 2003). Plain radiography is recommended for initial evaluation of possible vertebral compression fracture in selected higher-risk patients, such as those with a history of osteoporosis or steroid use (Jarvik 2002). Evidence to guide optimal imaging strategies is not available for low back pain that persists for more than one to two months despite standard therapies if there are no symptoms suggesting radiculopathy or spinal stenosis, although plain radiography may be a reasonable initial option. (See recommendation 2 for imaging recommendations in patients with symptoms suggesting radiculopathy or spinal stenosis.) Thermography and electrophysiologic testing are not recommended for evaluation of nonspecific low back pain.

Recommendation #2¹¹:

Prompt work-up with MRI or CT is recommended in patients who have severe or progressive neurologic deficits or are suspected of having a serious underlying condition (such as vertebral infection, the cauda equina syndrome, or cancer with impending spinal cord compression) because delayed diagnosis and treatment are associated with poorer outcomes (Loblaw 2005, Todd 2005, Tsiodras 2006). Magnetic resonance imaging is generally preferred over CT if available because it does not use ionizing radiation and provides better visualization of soft tissue, vertebral bone marrow, and the spinal canal (Jarvik 2002). There is insufficient evidence to guide precise recommendations on diagnostic strategies in patients who have risk factors for cancer but no signs of spinal cord compression. Several strategies have been proposed for such patients (Jarvik 2002, Joines 2001), but none have been prospectively evaluated. Proposed strategies generally recommend plain radiography or measurement of erythrocyte sedimentation rate (a rate of ≥ 20 mm/h is associated with 78% sensitivity and 67% specificity for cancer [van den Hoogen 1995]), with MRI reserved for patients with abnormalities on initial testing (Jarvik 2002, Joines 2001). An alternative strategy is to directly perform MRI in patients with a history of cancer, the strongest predictor of vertebral cancer (Joines 2001). While age over 50 years may be considered a red flag and justify more immediate imaging, delaying imaging while offering standard treatments and reevaluating within 1 month may also be a reasonable option for patients without other risk factors for cancer (Suarez-Almazor 1997).

Recommendation #3¹²:

The natural history of lumbar disc herniation with radiculopathy in most patients is for improvement within the first four weeks with noninvasive management (Vroomen 2002, Weber 1983). There is no

¹⁰ Extracted verbatim from Chou, et al. (2007)

¹¹ Extracted verbatim from Chou, et al. (2007)

¹² Extracted verbatim from Chou, et al. (2007)

compelling evidence that routine imaging affects treatment decisions or improves outcomes (Modic 2005). For prolapsed lumbar disc with persistent radicular symptoms despite noninvasive therapy, discectomy or epidural steroids are potential treatment options (Gibson 2000, Gibson 2005, Nelemans 2001, Peul 2007, Weinstein, 2006). Surgery is also a treatment option for persistent symptoms associated with spinal stenosis (Amundsen 2000, Atlas 2005, Weinstein 2007, Malmivaara, 2007).

Magnetic resonance imaging (preferred if available) or CT is recommended for evaluating patients with persistent back and leg pain who are potential candidates for invasive interventions—plain radiography cannot demonstrate discs or accurately show the degree of spinal stenosis (Jarvik 2002). However, clinicians should be aware that findings on MRI or CT (such as bulging disc without nerve root impingement) are often nonspecific. Recommendations for specific invasive interventions, interpretation of radiographic findings, and additional work-up (such as electrophysiologic testing) are beyond the scope of this guideline, but decisions should be based on the clinical correlation between symptoms and radiographic findings, severity of symptoms, patient preferences, surgical risks (including the patient’s comorbid conditions), and costs and will generally require specialist input.

Additionally, the Best Practice Advice from the American College of Physicians published in 2011¹³ provides the following advice:

“The ACP has found strong evidence that routine imaging for low back pain by using radiography or advanced imaging methods is not associated with a clinically meaningful effect on patient outcomes. Unnecessary imaging exposes patients to preventable harms, may lead to additional unnecessary interventions, and results in unnecessary costs. Diagnostic imaging studies should be performed only in selected, higher-risk patients who have severe or progressive neurologic deficits or are suspected of having a serious or specific underlying condition. Advanced imaging with MRI or CT should be reserved for patients with a suspected serious underlying condition or neurologic deficits, or who are candidates for invasive interventions. Decisions about repeated imaging should be based on development of new symptoms or changes in current symptoms. Patient education strategies should be used to inform patients about current and effective standards of care.”

