

CLINICAL PRACTICE GUIDELINES

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Hip Pain and Mobility Deficits— Hip Osteoarthritis: Revision 2017

*Clinical Practice Guidelines Linked to the
International Classification of Functioning,
Disability and Health From the Orthopaedic Section
of the American Physical Therapy Association*

J Orthop Sports Phys Ther. 2017;47(6):A1-A37. doi:10.2519/jospt.20170301

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Summary of Recommendations*

DIAGNOSIS/CLASSIFICATION

2017 Recommendation

A Clinicians should use the following criteria to classify adults over the age of 50 years into the International Statistical Classification of Diseases and Related Health Problems (ICD) category of coxarthrosis and the associated International Classification of Functioning, Disability and Health (ICF) impairment-based category of hip pain (**b28016 Pain in joints**) and mobility deficits (**b7100 Mobility of a single joint**): moderate anterior or lateral hip pain during weight-bearing activities, morning stiffness less than 1 hour in duration after waking, hip internal rotation range of motion less than 24° or internal rotation and hip flexion 15° less than the nonpainful side, and/or increased hip pain associated with passive hip internal rotation.

DIFFERENTIAL DIAGNOSIS

2017 Recommendation

F Clinicians should revise the diagnosis and change their plan of care, or refer the patient to the appropriate clinician, when the patient's history, reported activity limitations, or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or when the patient's symptoms are not diminishing with interventions aimed at normalization of the patient's impairments of body function.

EXAMINATION – OUTCOME MEASURES: ACTIVITY LIMITATION/SELF-REPORT MEASURES

2017 Recommendation

A Clinicians should use validated outcome measures that include domains of hip pain, body function impairment, activity limitation, and participation restriction to assess outcomes of treatment of hip osteoarthritis.

Measures to assess hip pain may include the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain subscale, Brief Pain Inventory (BPI), pressure pain threshold (PPT), and pain visual analog scale (VAS).

Activity limitation and participation restriction outcome measures may include the WOMAC physical function subscale, the Hip disability and Osteoarthritis Outcome Score (HOOS), Lower Extremity Functional Scale (LEFS), and Harris Hip Score (HHS).

EXAMINATION – ACTIVITY LIMITATION/PHYSICAL PERFORMANCE MEASURES

2017 Recommendation

A To assess activity limitation, participation restrictions, and changes in the patient's level of function over the episode of care, clinicians should utilize reliable and valid physical performance measures, such as the 6-minute walk test, 30-second chair stand, stair measure, timed up-and-go test, self-paced walk, timed single-leg stance, 4-square step test, and step test.

A Clinicians should measure balance performance and activities that predict the risk of falls in adults with hip osteoarthritis, especially those with decreased physical function or a high risk of falls because of past history. Recommended balance tests for patients with osteoarthritis include the Berg Balance Scale, 4-square step test, and timed single-leg stance test.

F Clinicians should use published recommendations from the Academy of Geriatric Physical Therapy of the American Physical Therapy Association⁶ to guide fall risk management in patients with hip osteoarthritis to assess and manage fall risk.

EXAMINATION – PHYSICAL IMPAIRMENT MEASURES

2017 Recommendation

A When examining a patient with hip pain/hip osteoarthritis over an episode of care, clinicians should document the flexion, abduction, and external rotation (FABER or Patrick's) test and passive hip range of motion and hip muscle strength, including internal rotation, external rotation, flexion, extension, abduction, and adduction.

INTERVENTIONS – PATIENT EDUCATION

2017 Recommendation

B Clinicians should provide patient education combined with exercise and/or manual therapy. Education should include teaching activity modification, exercise, supporting weight reduction when overweight, and methods of unloading the arthritic joints.

INTERVENTIONS – FUNCTIONAL, GAIT, AND BALANCE TRAINING

2017 Recommendation

C Clinicians should provide impairment-based functional, gait, and balance training, including the proper use of assistive devices (canes, crutches, walkers), to patients with hip osteoarthritis and activity limitations, balance impairment, and/or gait limitations when associated problems are observed and documented during the history or physical assessment of the patient.

C Clinicians should individualize prescription of therapeutic activities based on the patient's values, daily life participation, and functional activity needs.

INTERVENTIONS – MANUAL THERAPY

2017 Recommendation

A Clinicians should use manual therapy for patients with mild to moderate hip osteoarthritis and impairment of joint mobility, flexibility, and/or pain. Manual therapy may include thrust, nonthrust, and soft tissue mobilization. Doses and duration may range from 1 to 3 times per week over 6 to 12 weeks in patients with mild to moderate hip osteoarthritis. As hip motion improves, clinicians should add exercises including stretching and strengthening to augment and sustain gains in the patient's range of motion, flexibility, and strength.

Summary of Recommendations* (*continued*)

INTERVENTIONS – FLEXIBILITY, STRENGTHENING, AND ENDURANCE EXERCISES

2017 Recommendation

A Clinicians should use individualized flexibility, strengthening, and endurance exercises to address impairments in hip range of motion, specific muscle weaknesses, and limited thigh (hip) muscle flexibility. For group-based exercise programs, effort should be made to tailor exercises to address patients' most relevant physical impairments. Dosage and duration of treatment for effect should range from 1 to 5 times per week over 6 to 12 weeks in patients with mild to moderate hip osteoarthritis.

INTERVENTIONS – MODALITIES

2017 Recommendation

B Clinicians may use ultrasound (1 MHz; 1 W/cm² for 5 minutes each to the anterior, lateral, and posterior hip for a total of 10 treatments over a 2-week period) in addition to exercise and hot packs in the short-term management of pain and activity limitation in individuals with hip osteoarthritis.

INTERVENTIONS – BRACING

2017 Recommendation

F Clinicians should not use bracing as a first line of treatment. A brace may be used after exercise or manual therapies are unsuccessful in improving participation in activities that require turning/pivoting for patients with mild to moderate hip osteoarthritis, especially in those with bilateral hip osteoarthritis.

INTERVENTIONS – WEIGHT LOSS

2017 Recommendation

C In addition to providing exercise intervention, clinicians should collaborate with physicians, nutritionists, or dietitians to support weight reduction in individuals with hip osteoarthritis who are overweight or obese.

*These recommendations and clinical practice guidelines are based on the scientific literature published prior to April 2016. Please refer to our previously published guidelines on "Hip Pain and Mobility Deficits – Hip Osteoarthritis" for literature reviewed prior to 2009.

