

Low Back Pain AUC Evidence Table

Year	Author	Title	Journal	Grade (oxford level of evidence)	Study type	study details	Rule	Rule (simplified)	Modality
2008	Rubinstein	A best-evidence review of diagnostic procedures for neck and low-back pain	Best Practice & Research Clinical Rheumatology	1a	SR	SR of SRs and RCTs	There is no firm evidence that the presence or absence of radiographic abnormalities are associated with nonspecific low-back pain. For patients age 50, plain radiography together with standard laboratory tests can almost completely rule out underlying systemic disease. Advanced imaging should be reserved for candidates for surgery and patients for whom systemic disease is strongly suspected. The evidence does not support use of invasive techniques such as discography and single photon emission computed tomography (SPECT) bone imaging. In general, use of radiographs was not associated with improved outcomes, but did result in higher costs and workload for the general practitioner.	Advanced imaging should be reserved for candidates for surgery and patients for whom systemic disease is strongly suspected. The evidence does not support use of invasive techniques such as discography and SPECT bone imaging.	X-ray, CT, MR, Tc99 bone scan with SPECT spine
2015	Karel	Effect of routine diagnostic imaging for patients with musculoskeletal disorders: A meta-analysis	European Journal of Internal Medicine	1a	meta-analysis	meta-analysis using SR of RCTs	Diagnostic imaging can be considered for patients with low back pain to rule out a serious underlying condition in the presence of red flags and for subacute/chronic low back pain patients who show no improvement. Clinicians should use clinical decision rules for patients with traumatic knee complaints. For nontraumatic knee complaints, diagnostic imaging should be used if conservative treatment fails.	Red flags: smoking, age, cancer history, diabetes, drug abuse, chronic nonsteroidal anti-inflammatory drugs (NSAIDs), unnatural course of pain, night pain or symptoms of cauda equina - listed in discussion but not supported by the review.	All diagnostic imaging
2009	Chou	Imaging strategies for low-back pain: systematic review and meta-analysis	Lancet	1a	meta-analysis	meta-analysis of RCTs	Lumbar imaging for low-back pain without indications of serious underlying conditions does not improve clinical outcomes. Therefore, clinicians should refrain from routine, immediate lumbar imaging for patients with acute or subacute low-back pain and without features suggesting a serious underlying condition.	Clinicians should refrain from routine, immediate lumbar imaging for patients with acute or subacute low-back pain and without features suggesting a serious underlying condition.	X-ray, CT, MR
2004	Gilbert	Does early magnetic resonance imaging influence management or improve outcome in patients referred to secondary care with low back pain? A pragmatic randomized controlled trial	Health Technology Assessment	1b	RCT	RCT	Early use of sophisticated imaging does not appear to affect management overall but does result in a slight improvement in clinical outcome at an estimated cost of £870 per quality adjusted life years. Imaging was associated with an increase in clinicians' diagnostic confidence, particularly for nonspecialists.	Early MRI does not appear to affect management overall but does result in a slight improvement in clinical outcome at an estimated cost of £870 per quality adjusted life years.	MR
2008	Henschke	A systematic review identifies five "red flags" to screen for vertebral fracture in patients with low back pain	Journal of Clinical Epidemiology	2a	SR	SR of cohort studies good reference standard	Five clinical features that when present have a higher possibility of vertebral fracture and when absent a smaller chance of fracture: age >50, female gender, major trauma, pain and tenderness, distracting painful injury	Red flags for fracture: age >50, female gender, major trauma, pain and tenderness, distracting painful injury	X-ray, CT, MR
2013	Downie	Red flags to screen for malignancy and fracture in patients with low back pain: systematic review	BMJ	2a	SR	SR of cohort and cross sectional studies	While several red flags are endorsed in guidelines to screen for fracture or malignancy, only a small subset of these have evidence that they are informative. These findings suggest a need for revision of many current guidelines.	Insufficient evidence	X-ray, CT, MR
2007	Chou	Diagnosis and Treatment of Low Back Pain: A Joint Clinical Practice Guideline from the American College of Physicians and the American Pain Society	Annals of Internal Medicine	2a	SR	SR of RCTs and cohort studies	Clinicians should not routinely obtain imaging or other diagnostic tests for patients with nonspecific low back pain (strong recommendation, moderate-quality evidence).	Imaging not appropriate in nonspecific pain	X-ray, CT, MR
				2a	SR	SR of RCTs and cohort studies	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 (strong recommendation, moderate-quality evidence).	Severe or progressive neurologic deficits or serious underlying conditions suspected on the basis of history and physical examination are indications	CT and MR
				2a	SR	SR of RCTs and cohort studies	Clinicians should evaluate patients with persistent low back pain and signs or symptoms of radiculopathy or spinal stenosis with MRI (preferred) or CT only if they are potential candidates for surgery or epidural steroid injection (for suspected radiculopathy) (strong recommendation, moderate-quality evidence).	Persistent pain: only image if operative or injection candidate	CT and MR
2006	Carragee	Does Minor Trauma Cause Serious Low Back Illness?	Spine	2b	prospective cohort	prospective cohort	In this study cohort, minor trauma does not appear to increase the risk of serious low back pain (LBP) episodes or disability. The vast majority of incident-adverse LBP events may be predicted not by structural findings or minor trauma but by a small set of demographic and behavioral variables.	Minor trauma usually not associated with serious injury or disability. Red flags: lifting heavy weights, especially in awkward position	X-ray, CT, MR