¹³ Chou, R, Qaseem, A, Owens, D, Shekelle, P for the Clinical Guidelines Committee of the American College of Physicians. (2011). Diagnostic imaging for low back pain: Advice for high-value health care from the American College of Physicians. *Annals of Internal Medicine*, 154(3), 181-189.

Table B: Potentially Serious Conditions (“Red Flags”) and Recommendations for Initial Diagnostic Work-up

Possible cause	Key features on history or physical examination	Imaging*	Additional studies*
Cancer	<ul style="list-style-type: none"> History of cancer with new onset of LBP 	MRI	ESR
	<ul style="list-style-type: none"> Unexplained weight loss Failure to improve after 1 month Age >50 years Symptoms such as painless neurologic deficit, night pain or pain increased in supine position 	Lumbosacral plain radiography	
	<ul style="list-style-type: none"> Multiple risk factors for cancer present 	Plain radiography or MRI	
Spinal column infection	<ul style="list-style-type: none"> Fever Intravenous drug use Recent infection 	MRI	ESR and/or CRP
Cauda equina syndrome	<ul style="list-style-type: none"> Urinary retention Motor deficits at multiple levels Fecal incontinence Saddle anesthesia 	MRI	None
Vertebral compression fracture	<ul style="list-style-type: none"> History of osteoporosis Use of corticosteroids Older age 	Lumbosacral plain radiography	None
Ankylosing spondylitis	<ul style="list-style-type: none"> Morning stiffness Improvement with exercise Alternating buttock pain Awakening due to back pain during the second part of the night Younger age 	Anterior-posterior pelvis plain radiography	ESR and/or CRP, HLA-B27
Nerve compression/ disorders (e.g. herniated disc with radiculopathy)	<ul style="list-style-type: none"> Back pain with leg pain in an L4, L5, or S1 nerve root distribution present < 1 month Positive straight-leg-raise test or crossed straight-leg-raise test 	None	None
	<ul style="list-style-type: none"> Radiculopathic symptoms present >1 month Severe/progressive neurologic deficits (such as foot drop), progressive motor weakness 	MRI**	Consider EMG/NCV
Spinal stenosis	<ul style="list-style-type: none"> Radiating leg pain Older age Pain usually relieved with sitting (Pseudoclaudication a weak predictor)	None	None
	<ul style="list-style-type: none"> Spinal stenosis symptoms present >1 month 	MRI**	Consider EMG/NCV

* Level of evidence for diagnostic evaluation is variable

** Only if patient is a potential candidate for surgery or epidural steroid injection

Red Flag: Red flags are findings from the history and physical examination that may be associated with a higher risk of serious disorders.

CRP = C-reactive protein; EMG = electromyography; ESR = erythrocyte sedimentation rate; MRI = magnetic resonance imaging; NCV = nerve conduction velocity.

Extracted and modified from Chou R, Qaseem A, Snow V, et al: *Diagnosis and Treatment of Low Back Pain: A Joint Clinical Practice Guideline from the American College of Physicians and the American Pain Society. Ann Intern Med. 2007; 147:478-491.*

Appendix A. Sources Searched for Advanced Imaging for Low Chronic Back Pain Guidelines

1. British Medical Journal – Clinical Evidence
2. Cochrane Library
3. Agency for Healthcare Research and Quality
4. ECRI
5. Hayes, Inc
6. Veterans Administration – Technology Assessment Program (VA TAP)
7. Blue Cross Blue Shield HTA
8. Centers for Medicare and Medicaid
9. CADTH
10. Washington HTA Program
11. US Preventive Services Task Force
12. ICSI
13. Guidelines.gov
14. American College of Physicians AND American Pain Society
15. American Physical Therapy Association
16. PEDro.org.au (evidence-based physiotherapy database)
17. GIN Guidelines Database

Appendix B. Low Back Pain Guidelines Identified

Methods Summary:

Initially, 17 databases and other sources for guidelines related to Advanced Imaging for Low Back Pain were searched. Candidate guidelines were required to:

- be evidence-based (recommendations based on a full systematic review)
- be comprehensive
- be published in English
- be freely available to the public

Nine pertinent guidelines were identified, of which five were sufficiently comprehensive and were assessed by two clinical epidemiologists for methodologic quality using a modified AGREE (Appraisal of Guidelines Research and Evaluation) II¹⁴ instrument.