List of Abbreviations

ACR: American College of Rheumatology

APTA: American Physical Therapy Association

BMI: body mass index

BPI: Brief Pain Inventory

CI: confidence interval

CPG: clinical practice guideline

ER: external rotator or rotation

FABER: flexion, abduction, and external rotation

GREES: Group for the Respect of Ethics and Excellence in Science

HHD: handheld dynamometer

HHS: Harris Hip Score

HOOS: Hip disability and Osteoarthritis Outcome Score

ICC: intraclass correlation coefficient

ICD: International Classification of Diseases and Related Health Problems

ICF: International Classification of Functioning, Disability and Health

IR: internal rotator or rotation

ISS: ischial spine sign

JOSPT: *Journal of Orthopaedic & Sports Physical Therapy*

KL: Kellgren-Lawrence radiographic score

LEFS: Lower Extremity Functional Scale

LISH: Lequesne Index of Severity for Osteoarthritis of the Hip

MCID: minimal clinically important difference

MDC: minimal detectable change

MRI: magnetic resonance imaging

NSAID: nonsteroidal anti-inflammatory drug

OA: osteoarthritis

OR: odds ratio

PPT: pressure pain threshold

QOL: quality of life

RCT: randomized clinical trial

ROM: range of motion

RR: risk ratio

SCFE: slipped capital femoral epiphysis

SD: standard deviation

SEM: standard error of the measurement

SF-36: Medical Outcomes Study 36-Item Short-Form Health Survey

THA: total hip arthroplasty

TUG: timed up-and-go test

VAS: visual analog scale

WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index

Introduction

AIM OF THE GUIDELINES

The Orthopaedic Section of the American Physical Therapy Association (APTA) has an ongoing effort to create evidence-based clinical practice guidelines (CPGs) 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).⁷³

The purposes of these clinical guidelines are to:

- Describe evidence-based physical therapy practice, including diagnosis, prognosis, intervention, and assessment of outcomes for musculoskeletal disorders commonly managed by orthopaedic physical therapists
- Classify and define common musculoskeletal conditions using the World Health Organization's terminology related to impairments of body function and body structure, activity limitations, and participation restrictions
- Identify interventions supported by current best evidence to address impairments of body function and structure, activity limitations, and participation restrictions associated with common musculoskeletal conditions
- Identify appropriate outcome measures to assess changes resulting from physical therapy interventions in body function and structure as well as in activity and participation of these individuals
- Provide a description to policy makers, using internationally accepted terminology, of the practice of orthopaedic physical therapists

- Provide information for payers and claims reviewers regarding the practice of orthopaedic physical therapy for common musculoskeletal conditions
- Create a reference publication for orthopaedic physical therapy clinicians, academic instructors, clinical instructors, students, interns, residents, and fellows regarding the best current practice of orthopaedic physical therapy

STATEMENT OF INTENT

These guidelines are not intended to be construed or to serve as a standard of medical care. Standards of care are determined on the basis of all clinical data available for an individual patient and are subject to change as scientific knowledge and technology advance and patterns of care evolve. These parameters of practice should be considered guidelines only. Adherence to them will not ensure a successful outcome in every patient, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgment regarding a particular clinical procedure or treatment plan must be made based on clinician experience and expertise in light of the clinical presentation of the patient, the available evidence, available diagnostic and treatment options, 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 of the APTA to conduct a review of the literature and to develop an updated hip osteoarthritis (OA) CPG as indicated by the current state of the evidence in the field. The aims of the revision were to provide a concise summary of the evidence since publication in 2009 of the original guidelines, and to develop new recommendations or revise previously published recommendations to support evidence-based practice. The authors of this guideline revision worked with research librarians with expertise in systematic review to perform a systematic search for hip OA articles published since 2008 related to classification, examination, and intervention strategies, consistent with previous guideline development methods related to ICF classification. Briefly, the following databases were searched

from 2008 to 2016: MEDLINE (PubMed; 2008-2016), CINAHL (EBSCO; 2008-date), PEDro (EBSCO; 2008-date), and the Cochrane Library (Wiley; 2008-date). See **APPENDIX A** for full search strategies and **APPENDIX B** for search dates and results (available at www.orthopt.org).

The authors declared relationships and developed a conflict management plan, which included submitting a conflict-of-interest form to the Orthopaedic Section of the APTA. Articles that were authored by a reviewer were assigned to an alternate reviewer. Funding was provided to the CPG development team for travel and expenses for CPG development training. The CPG development team maintained editorial independence.

Methods (continued)

Articles contributing to recommendations were reviewed based on specified inclusion and exclusion criteria, with the goal of identifying evidence relevant to physical therapist clinical decision making for adults with hip OA. The title and abstract of each article were reviewed independently by 2 members of the CPG development team for inclusion. See **APPENDIX C** for inclusion and exclusion criteria (available at www.orthopt.org). Full-text review was then similarly conducted to obtain the final set of articles for contribution to recommendations. The team leader (M.T.C.) provided the final decision for discrepancies that were not resolved by the review team. See **APPENDIX D** for a flow chart of articles and **APPENDIX E** for articles included in recommendations by topic (available at www.orthopt.org). For selected relevant topics that were not appropriate for the development of recommendations, such as incidence and imaging, articles were gathered, reviewed, and synthesized but were not subject to a formal systematic review process and were not included in the flow chart. Evidence tables for this CPG are available on the Clinical Practice Guidelines page of the Orthopaedic Section of the APTA website (www.orthopt.org).

This guideline was issued in 2017 based on the published literature up to 2016. This guideline will be considered for review in 2021, or sooner if new evidence becomes available. Any updates to the guideline in the interim period will be noted on the Orthopaedic Section of the APTA website (www.orthopt.org).

LEVELS OF EVIDENCE

Individual clinical research articles were graded according to criteria adapted from the Centre for Evidence-based Medicine (Oxford, UK) for diagnostic, prospective, and therapeutic studies.⁵² In teams of 2, each reviewer independently assigned a level of evidence and evaluated the quality of each article using a critical appraisal tool. See **APPENDICES F** and **G** (available at www.orthopt.org) for a levels of evidence table and details on procedures used for assigning levels of evidence. The evidence update was organized from highest level of evidence to lowest level. An abbreviated version of the grading system is provided below.

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, less than 80% follow-up)

III	Case-control studies or retrospective studies
IV	Case series
V	Expert opinion

GRADES OF EVIDENCE

The strength of the evidence supporting the recommendations was graded according to the previously established methods for the original guideline and those provided below. Each team developed recommendations based on the strength of evidence, including how directly the studies addressed the question of hip pain and hip OA. In developing their recommendations, the authors considered the strengths and limitations of the body of evidence and the health benefits, side effects, and risks of tests and interventions.

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 guidelines development team

GUIDELINE REVIEW PROCESS AND VALIDATION

Identified reviewers who are experts in hip OA management and rehabilitation reviewed the CPG draft for integrity, accuracy, and to ensure that it fully represents the current evidence for the condition. The guideline draft was also posted for public comment and review on www.orthopt.org, and a notification of this posting was sent to the members of the Orthopaedic Section of the APTA. In addition, a panel of consumer/patient representatives and external stakeholders, such as claims reviewers, medical coding experts, academic educa-

Methods *(continued)*

tors, clinical educators, physician specialists, and researchers, also reviewed the guideline. All comments, suggestions, and feedback from the expert reviewers, the public, and consumer/patient representatives were provided to the authors and editors for consideration and revisions. Guideline-development methods, policies, and implementation processes are reviewed at least yearly by the Orthopaedic Section of the APTA's ICF-based Clinical Practice Guideline Advisory Panel, including consumer/patient representatives, external stakeholders, and experts in physical therapy practice guideline methodology.