2017	Todd	Guidelines for cauda equina syndrome. Red flags and white flags. Systematic review and implications for triage	British Journal of Neurosurgery	3a	SR	SR of guidelines, did not rate evidence given	Only 32% of the symptoms/signs were true "red flags" — i.e., they warn of further, avoidable damage ahead. Guidelines should be redrawn to emphasize referral of patients who are at risk of developing CES or who have early CES. It is illogical for these guidelines to emphasize the clinical features of severe, often untreatable CES. Demand for emergency MRI will increase; MRI is part of triage and should be performed.	Early signs and symptoms should precipitate imaging.	MR
2013	Williams	Red flags to screen for vertebral fracture in patients presenting with low-back pain (Review)	Cochrane Library	3a	SR	SR of cohort, cross sectional, and case control studies	The available evidence suggests that the use of many red flags to guide decisions about the need for further investigation of suspected vertebral fracture is unfounded. Most red flags neither increase the likelihood of fracture enough when present, nor decrease its likelihood when absent. Descriptive analyses of single studies revealed three red flags with promising results in primary care (older age, significant trauma and corticosteroid use) and one for in tertiary care (contusion/abrasion). Combinations of red flags also appeared more informative to assist clinical decision making than individual tests. Unfortunately, clear implications for practice regarding which red flags should be used remains challenging given limitations in the evidence available. Since vertebral fracture is rare among patients presenting with LBP and many red flags have high false positive rates, the current set of recommendations for screening of fracture in clinical practice should be reviewed.	Red flags for fracture primary older age, significant trauma and corticosteroid use contusion/abrasion	X-ray, CT, MR
2013	Henschke	Red flags to screen for malignancy in patients with low-back pain (Review)	Cochrane Library	3a	SR	SR of cohort, cross sectional, and case control studies	Commonly suggested "red flags" for malignancy in clinical practice guidelines are: age > 50, no improvement in symptoms after one month, insidious onset, a previous history of cancer, no relief with bed rest, unexplained weight loss, fever, thoracic pain or being systematically unwell (Koes 2010). These "red flags" are usually elicited through the initial assessment (history taking and physical examination) to decide which patients should be referred for imaging or specialist consultation. The limited evidence available suggests that only one "red flag" when used in isolation (a previous history of cancer) meaningfully increases the likelihood of cancer. "Red flags" such as insidious onset, age > 50 and failure to improve after one month have high false positive rates suggesting that uncritical use of these "red flags" as triggers to order further investigation will lead to unnecessary investigations that are harmful, through unnecessary radiation and false-positive results. While the lack of evidence to support or refute the use of "red flags" is recognized, a more pragmatic solution is to consider the possibility of spinal malignancy (in light of its low prevalence in primary care) when a combination of recommended "red flags" are found to be positive.	History of cancer is the best predictor — otherwise, more than one of these: age > 50, no improvement in symptoms after one month, insidious onset, a previous history of cancer, no relief with bed rest, unexplained weight loss, fever, thoracic pain or being systematically unwell	X-ray, CT, MR
2010	Dagenais	Synthesis of recommendations for the assessment and management of low back pain from recent clinical practice guidelines	The Spine Journal	3a	SR	SR of 10 clinical practice guidelines, then dichotomized to "recommended" if strong, moderate, or limited evidence; or "not recommended" if there was insufficient, conflicting, or evidence against a particular intervention	Recommendations from several recent clinical practice guidelines regarding assessment and management of LBP were similar. Clinicians who care for patients with LBP should try to adopt these recommendations to improve patient care.	22 red flags were identified — the most common were age older than 50 (n=9), history of cancer (n=9) and steroid use (n=9). Cancer: history of cancer, unexplained weight loss, refractory to care, night or rest pain, multifocal pain, age > 50, urinary retention (MRI). Cauda equina: fecal incontinence, urinary retention, weakness in limbs, widespread neurologic symptoms, gait abnormality, saddle numbness (MRI). Fracture: age >50, osteoporosis, steroid use, trauma, structural deformity (CT or MRI). Infection: fever, immunocompromise, IVDA, systemic illness, trauma (MRI). Red flags: severe lower extremity pain or neurologic deficit	
2011	Andersen	Is Immediate Imaging Important in Managing Low Back Pain?	Journal of Athletic Training	3a	SR	SR of RCTs, meta-analysis, non consecutive cohort studies	Available evidence indicates that immediate, routine lumbar spine imaging for patients with LBP and without features indicating a serious underlying condition did not improve outcomes compared with usual clinical care without immediate imaging. This evidence confirms that clinicians should refrain from routine, immediate lumbar imaging for primary care patients with nonspecific, acute or subacute LBP and no indications of underlying serious conditions.	Immediate imaging does not improve outcomes for patients with uncomplicated low back pain.	
2004	Gilbert	Low Back Pain: Influence of Early MR Imaging or CT on Treatment and Outcome—Multicenter Randomized Trial	Radiology	3b	prospective cohort	prospective cohort, randomized study using 2 imaging policies for LBP. non-consecutive	Early use of imaging does not appear to affect treatment overall. Decisions about the use of imaging depend on judgments concerning whether the small observed improvement in outcome justifies additional cost.	Early MRI and CT do not improve outcomes	CT and MR
2017	Verhagen	Most red flags for malignancy in low back pain guidelines lack empirical support: a systematic review	Pain	4	SR	SR of a mix of prospective cohorts, case control, case series, and a case study	The origin and diagnostic accuracy of many red flags endorsed in guidelines are unclear. A "history of malignancy" and "strong clinical suspicion" are the only red flags with empirical evidence of acceptably high diagnostic accuracy.	Red flags: history of malignancy and strong clinical suspicion	MR