Candidate guidelines were then assessed considering:

- age
- source
- specific treatment elements addressed
- presentation

The GDG selected the two guidelines of highest quality that were most comprehensive. (See guideline text for comprehensive Methods discussion)

Low Back Pain Guidelines Identified in Search – Selected for Quality Assessment

Brussieres, A.E., Taylor, J.A., & Peterson, C. (2008). Diagnostic imaging practice guidelines for musculoskeletal complaints in adults: An evidence-based approach-part 3: spinal disorders. *Journal of Manipulative and Physiological Therapeutics*, 31(1), 33-88.

Overall guideline quality rating: Fair

Chou, R., Qaseem, A., Snow, V., Casey, D., Cross, J.T. Jr., Shekelle, P., Owens, D.K., Clinical Efficacy Assessment Subcommittee of the American College of Physicians, American College of Physicians, American Pain Society Low Back Pain Guidelines Panel. (2007). Diagnosis and treatment of low back pain: A joint clinical practice guideline from the American College of Physicians and the American Pain Society. *Ann Intern Med*, 147(7), 478-91.

Overall guideline quality rating: Good

National Health and Medical Research Council. Australian Acute Musculoskeletal Pain Guidelines Group. (2003). Evidence-based management of acute musculoskeletal pain. (Website states that status is “current”). [Chapter 4 of document is on Acute Low Back Pain.]

<http://www.nhmrc.gov.au/files/nhmrc/file/publications/synopses/cp94.pdf>

Overall guideline quality rating: Fair

National Institute for Health and Clinical Excellence (NICE). (2009). Low back pain: Early management of persistent non-specific low back pain. London, UK: National Institute for Health and Clinical Excellence. Retrieved September 30, 2010, from <http://www.nice.org.uk/nicemedia/live/11887/44343/44343.pdf>

Overall guideline quality rating: Good

New Zealand Guidelines Group. (2004). New Zealand acute low back pain guide. Wellington, NZ: New Zealand Guidelines Group. Retrieved December 13, 2010, from

http://www.nzgg.org.nz/guidelines/0072/acc1038_col.pdf

Overall guideline quality rating: Fair

¹⁴ <http://www.agreecollaboration.org/>

Low Back Pain Guidelines Identified in Search– Not Selected for Quality Assessment

Institute for Clinical Systems Improvement (ICSI). (2010). Adult low back pain. Fourteenth edition. Bloomington, MN: ICSI.

Overall guideline quality rating: Poor

Michigan Quality Improvement Consortium. (2008). Management of acute low back pain. Southfield, MI: Michigan Quality Improvement Consortium.

Overall guideline quality rating: Poor

Towards Optimized Practice. (2009). Management of low back pain. Edmonton, AB: Towards Optimized Practice Program.

Overall guideline quality rating: Fair

University of Michigan Health System. (2010). Acute low back pain. Ann Arbor, MI: University of Michigan Health System.

Overall guideline quality rating: Poor

Appendix C: Methodology Checklist Adapted from the AGREE II materials

Methodology Checklist: Guidelines			
Guideline citation <i>(Include name of organization, title, year of publication, journal title, pages)</i>			
Guideline Topic:			
Checklist completed by:			Date:
SECTION 1: PRIMARY CRITERIA			
To what extent is there		Assessment/Comments:	
1.1	RIGOR OF DEVELOPMENT: Evidence <ul style="list-style-type: none"> Systematic literature search Study selection criteria clearly described Quality of individual studies and overall strength of the evidence assessed Explicit link between evidence & recommendations <i>(If any of the above are missing, rate as poor)</i>	GOOD	FAIR POOR
1.2	RIGOR OF DEVELOPMENT: Recommendations <ul style="list-style-type: none"> Methods for developing recommendations clearly described Strengths and limitations of evidence clearly described Benefits/side effects/risks considered External review 	GOOD	FAIR POOR
1.3	EDITORIAL INDEPENDENCE¹⁵ <ul style="list-style-type: none"> Views of funding body have not influenced the content of the guideline Competing interests of members have been recorded and addressed 	GOOD	FAIR POOR
<i>If any of three primary criteria are rated poor, the entire guideline should be rated poor.</i>			
SECTION 2: SECONDARY CRITERIA			
2.1	SCOPE AND PURPOSE <ul style="list-style-type: none"> Objectives described Health question(s) specifically described Population (patients, public, etc.) specified 	GOOD	FAIR POOR

¹⁵ Editorial Independence is a critical domain. However, it is often very poorly reported in guidelines. The assessor should not rate the domain, but write “unable to assess” in the comment section. If the editorial independence is rated as “poor”, indicating a high likelihood of bias, the entire guideline should be assessed as poor.