DISSEMINATION AND IMPLEMENTATION TOOLS

In addition to publishing these guidelines in the *Journal of Orthopaedic & Sports Physical Therapy (JOSPT)*, these guidelines will be posted on CPG areas of both the *JOSPT* and Orthopaedic Section of the APTA websites, which are free-access website areas, and submitted to be available as free access on the Agency for Healthcare Research and Quality website (www.guideline.gov). The implementation tools planned to be available for patients, clinicians, educators, payers, policy makers, and researchers, and the associated implementation strategies, are:

TOOL	STRATEGY
"Perspectives for Patients" and/or "Perspectives for Practice"	Patient-oriented guideline summary available on www.jospt.org and www.orthopt.org
Mobile app of guideline-based exercises for patients/clients and health care practitioners	Marketing and distribution of app using www.orthopt.org and www.jospt.org
Clinician's quick-reference guide	Summary of guideline recommendations available on www.orthopt.org
Read-for-credit continuing education units	Continuing education units available for physical therapists and athletic trainers through <i>JOSPT</i>
Webinars: educational offering for health care practitioners	Guideline-based instruction available for practitioners on www.orthopt.org
Mobile and web-based app of guideline for training of health care practitioners	Marketing and distribution of app using www.orthopt.org and www.jospt.org
Physical Therapy National Outcomes Data Registry	Support the ongoing usage of data registry for common musculoskeletal conditions of the hip
Logical Observation Identifiers Names and Codes mapping	Publication of minimal data sets and their corresponding Logical Observation Identifiers Names and Codes for the hip region on www.orthopt.org

TOOL	STRATEGY
Non-English versions of the guidelines and guideline implementation tools	Development and distribution of translated guidelines and tools to <i>JOSPT's</i> international partners and global audience via www.jospt.org

CLASSIFICATION

The primary International Classification of Diseases 10th Revision (ICD-10) code and condition associated with hip pain and mobility deficits is **M16.1 Primary coxarthrosis, unilateral**. In the ICD, the term OA is used as a synonym for arthrosis or osteoarthritis. Other, secondary codes associated with hip OA are **M16.0 Primary coxarthrosis, bilateral**; **M16.2 Coxarthrosis resulting from dysplasia, bilateral**; **M16.3 Dysplastic coxarthrosis, unilateral**; **M16.4 Post-traumatic coxarthrosis, bilateral**; **M16.5 Posttraumatic coxarthrosis, unilateral**; **M16.7 Secondary coxarthrosis, not otherwise specified**; **M25.65 Stiffness in hip**; and **M25.55 Pain in hip**.

The primary ICF body function codes associated with the above-noted primary ICD-10 conditions are the sensory functions related to pain and the movement-related functions related to joint mobility. These body function codes are **b2816 Pain in joints** and **b7100 Mobility of a single joint**.

The primary ICF body structure codes associated with hip pain and mobility deficits are **s75001 Hip joint**, **s7402 Muscles of the pelvic region**, and **s7403 Ligaments and fascia of the pelvic region**.

The primary ICF activities and participation codes associated with hip pain and mobility deficits are: **d4154 Maintaining a standing position**, **d4500 Walking short distances**, and **d4501 Walking long distances**.

A comprehensive list of codes was published in the previous guideline.¹⁷

ORGANIZATION OF THE GUIDELINE

For each topic, the summary recommendation and grade of evidence from the 2009 guideline are presented, followed by a synthesis of the recent literature with the corresponding evidence levels. Each topic concludes with the 2017 summary recommendation and its updated grade of evidence.

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CLINICAL GUIDELINES

Impairment/Function-Based Diagnosis

PREVALENCE

2009 Summary

Hip pain associated with OA is the most common cause of hip pain in older adults. Prevalence studies have shown that the rates for adult hip OA range from 0.4% to 27%.

EVIDENCE UPDATE



In a systematic review assessing age- and sex-specific epidemiological data for hip and knee OA, the global age-standardized prevalence of hip OA was 0.85% (95% confidence interval [CI]: 0.74%, 1.02%). Prevalence was higher for females than males.¹⁹ In a case-control study examining the prevalence of hip OA among 978 individuals in the United States, the prevalence was estimated at 19.6% (95% CI: 16.7%, 23.0%). Men showed a higher prevalence of radiographic hip OA. No difference in symptomatic hip OA prevalence was observed between men and women.³⁹ In a study examining the prevalence of OA in 7126 residents of rural China, the prevalence of symptomatic hip OA was estimated at 0.6%.⁷⁷

2017 Summary

Osteoarthritis is the most common cause of hip pain in older adults (older than 50 years of age). Prevalence rates for adult hip OA range from 0.4% to 27%. The reported prevalence of hip OA continues to show great variability, with men showing higher prevalence of radiographic hip OA.

PATHOANATOMICAL FEATURES

2009 Summary

Clinicians should assess for impairments in mobility of the hip joint and the strength of the surrounding muscles, especially the hip abductor muscles, when a patient presents with hip pain.

EVIDENCE UPDATE



Acetabular retroversion is associated with the development of hip OA.⁴² External rotation (ER) of the hemi-pelvis is often noted with acetabular retroversion and can be identified on radiographs by noting a protrusion of the ischial spine into the pelvis on that side, called the ischial spine sign (ISS).^{32,36,66}



Cartilage defects and bone marrow lesions in the anterior and central superolateral regions of the joint may represent early structural damage in the development of hip OA. Patients with hip OA also have less femoral-head cartilage volume and a higher prevalence of cartilage defects and bone marrow lesions.⁶⁷

2017 Summary

Early articular changes observed on imaging may help identify individuals who have not been clinically diagnosed with hip OA. In patients with hip pain, there is some evidence that the presence of acetabular retroversion is related to the development of hip OA.

CLINICAL COURSE

Evidence Update



French et al,²⁹ in a secondary analysis of 131 patients meeting the American College of Rheumatology (ACR) criteria for hip OA, were unable to identify variables that predicted treatment success for patients with hip OA. Independent variables included age, sex, body mass index (BMI), duration of symptoms, comorbidities, treatment adherence, baseline pain with activity, baseline Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) physical function subscale score, baseline Hospital Anxiety and Depression Scale score, baseline aggregate range of motion (ROM), and treatment adherence.

2009 and 2017 Summary

Total hip arthroplasty (THA) is the most common surgical procedure for end-stage hip OA. Despite the success of THA and knee arthroplasty over the last 3 decades, consensus on criteria for the timing of surgery has not been established. However, the Group for the Respect of Ethics and Excellence in Science (GREES) suggests that nonsurgical intervention has failed if a patient has not experienced a reduction in symptoms, such as a 20% to 25% improvement on the WOMAC pain subscale, and has progressive loss of joint space of between 0.3 and 0.7 mm per year. The rate of hip OA progression varies from patient to patient, thus therapists should monitor the clinical course of hip OA (ROM and strength) and baseline hip pain, Kellgren-Lawrence (KL) grades, joint space width, and outcome score.⁷⁵

RISK FACTORS**2009 Recommendation**

Clinicians should consider age, hip developmental disorders, and previous hip joint injury as risk factors for hip OA.

EVIDENCE UPDATE

In hip OA,³¹ lower range of hip internal rotation (IR) and hip flexion is associated with hip osteophytes, morning stiffness, male sex, higher BMI, and hip pain. An increase in BMI is related to increased risk of hip OA of similar magnitude for men and women (risk ratio [RR] = 1.11; 95% CI: 1.07, 1.16).³³



Living in a community with a high poverty level is independently associated with radiographic OA in 1 or both hips. Low education attainment is independently associated with symptomatic OA of 1 or both hips (odds ratio [OR] = 1.44).¹⁸ People with high bone mass and hip OA have a higher prevalence of osteophytosis and excessive bone formation than those with less bone mass (osteophytosis OR = 2.12; 95% CI: 1.61, 2.79 and subchondral sclerosis OR = 2.78; 95% CI: 1.49, 5.18).^{28,29} A genetic predisposition to end-stage hip OA exhibited an increased level of clinical OA signs in some individuals.^{55,56}

2017 Summary

Age, history of hip developmental disorders, previous hip joint injury, reduced hip ROM (especially hip IR), presence of osteophytes, lower socioeconomic status, higher bone mass, and higher BMI are risk factors for developing hip OA.