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Year	Author	Title	Journal	Grade (oxford level of evidence)	Study type	study details	Rule	Rule (simplified)	Modality
Clinical Guideline Evaluation									
2016	Patel	ACR Appropriateness Criteria Low Back Pain	American College of Radiology	1b and 5	RCT	RCT (therapy), but also expert opinion	Acute, subacute, chronic uncomplicated low back pain or radiculopathy; no red flags; no prior management	Conservative treatment if < six weeks	X-ray, CT, MR, Tc99 bone scan with SPECT spine, +/- myelography
				2a and 5	meta-analysis	meta-analysis of SR and cohort, but also expert opinion	Acute, subacute, chronic uncomplicated low back pain or radiculopathy; one or more of the following: low-velocity trauma, osteoporosis, elderly individual or chronic steroid use	Start with X-ray, CT without or MR without	X-ray, CT, MR, Tc99 bone scan with SPECT spine, +/- myelography
				2a and 5	SR	SR of cohort and cross sectional studies (Henschke 2013), but also expert opinion	Acute, subacute, chronic uncomplicated low back pain or radiculopathy; one or more of the following: suspicion of cancer, infection, or immunosuppression	Best is MR with and without, then MR without, then CT with, then CT without	X-ray, CT, MR, Tc99 bone scan with SPECT spine, +/- myelography
				5	expert opinion	expert opinion	Acute, subacute, chronic uncomplicated low back pain or radiculopathy; surgery or intervention candidate with persistent or progressive symptoms during or after 6 weeks o conservative management	Best with MR without, then CT with, then CT without, then MR with and without	X-ray, CT, MR, Tc99 bone scan with SPECT spine, +/- myelography
				5	expert opinion	expert opinion	Low back pain or radiculopathy; new or progressing symptoms or clinical findings with history of prior lumbar surgery	Best is MR with and without, then CT with, then CT without, then MR without	X-ray, CT, MR, Tc99 bone scan with SPECT spine, +/- myelography
				2b and 5	prospective cohort	prospective cohort	Low back pain with suspected cauda equina syndrome or rapidly progressive neurologic deficit	Best with MR without, then MR with and without, then X-ray, then CT with, then CT without	X-ray, CT, MR, Tc99 bone scan with SPECT spine, +/- myelography

Low Back Pain AUC Levels of Evidence

Level 1			
2008	Rubinstein	A best-evidence review of diagnostic procedures for neck and low-back pain	Rule 1
2016	Patel	ACR Appropriateness Criteria Low Back Pain	Rule 1
2015	Karel	Effect of routine diagnostic imaging for patients with musculoskeletal disorders: A meta-analysis	Rule 1
2009	Chou	Imaging strategies for low-back pain: systematic review and meta-analysis	Rule 1
2004	Gilbert	Does early magnetic resonance imaging influence management or improve outcome in patients referred to secondary care with low back pain? A pragmatic randomized controlled trial	Rule 1