SECTION 2: SECONDARY CRITERIA, Cont.				
2.2	STAKEHOLDER INVOLVEMENT <ul style="list-style-type: none"> • Relevant professional groups represented • Views and preferences of target population sought • Target users defined 	GOOD	FAIR	POOR
2.3	CLARITY AND PRESENTATION <ul style="list-style-type: none"> • Recommendations specific, unambiguous • Management options clearly presented • Key recommendations identifiable • Application tools available • Updating procedure specified 	GOOD	FAIR	POOR
2.4	APPLICABILITY <ul style="list-style-type: none"> • Provides advice and/or tools on how the recommendation(s) can be put into practice • Description of facilitators and barriers to its application • Potential resource implications considered • Monitoring/audit/review criteria presented 	GOOD	FAIR	POOR
SECTION 3: OVERALL ASSESSMENT OF THE GUIDELINE				
3.1	How well done is this guideline?	GOOD	FAIR	POOR
3.2	Other reviewer comments:			

Description of Ratings: Methodology Checklist for Guidelines

The checklist for rating guidelines is organized to emphasize the use of evidence in developing guidelines and the philosophy that “evidence is global, guidelines are local.” This philosophy recognizes the unique situations (e.g., differences in resources, populations) that different organizations may face in developing guidelines for their constituents. The second area of emphasis is transparency. Guideline developers should be clear about how they arrived at a recommendation and to what extent there was potential for bias in their recommendations. For these reasons, rating descriptions are only provided for the primary criteria in section one. There may be variation in how individuals might apply the good, fair, and poor ratings in section two based on their needs, resources, organizations, etc.

Section 1. Primary Criteria (rigor of development and editorial independence) ratings:

Good: All items listed are present, well described, and well executed (e.g., key research references are included for each recommendation).

Fair: All items are present, but may not be well described or well executed.

Poor: One or more items are absent or are poorly conducted

Appendix D. List of Peer Reviewers

Invited: Accepted & Reviewed

Susan Bamberger, PT, MPT, DIP MDT

Past President

Oregon Physical Therapy Association

Dianna Bardo, MD

Associate Professor, Radiology

Oregon Health & Science University

Roger Batchelor, DAOM, LAC

Associate Professor

National College of Natural Medicine

Roger Chou, MD

Scientific Director, Oregon Evidence-based Practice Center

Associate Professor of Medicine, Division of General Internal Medicine and Geriatrics

Oregon Health & Science University

Rahul N. Desai, MD

Musculoskeletal/Interventional Pain Radiologist

EPIC Imaging

Rick Deyo, MD, MPH

Kaiser Permanente Professor of Evidence-Based Family Medicine

Director, KL2 Multidisciplinary Clinical Research Career Development Program

Director, OCTRI Community and Practice-based Research Program

Departments of Family Medicine and Internal Medicine

Oregon Health & Science University

Dorothy Epstein, DPT, OCS

Physical Therapist

Legacy Good Samaritan Pain Management Center

Legacy Good Samaritan Outpatient Rehabilitation

Marc Gosselin, MD

Associate Professor

Director, Thoracic Imaging

Department of Diagnostic Radiology

Oregon Health & Science University

Mitch Haas, DC, MA

Associate Vice President of Research

University of Western States

LaVerne A. Saboe, Jr., DC, DACAN, FICC, DABFP, FACO

Chiropractic Physician

Past president, Chiropractic Association of Oregon

Invited: Declined/Did Not Respond/Did Not Review

Nineteen additional reviewers were invited but either declined, did not respond, missed the deadline or did not return the review. Areas of professional expertise for invited reviewers included:

Anesthesiology
Behavioral Health
Complementary and Alternative Medicine
Family Medicine
Internal Medicine
Occupational Medicine
Orthopedic Surgery
Neurosurgery
Pain Advocacy
Pain Medicine
Physical Therapy
Physical Medicine and Rehabilitation
Radiology
Sports Medicine
Worker's Compensation

Appendix E. References

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