NATURAL HISTORY**2009 Summary**

The natural history of hip OA is not completely understood. Many different factors contribute to this. Arthritic changes occurring both inside and outside of the hip joint result in loss of joint space and the development of osteophytes, subchondral sclerosis, and cysts. Joint ROM is reduced and muscle weakness develops around the joint with OA progression.

EVIDENCE UPDATE

Degenerative hip changes occur most rapidly in those with developmental dysplasia of the hip. Cam deformities and acetabular dysplasia are associated with developing hip OA more rapidly.^{25,43,46} The extent of cam deformity is related to the presence of hip OA in early adulthood; in 121 patients with stable slipped capital femoral epiphysis (SCFE), 96 had signs of femoroacetabular impingement (FAI) and all 121 had some radiographic signs of hip OA.¹⁴

2017 Summary

The natural history of hip OA is not completely understood. Arthritic changes occur both inside and outside of the hip joint, resulting in loss of joint space, development of osteophytes, and subchondral sclerosis and cysts. Joint ROM is reduced and muscle weakness develops around the joint with a progression of OA. Degenerative hip changes develop more frequently in those with developmental dysplasia as compared to those with structurally normal hips. Those with cam deformities develop hip OA more rapidly. Cam deformities that develop after SCFE are related to the development of early hip OA.

DIAGNOSIS/CLASSIFICATION**2009 Recommendation**

Moderate lateral or anterior hip pain during weight bearing, in adults over the age of 50 years, with morning stiffness less than 1 hour, with limited hip IR and hip flexion by more than 15°, and when comparing the painful to the nonpainful side constitute useful clinical findings to classify a patient with hip pain into the International Statistical Classification of Diseases and Related Health Problems (ICD) category of unilateral coxarthrosis and the associated International Classification of Functioning, Disability and Health (ICF) impairment-based category of hip pain (**b2816 Pain in joints**) and mobility deficits (**b7100 Mobility of a single joint**).

EVIDENCE UPDATE

Using the ACR definition of clinical hip OA, the criteria for hip IR should be revised from less than 15° to less than 24°. Patients with hip pain often do not have radiographic evidence of hip OA (eg, osteophytes, joint space narrowing, etc), and many people with radiographic evidence of hip OA do not have hip pain.⁴⁰

2017 Recommendation

Clinicians should use the following criteria to classify adults over the age of 50 years into the International Statistical Classification of Diseases and Related Health Problems (ICD) category of coxarthrosis and the associated International Classification of Functioning, Disability and Health (ICF) impairment-based category of hip pain (**b28016 Pain in joints**) and mobility deficits (**b7100 Mobility of a single joint**): moderate anterior or lateral hip pain during weight-bearing activities, morning stiffness less than 1 hour in duration after waking, hip internal rotation range of motion less than 24° or internal rotation and hip flexion 15° less than the nonpainful side, and/or increased hip pain associated with passive hip internal rotation.

DIFFERENTIAL DIAGNOSIS**2009 and 2017 Recommendation**

F Clinicians should revise the diagnosis and change their plan of care, or refer the patient to the appropriate clinician, when the patient's history, reported activity limitations, or impairments of body function and structure are not consistent with those presented in the diagnosis/classification section of this guideline, or when the patient's symptoms are not diminishing with interventions aimed at normalization of the patient's impairments of body function.

IMAGING STUDIES**2009 and 2017 Summary**

Plain-film radiography is the most often used method when radiographically diagnosing and assessing the progression of hip OA. Radiographs are used to look for the amount of joint space narrowing, the presence of osteophytes, and subchondral sclerosis or cysts. Research on imaging methods, using magnetic resonance imaging (MRI) and ultrasound, that can identify prearthritic changes is still under way. Much of the imaging research has looked at how hip dysplasia or FAI may predispose hips to OA; however, results to date are not conclusive.

CLINICAL GUIDELINES

Examination

OUTCOME MEASURES: ACTIVITY LIMITATION – SELF-REPORT MEASURES

2009 Recommendation

A Clinicians should use validated outcome measures, such as the WOMAC, the Lower Extremity Functional Scale (LEFS), and the Harris Hip Score (HHS), before and after interventions intended to alleviate impairments of body function and structure, activity limitations, and participation restrictions associated with hip OA.

Evidence Update

I Adults with hip OA have decreased physical function that can affect balance. In a prospective study of 79 individuals with hip OA, falls efficacy (individuals' belief in their ability and skill to successfully perform a task and avoid a fall) was measured using 2 questionnaires, and the results showed that falls efficacy independently predicted balance performance as measured by the last 9 items of the Berg Balance Scale.⁵

II The 40-item Hip disability and Osteoarthritis Outcome Score (HOOS) is a reliable and valid measure of pain, symptoms, physical function (daily living and sports/recreation), and quality of life (QOL) in patients with hip disability and OA.^{30,49,68} The HOOS activities of daily living subscale consists of the WOMAC physical function subscale items.⁴⁹ The short version of the HOOS²⁰ consists of 5 items, including sitting, descending stairs, getting in/out of a bath or shower, twisting/pivoting on loaded leg, and running.^{20,63}

II In a prospective study of 57 patients with hip OA and 100 patients with FAI, the construct validity of a German version of the WOMAC was evaluated.⁵⁹ The results of the study support the validity of using a reduced 12-item version of the WOMAC for assessing patients with FAI and OA; items removed from the physical function subscale were “bending to the floor,” “putting on socks,” “lying in bed,” “getting off/on toilet,” “heavy domestic duties,” and “light domestic duties.” The item “pain with sitting/lying” was removed from the pain subscale.⁵⁹

III The Brief Pain Inventory (BPI) measures 4 dimensions of pain intensity (now, average, worst, and least). A prospective study³⁷ of 224 patients with hip OA identified established cut points for pain levels: mild, 1 to 4; moderate, greater than 4 to 6; severe, greater than 6

to 10. The BPI has also been shown to have good internal consistency (Cronbach $\alpha > .80$), construct validity, and responsiveness in a prospective study of 250 patients with hip OA.³⁸

III Hyperalgesia has been associated with central pain sensitization and chronic conditions such as OA, and there is growing interest in its potential to inform clinical decision making and research.⁶⁴ Although hyperalgesia may occur in response to mechanical, thermal, or chemical stimuli, the literature is most well developed in the area of mechanical hyperalgesia.⁴ A mechanical pressure algometer is commonly used to measure pressure pain threshold (PPT), defined as the minimal amount of pressure at which the sensation of pressure first changes to a sensation of pain. Typically, PPTs are measured in a variety of body locations, and low values in locations away from the primary painful site are used as an indicator of central pain sensitization. Emerging research has demonstrated a strong negative correlation between PPT and pain severity in patients with hip OA.⁷⁶ Wylde et al⁷⁶ found a strong negative correlation between PPT measured at the forearm and pain severity as measured by the WOMAC pain subscale in 254 patients with hip OA. Those with low PPT values had high pain severity ($P < .001$). Aranda-Villalobos et al⁹ found a similar negative correlation between PPT measured at the second metacarpal, gluteus medius, vastus lateralis, vastus medialis, and anterior tibialis and pain assessed with a visual analog scale (VAS) in 40 adults with hip OA. Goode et al²⁶ investigated hip radiographs, self-reported hip pain, and PPT from the upper trapezius in 1550 individuals aged 45 years and older. They found a significant association between PPT and self-reported hip pain, but no significant association between PPT and the presence or severity of radiographic hip OA. These findings suggest that PPT may be a useful indicator of pain processing associated with hip OA.