Low Back Pain AUC Levels of Evidence

Level 2			
2008	Henschke	A systematic review identifies five “red flags” to screen for vertebral fracture in patients with low back pain	Rule 1
2013	Downie	Red flags to screen for malignancy and fracture in patients with low back pain: systematic review	Rule 1
2008	Henschke	A systematic review identifies five “red flags” to screen for vertebral fracture in patients with low back pain	Rule 1
1999	Ren	Assessment of Functional Status, Low Back Disability, and Use of Diagnostic Imaging in Patients with Low Back Pain and Radiating Leg Pain	Rule 1
2009	Pham	Rapidity and Modality of Imaging for Acute Low Back Pain in Elderly Patients	Rule 1
2016	Patel	ACR Appropriateness Criteria Low Back Pain	Rule 2
2016	Patel	ACR Appropriateness Criteria Low Back Pain	Rule 6
2015	Konstantinou	Characteristics of patients with low back and leg pain seeking treatment in primary care: baseline results from the ATLAS cohort study	Rule 1
2012	Konstantinou	Clinical course, characteristics and prognostic indicators in patients presenting with back and leg pain in primary care. The ATLAS study protocol	Rule 1

Low Back Pain AUC Levels of Evidence

Level 2			
2018	Kohns	Clinical predictors of the medical interventions provided to patients with low back pain in the emergency department	Rule 1
2018	Jensen	The association between subgroups of MRI findings identified with latent class analysis and low back pain in 40-year-old Danes	Rule 1
2007	Hancock	Systematic review of tests to identify the disc, SIJ or facet joint as the source of low back pain	Rule 1
2003	Gray	Conventional Radiography, Rapid MR Imaging, and Conventional MR Imaging for Low Back Pain: Activity-based Costs and Reimbursement	Rule 1
2007	Chou	Diagnosis and Treatment of Low Back Pain: A Joint Clinical Practice Guideline from the American College of Physicians and the American Pain Society	Rule 1
2007	Chou	Diagnosis and Treatment of Low Back Pain: A Joint Clinical Practice Guideline from the American College of Physicians and the American Pain Society	Rule 2
2007	Chou	Diagnosis and Treatment of Low Back Pain: A Joint Clinical Practice Guideline from the American College of Physicians and the American Pain Society	Rule 3
2014	Dagenais	A systematic review of diagnostic imaging use for low back pain in the United States	Rule 1
2006	Carragee	Does Minor Trauma Cause Serious Low Back Illness?	Rule 1
2012	Bossher	Diagnosis of the Vertebral Level from Which Low Back or Leg Pain Originates. A Comparison of Clinical Evaluation, MRI and Epiduroscopy	Rule 1

Low Back Pain AUC Levels of Evidence

Level 3			
2017	Todd	Guidelines for cauda equina syndrome. Red flags and white flags. Systematic review and implications for triage	Rule 1
2013	Williams	Red flags to screen for vertebral fracture in patients presenting with low-back pain (Review)	Rule 1
2013	Henschke	Red flags to screen for malignancy in patients with low-back pain (Review)	Rule 1
2016	Patel	ACR Appropriateness Criteria Low Back Pain	Rule 3
2015	Ogon	Analysis of chronic low back pain with magnetic resonance imaging T2 mapping of lumbar intervertebral disc	Rule 1
2011	Endean	POTENTIAL OF MRI FINDINGS TO REFINE CASE DEFINITION FOR MECHANICAL LOW BACK PAIN IN EPIDEMIOLOGICAL STUDIES: A SYSTEMATIC REVIEW	Rule 1
2004	Gilbert	Low Back Pain: Influence of Early MR Imaging or CT on Treatment and Outcome—Multicenter Randomized Trial	Rule 1
2010	Dagenais	Synthesis of recommendations for the assessment and management of low back pain from recent clinical practice guidelines	Rule 1
2011	Andersen	Is Immediate Imaging Important in Managing Low Back Pain?	Rule 1

Low Back Pain AUC Levels of Evidence

Level 4			
2017	Verhagen	Most red flags for malignancy in low back pain guidelines lack empirical support: a systematic review	Rule 1

Low Back Pain AUC Levels of Evidence

Level 5			
2016	Patel	ACR Appropriateness Criteria Low Back Pain	Rule 4
2016	Patel	ACR Appropriateness Criteria Low Back Pain	Rule 5