2017 Recommendation

A Clinicians should use validated outcome measures that include domains of hip pain, body function impairment, activity limitation, and participation restriction to assess outcomes of treatment of hip osteoarthritis.

Measures to assess hip pain may include the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain subscale, Brief Pain Inventory (BPI), pressure pain threshold (PPT), and pain visual analog scale (VAS).

Activity limitation and participation restriction outcome measures may include the WOMAC physical function subscale, the Hip disability and Osteoarthritis Outcome Score (HOOS), Lower Extremity Functional Scale (LEFS), and Harris Hip Score (HHS).

ACTIVITY LIMITATION/PHYSICAL PERFORMANCE MEASURES

2009 Recommendation

A Clinicians should utilize easily reproducible physical performance measures, such as the 6-minute walk, self-paced walk, stair measure, and timed up-and-go tests, to assess activity limitation and participation restrictions associated with their patient's hip pain and to assess the changes in the patient's level of function over the episode of care.

Evidence Update

I Reliability and measurement error were determined for 4 balance tests in 30 people with hip OA: the 4-square step, step, timed single-leg stance, and functional reach tests. Interrater reliability for all tests was sufficient, with intraclass correlation coefficients (ICCs) greater than or equal to 0.85, except for the functional reach test (ICC = 0.62-0.72). Intrarater reliability was sufficient for the step test performed on the side of the involved hip and the timed single-leg stance test on the other side (ICC = 0.91), with low measurement error. However, the timed single-leg stance test demonstrated a ceiling effect, indicating potential problems measuring outcomes for higher-functioning patients.¹⁶

30-Second Chair-Stand Test⁹

- I**
- ICF category: activity limitation: changing basic body position
 - Description: the number of full sit-to-stand repetitions completed in 30 seconds
 - Measurement method: a standard/folding chair is placed with the back against the wall. The clinician should demonstrate the movements and ask the patient to complete a practice trial. Then, the patient begins, seated on the chair with feet shoulder-width apart and flat on the floor and arms crossed at the chest. The patient rises to a full stance and repeats as many as possible in the time allotted. The clinician records the total number of completed chair stands (full rise back to seated position) in 30 seconds
 - Nature of variable: continuous
 - Units of measurement: the completed number of chair stands
 - Measurement properties: in a cohort of 37 adults with hip OA, based on ACR clinical diagnostic criteria⁹
 - Intrarater reliability: ICC = 0.88

- Minimal detectable change: MDC_{90} , 3.5
- Standard error of the measurement: SEM, 1.5
- Mean \pm SD, 12.6 \pm 3.4 in week 1 and 13.5 \pm 3.5 in week 2

4-Square Step Test¹⁶

- I**
- ICF category: measurement of activity limitation: moving within the home
 - Description: assesses how well a person can manage moving in different directions
 - Measurement method: 4 canes are placed with handles out at 90° angles to form 4 squares. After demonstration from clinician and a practice trial, the participant begins by standing in square 1 (always facing square 2 throughout the test) and stepping forward with both feet into square 2, then side steps right into square 3, and steps back into square 4, then returns to square 1 with a side step to the left. The sequence is then reversed back to the starting position (squares 1, 4, 3, 2, and back to 1). Both sequences are completed as quickly as possible
 - Nature of variable: continuous
 - Units of measurement: seconds
 - Measurement properties: in a cohort of 30 adults with hip OA, based on the ACR clinical diagnostic criteria¹⁶
 - Interrater reliability
 - ICC = 0.86 (95% CI: 0.72, 0.93)
 - MDC_{90} , 1.80 (95% CI: 1.53, 2.42)
 - SEM, 0.77 (95% CI: 0.65, 1.04)
 - Mean \pm SD, 8.97 \pm 2.32
 - Intrarater reliability (1-week interval)
 - ICC = 0.83 (95% CI: 0.57, 0.93)
 - MDC_{90} , 2.00 (95% CI: 1.58, 2.72)
 - SEM, 0.86 (95% CI: 0.68, 1.17)
 - Mean \pm SD, 9.07 \pm 2.35

Step Test¹⁶

- I**
- ICF category: activity limitation: climbing; moving the whole body upward or downward, such as climbing steps
 - Description: determine how many steps a person can complete while standing on the painful hip, assessing a participant's standing balance
 - Method of measurement: after demonstration by the clinician and 1 practice trial, the participant steps up onto and then off of a 15-cm step while maintaining stance on the painful leg on a 5-cm-wide cardboard template that is used as a starting marker and placed on the floor in front of the step. The other leg is then moved up onto the step, then back down to the floor (the stepping foot must be placed flat on the step and then back down flat on the ground to count as a completed step). The test is performed for 15 seconds, and full steps are counted without the patient moving his or her stance leg from the starting position

(overbalancing). The test may also be performed on the other leg

- Nature of variable: continuous
- Units of measurement: number of steps
- Measurement properties: in a cohort of 30 adults with hip OA, based on clinical diagnostic criteria established by the ACR³⁹
- Interrater reliability for standing on the side of the painful hip
 - ICC = 0.94 (95% CI: 0.88, 0.97)
 - MDC₉₀, 3.0 (95% CI: 1.97, 3.33)
 - SEM, 1.06 (95% CI: 0.85, 1.43)
 - Mean ± SD, 14.63 ± 4.63
- Intrarater reliability for standing on the side of the painful hip
 - ICC = 0.91 (95% CI: 0.77, 0.96)
 - MDC₉₀, 3.0 (95% CI: 2.52, 4.34)
 - SEM, 1.37 (95% CI: 1.08, 1.86)
 - Mean ± SD, 14.71 ± 4.74

Timed Single-Leg Stance¹⁶

- I** • ICF category: activity limitation: maintaining and shifting center of gravity
- Description: assesses static balance
- Measurement method: after demonstration by the clinician and 1 practice trial, the patient places hands on hips and stands on 1 leg, with the knee of the nonstance leg flexed so the foot is behind the patient and the nonstance hip is in a neutral position. While focusing on a stationary target 1 to 3 m ahead, the patient stands on 1 leg for as long as possible, up to 30 seconds. The test is completed when the patient touches the stance leg, removes hands from hip, or if the stance leg touches the nonstance leg. The longer of 2 trials on each leg, to the nearest 0.1 second, is recorded
- Nature of variable: continuous
- Units of measurement: seconds
- Measurement properties: in a cohort of 30 adults with hip OA, based on clinical diagnostic criteria established by the ACR¹⁶
- Interrater reliability for standing on the side of the painful hip
 - ICC = 0.89 (95% CI: 0.78, 0.95)
 - MDC₉₀, 8.08 (95% CI: 6.44, 10.87)
 - SEM, 3.46 (95% CI: 2.76, 4.66)
 - Mean ± SD, 21.26 ± 10.30
- Intrarater reliability for standing on the side of the painful hip
 - ICC = 0.82 (95% CI: 0.64, 0.91)
 - MDC₉₀, 10.78 (95% CI: 8.52, 14.67)
 - SEM, 4.62 (95% CI: 3.65, 6.29)
 - Mean ± SD, 20.63 ± 10.39

2017 Recommendation

A To assess activity limitation, participation restrictions, and changes in the patient's level of function over the episode of care, clinicians should utilize reliable and valid physical performance measures, such as the 6-minute walk test, 30-second chair stand, stair measure, timed up-and-go test, self-paced walk, timed single-leg stance, 4-square step test, and step test.

A Clinicians should measure balance performance and activities that predict the risk of falls in adults with hip osteoarthritis, especially those with decreased physical function or a high risk of falls because of past history. Recommended balance tests for patients with osteoarthritis include the Berg Balance Scale, 4-square step test, and timed single-leg stance test.

F Clinicians should use published recommendations from the Academy of Geriatric Physical Therapy of the American Physical Therapy Association⁶ to guide fall risk management in patients with hip osteoarthritis to assess and manage fall risk.

PHYSICAL IMPAIRMENT MEASURES

2009 Recommendation

Recommended impairment measures and their properties are provided in the 2009 CPG.¹⁷

Evidence Update

Hip ROM

- I** • ICF category: impairment of body function: mobility of a single joint
- Description: active and passive hip motion are measured in prone, supine, and sitting. Although assessing ROM for supine hip flexion, prone hip IR, and sidelying hip abduction is most important, occasionally clinicians may need to assess other hip motions. The therapist may ask the patient to rate the amount of pain experienced during movement on a 0-to-10 numeric pain-rating scale (NPRS) to assess hip joint irritability and to guide intervention choice
- Nature of variable: continuous (ROM) and ordinal (pain)
- Unit of measurement: degrees and 0-to-10 NPRS rating
- Measurement properties: limited ROM is associated with high levels of disability in patients with hip OA.⁵⁸ Pua et al⁵⁸ found both excellent intrarater and interrater reliability for hip passive ROM when testing 22 patients with clinical and radiographic evidence of hip OA. Measurement properties for passive hip ROM are provided below⁵⁸

	Reliability: ICC (95% CI)	SEM	MDC ₉₀
Flexion	0.97 (0.93, 0.99)	3.5°	8.2°
Extension: knee flexed	0.86 (0.67, 0.94)	4.5°	10.5°
Extension: knee unconstrained	0.89 (0.72, 0.95)	4.7°	11.0°
Abduction	0.94 (0.86, 0.98)	3.2°	7.3°
IR	0.93 (0.83, 0.97)	3.4°	7.8°
ER	0.96 (0.91, 0.99)	3.1°	7.1°

- Measurement method: hip IR can be measured in prone or sitting, with goniometer placement being the same for both.⁵⁸ The patient is positioned with the knee flexed to 90°. The movement arm of the goniometer is placed along the center of the tibia, while the stationary arm is placed along a vertical plane. When using a bubble goniometer, the distal end of the goniometer is placed 5 cm proximal to the lateral malleolus along the shaft of the fibula. Use of a stabilization belt is preferable to prevent movement of the pelvis. Being careful to control tibiofemoral joint motion, the lower leg is actively or passively moved into IR and measured when a firm end feel is appreciated or the pelvis begins to move.⁵⁸ Hip ER can be measured in prone or sitting, and goniometer placement is the same. The patient is positioned with the knee flexed to 90°. The movement arm of the goniometer is placed along the center of the tibia, while the stationary arm is placed along a vertical plane. When using a bubble goniometer, the distal end of the goniometer is placed along the shaft of the tibia 5 cm above the medial malleolus. Use of a belt is preferable to stabilize and prevent movement of the pelvis.⁵⁸ Hip flexion is measured with the patient in supine. A strap can be placed across the contralateral thigh to stabilize the pelvis. The stationary arm of the goniometer is aligned along the long axis of the trunk, while the movement arm is aligned parallel with the femur. When using a bubble inclinometer, the inclinometer is zeroed on a horizontal surface and then placed parallel to the femur.⁵⁸ Hip abduction is measured in the supine position (passive) or in sidelying (active). The stationary arm of the goniometer is placed so as to connect an imaginary line from the left and right anterior superior iliac spines. The movement arm is parallel along the thigh. The hip is abducted until a firm end feel is noted or the pelvis begins to move. For active abduction, the procedure is the same; however, stabilization of the pelvis is created by body weight. Hip extension is measured with the patient in the supine position and hip joint positioned at the edge of the treatment table. Both hips are fully flexed until there is adequate hip flexion to produce a flattened lumbar spine (Thomas test position); then, the measured hip is slowly extended. Hip

extension is measured as the angle between the femur and the horizontal surface. The stationary arm of the goniometer is along the horizontal surface and the movement arm along the thigh.⁵⁸ An alternative position is to have the patient lie prone and actively or passively extend the hip. Goniometer position is the same as above

Hip Muscle Strength

- ICF category: impairment of body function: strength of a single joint
- Description: the amount of muscle strength in hip muscles measured in different positions
- Measurement method: hip IR is tested with the patient seated in a chair or prone, with the knee flexed to 90°. In prone, the pelvis should be stabilized to prevent movement during the test. Resistance is manually applied at the medial distal femur and lateral lower leg. When using a handheld dynamometer (HHD), the device is placed 5 cm above the lateral malleolus. Hip ER is tested with the patient prone and the knee flexed to 90°. In prone, the pelvis should be stabilized to prevent movement during the test. Resistance is manually applied at the lateral distal femur and medial lower leg. When using an HHD, the device is placed 5 cm above the medial malleolus. Hip flexors are tested with the patient seated in a chair or supine, with the knee flexed to 90° (while seated) or extended fully (supine), stabilizing the pelvis as necessary. An HHD is placed 5 cm proximal to the superior pole of the patella (sitting) or 5 cm proximal to the ankle joint (supine). Hip abductors are measured with the patient in supine or sidelying by placing an HHD 5 cm proximal to the lateral femoral condyle to isolate action of the hip joint. Pua et al⁵⁸ measured hip extensor strength with the patient in the supine position, the uninvolved thigh stabilized, and the measured hip placed in 20° of hip flexion, suspended by a strap attached to a force transducer. An alternative method is to measure using the same position, but with an HHD positioned 5 cm proximal to the ankle on the Achilles tendon. This test may also be performed in the prone position
- Nature of variable: continuous
- Unit of measurement: Newtons, kilograms, or pounds
- Measurement properties: limited strength is associated with high levels of disability in patients with hip OA.⁵⁸ Pua et al⁵⁸ found both excellent intrarater and interrater reliability for hip muscle strength when testing 22 patients with clinical and radiographic evidence of hip OA. Tests of isometric muscle strength should be performed for the hip abductors, IRs, ERs, flexors, adductors, and extensors. Bieler et al⁹ also measured hip muscle strength in patients with hip OA and found similar results. Measurement properties for hip muscle strength are provided below.⁵⁸

	Reliability: ICC (95% CI)	SEM	MDC ₉₀
Flexors	0.87 (0.69, 0.95)	10.9 Nm	25.3 Nm
Extensors	0.97 (0.92, 0.99)	13.3 Nm	30.8 Nm
Abductors	0.84 (0.55, 0.94)	12.1 Nm	28.0 Nm
Internal rotators	0.98 (0.94, 0.99)	3.7 Nm	8.5 Nm
External rotators	0.98 (0.96, 0.99)	3.2 Nm	7.4 Nm

Pressure Pain Threshold



- ICF category: impairment of body function: pain hyperalgesia
- Description: a measure of pressure/tenderness taken over the hip joint and in areas away from the hip joint
- Measurement method: place the rubber disc of the algometer on the site of choice and apply pressure until the patient indicates that the sensation of pressure has changed to pain. Record the value indicated on the strain gauge. Always begin with the algometer on 0 kg/cm². Change the location on the skin slightly and repeat 2 more times. Allow 30 seconds between trials. Record the average of the 3 trials. Sites to test include the upper trapezius, gluteus medius, second metacarpal, vastus medialis or lateralis, and anterior tibialis. Test both sides
- Nature of variable: continuous
- Units of measure: kilograms per square centimeter
- Measurement properties: the interrater reliability of pressure algometry has been found to be high in healthy individuals, with an ICC of 0.91 (95% CI: 0.82, 0.97).¹⁵ Construct validity has been demonstrated, with high correlations between force-plate readings and algometer readings ($r = 0.99$).⁴¹ Values of PPTs (kilopascals) reported by Maquet et al,⁴⁸ obtained from healthy male and female adults, ranged from 190 to 350 kPa (1.94-3.57 kg/cm²), depending on the site tested. Abnormal tenderness is defined as a PPT that is 2 kg/cm² lower than a normal sensitive corresponding point.²² Values of PPT suggestive of hyperalgesia for individuals with hip OA have not been published.

2017 Recommendation



When examining a patient with hip pain/hip osteoarthritis over an episode of care, clinicians should document the flexion, abduction, and external rotation (FABER or Patrick's) test and passive hip range of motion and hip muscle strength, including internal rotation, external rotation, flexion, extension, abduction, and adduction.

BEST-PRACTICE POINT Essential Data Elements

Clinicians should use the following measures, at least at baseline and at 1 follow-up time point, for all patients with hip OA to support standardization for quality improvement in clinical care and research:

Activity Limitation – Self-Report Measures

- WOMAC physical function subscale

Activity Limitation – Physical Performance Measures

- 6-minute walk test
- 30-second chair-stand test
- Timed up-and-go test
- Stair measure

Physical Impairment Measures

- Hip ROM and muscle strength for the following:
 - IR
 - ER
 - Flexion
 - Extension
 - Abduction
 - Adduction
- Pain
 - NPRS
- Joint irritability
 - FABER test

CLINICAL GUIDELINES

Interventions

ANTI-INFLAMMATORY AGENTS

2009 and 2017 Summary

Nonsteroidal anti-inflammatory drugs (NSAIDs), COX-2 inhibitors, and steroid injections are effective treatments for relief of symptoms in patients with hip OA. Some evidence suggests that NSAIDs may increase the progression of hip OA by decreasing glycosaminoglycan synthesis; however, data are not conclusive. Clinicians should be aware of the incidence of serious gastrointestinal side effects associated with the use of oral NSAIDs.

ALTERNATIVE/COMPLEMENTARY MEDICATION

2009 Summary

There is some evidence to support the short-term use of injectable viscosupplementation with hyaluronic acid into the hip joint of patients with hip OA. Despite a paucity of evidence, the use of injectable synthetic hyaluronic acid (hyaluronan) into the hip joint has been shown to be an elective treatment for symptomatic hip OA. Evidence also shows that injectable hyaluronan works best in mild to moderate hip OA, especially when nonsurgical therapy has failed. A recent published meta-analysis suggests the benefit of hyaluronan for the treatment of hip OA, but so far it is only approved by the Federal Drug Administration for the knee. More controlled studies are needed to show its effectiveness in patients with hip OA.

Evidence Update

I Rozendaal et al⁶⁰ studied 222 patients with hip OA treated with glucosamine or placebo once daily for 2 years. No differences were noted after 2 years in joint space on radiographs or in WOMAC physical function score.^{60,61} Wandel et al⁷² conducted a meta-analysis of glucosamine and/or chondroitin on joint pain and joint space in patients with hip or knee OA. Pain was not improved, nor did glucosamine have an effect on joint space narrowing. The efficacy of intra-articular hyaluronic acid in treating hip OA has still not been established in high-quality randomized clinical trials (RCTs).⁴⁷

2017 Summary

There is insufficient evidence to support the use of supplements such as glucosamine, chondroitin, hyaluronic acid (injectable), or similar substances for the treatment of hip OA.

PATIENT EDUCATION

2009 Recommendation

B Clinicians should consider the use of patient education to teach activity modification, exercise, weight reduction when overweight, and methods of unloading the arthritic joints.

Evidence Update

I Svege et al⁶⁵ conducted a 6-year follow-up study of a previous RCT of 109 patients in which participants were randomized to 2 groups: exercise plus patient education and patient education only (control group). Exercise plus patient education had a protective effect against hip arthroplasty compared with patient education only (hazard ratio = 0.56; 95% CI: 0.32, 0.96). Results showed that exercise therapy plus education and education only were associated with 6-year cumulative survival of the native hip of 41% and 25%, respectively ($P = .034$).⁶⁵

I Fernandes et al²¹ enrolled 109 patients with mild to moderate hip OA and compared patient education versus patient education plus exercise at 16 months. The WOMAC physical function scores had improved significantly for the education-plus-exercise group (from an initial score of 21.1 to 15.1), but did not exceed the minimal clinically important difference (MCID) for the outcome measure, while those receiving only patient education improved minimally (from 23.6 to 22.8).

I Poulsen et al⁵⁷ compared patient education only, patient education plus manual therapy, and minimal (control) intervention (continue medication usage, minimal education on stretching) groups. At 6 weeks, significant differences were found in all HOOS subscales, favoring patient education plus manual therapy versus the minimal (control) intervention group. At 6 weeks, 76.5% of patients in the education-plus-manual therapy group improved, versus 22.2% in the patient-education group and 12.5% in the control group. No overall difference was found between groups for mean pain severity. At 12 months, no differences were noted among groups for pain, HOOS scores, and ROM.

II Voorn et al⁷¹ observed 29 patients referred to an outpatient orthopaedic clinic with hip OA who were given tailored management advice and a fol-

low-up phone call by a physical therapist and/or a nurse practitioner to assess whether education was effective in changing their QOL after 10 weeks. Significant improvement was found in the HOOS subscale for sports, the Intermittent and Constant Osteoarthritis Pain questionnaire score, the Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) physical functioning subscale score, and the EuroQol-5 dimensions score.

2017 Recommendation

B Clinicians should provide patient education combined with exercise and/or manual therapy. Education should include teaching activity modification, exercise, supporting weight reduction when overweight, and methods of unloading the arthritic joints.

FUNCTIONAL, GAIT, AND BALANCE TRAINING

2009 Recommendation

C Functional gait and balance training, including the use of assistive devices such as canes, crutches, and walkers, can be used in patients with hip OA to improve function associated with weight-bearing activities.

Evidence Update

III Bossen et al¹⁰ conducted an RCT of patients with self-reported hip OA, comparing a self-paced physical activity intervention individualized based on favorite recreational activity to a wait-list control group. At 3 months, the intervention group demonstrated greater improvement in HOOS physical function score (6.5/100 points) and global rating of change. At 12 months, the intervention group showed higher levels of self-reported physical activity, but no difference in HOOS physical function score or global rating of change, compared to the control group.

2017 Recommendation

C Clinicians should provide impairment-based functional, gait, and balance training, including the proper use of assistive devices (canes, crutches, walkers), to patients with hip osteoarthritis and activity limitations, balance impairment, and/or gait limitations when associated problems are observed and documented during the history or physical assessment of the patient.

C Clinicians should individualize prescription of therapeutic activities based on the patient's values, daily life participation, and functional activity needs.

MANUAL THERAPY

2009 Recommendation

B Clinicians should consider the use of manual therapy procedures to provide short-term pain relief and improve hip mobility and function in patients with mild hip OA.

Evidence Update

I Abbott et al¹ conducted an RCT of 4 groups: usual care plus manual therapy, usual care plus exercise therapy, usual care plus manual and exercise therapy, or usual care in 206 patients with hip or knee OA. Results for hip and knee OA were similar and were therefore combined. Each intervention group demonstrated statistically significant improvement at 1 year. The WOMAC composite score improvement was greater than the MCID of 28 points for the usual care-plus-manual therapy and the usual care-plus-exercise therapy groups. The magnitude of improvement in WOMAC composite score was greater for usual care plus manual therapy than for the other 2 intervention groups.

I Bennell et al⁷ completed an RCT of 102 patients with mild, moderate, and severe hip OA confirmed by radiographs, comparing education/advice, manual therapy, home exercise, and gait aid if needed to a sham intervention consisting of inactive ultrasound. The protocol included hip thrust mobilization/manipulation and deep tissue massage in the thigh/hip region. More than half of the sample had moderate to severe hip OA (KL radiographic score grades 3-4), with significantly reduced total hip rotation (mean, 42°) and long duration of hip OA symptoms (intervention group, 36 months; sham group, 30 months). After 13 weeks, there were no between-group differences for pain or function. Mild adverse events were reported by 41% in the active groups versus 14% in the sham group, including hip pain (33%) and spinal stiffness (4%), with 1 in 3 active participants reporting increased hip pain. This study shows that a multimodal physical therapy intervention, including education and advice, manual therapy, and home exercise, in people who have radiographic evidence of moderate/severe hip OA, limited hip rotation, and a long duration of hip pain will not likely have better success with reduction in pain or improvement in function than a sham intervention using inert ultrasound gel.

I Beselga et al⁸ performed an RCT of 40 patients to test the effect of a single session of mobilization-with-movement techniques, compared to a sham treatment, on pain, hip ROM, and function. Compared to the sham group, the mobilization-with-movement group had decreased pain (2/10 points), increased hip flexion (12.2°) and IR (4.4°), and clinically significant improvement in the

40-m self-paced walk test by 11.2 seconds. The intervention was performed by a single physical therapist, which reduces the external validity of the study.

I Brantingham et al¹³ conducted an RCT comparing manipulative therapy and stretching versus a “full kinetic chain” approach in 111 patients with mild to moderate hip OA (based on ACR criteria, with KL grades ranging from 0 to 3). The manipulative group received high-velocity hip traction and stretching of thigh muscles. The “full kinetic chain” group received manipulative therapy and stretching to the hip plus soft tissue mobilization and manipulation to the low back and ipsilateral knee, ankle, and foot at the discretion of the practitioner. Results indicated that applying manual therapy distal to the hip (knee, ankle, or foot) offers no additional benefit.

I French et al²³ completed an RCT comparing the effects of exercise therapy, exercise plus manual therapy, and no therapy in the management of 131 patients with hip OA based on ACR criteria. Manual therapy included grade II and III mobilizations performed for the 2 most restricted movements. Exercise and exercise-plus-manual therapy groups showed statistically significant improvement in WOMAC physical function score, aggregate ROM, and global rating of change at 9 weeks compared to no therapy. There were no significant differences in mean WOMAC physical function or pain score found between exercise therapy and exercise plus manual therapy.

I The 2012 review by Brantingham et al¹¹ on the effectiveness of manipulative interventions throughout the lower extremity found fair evidence for benefit of manual therapy in hip OA using a range of measures. This review included 5 case series that provided lower-level support for manual therapy for hip OA.

II Pinto et al⁵³ conducted an economic evaluation of the RCT conducted by Abbott et al¹ of patients who met the ACR criteria for hip OA using 1-year outcomes. Manual therapy, exercise therapy, and combined manual and exercise therapy provided gains in quality-adjusted life-years compared to usual medical care. From the societal perspective, manual therapy was cost saving compared to usual care, and exercise therapy was cost-effective. Using either exercise or manual therapy was more cost-effective than the combination of the 2. The 1-year time frame is an important limitation of this study because gains sustained over time would increase cost-effectiveness.

II Poulsen et al⁵⁷ completed an RCT of 118 patients with hip OA assigned to 3 groups: (1) patient education, (2) patient education plus manual therapy, and (3)

control: home stretching. At 6 weeks, no significant differences were found between the groups for mean pain severity. Comparing pairwise change in pain, the education-plus-manual therapy group showed reduction in pain versus the control group (effect size, 0.92) and the education group. No difference was noted between the education and control groups. All HOOS subscale scores showed improvement for the patient education-plus-manual therapy group compared to the control group. For hip ROM, no differences were found.

II Peter et al⁵¹ provided an update to the Dutch CPG for hip OA, adding manual therapy to exercise as a level II recommendation for pain and reversible joint mobility limitation. Manual therapy, according to the guidelines, includes manipulation, manual traction, and muscle stretching. The CPG recommends adding manual therapy when hip joint mobility is limited as a preparation for exercise.

III Wright et al⁷⁴ completed a secondary analysis of data from a previous study of 70 patients with clinical diagnosis of hip OA to determine whether within-session changes in pain, function, and well-being after manual hip traction predicted outcomes at 9 weeks and whether this differed for those who received manual therapy and those who did not. Within-session changes for the group receiving manual hip traction and manual therapy were not associated with 9-week change in pain and function based on the WOMAC pain and function subscale scores and a global rating of change score.

IV Brantingham et al¹² conducted a prospective single-group, pretest/posttest study of 18 participants with hip OA based on ACR criteria. Treatment included axial manipulation to the hip combined with manipulative therapy to the spine, knee, ankle, or foot. Results included reduced hip pain and improved function, as evidenced by lower composite WOMAC scores, HHS, and improved hip flexion ROM that were sustained for up to 3 months.

IV Hando et al²⁷ performed a case series of 27 patients with mild to severe hip OA based on ACR criteria. Treatment included ten 30-minute sessions over 8 weeks for preselected manual therapy (muscle stretching, nonthrust and thrust manipulation) and therapeutic exercise as a home program. After 8 weeks, the HHS improved an average of 20.4 points (100-point scale) and the NPRS was reduced by an average of 2.3 (0-10) points.

2017 Recommendation

A Clinicians should use manual therapy for patients with mild to moderate hip osteoarthritis and impairment of joint mobility, flexibility, and/or pain. Manual therapy may include thrust, nonthrust, and soft tissue

mobilization. Doses and duration may range from 1 to 3 times per week over 6 to 12 weeks in patients with mild to moderate hip osteoarthritis. As hip motion improves, clinicians should add exercises, including stretching and strengthening to augment and sustain gains in the patient's range of motion, flexibility, and strength.

FLEXIBILITY, STRENGTHENING, AND ENDURANCE EXERCISES

2009 Recommendation

B Clinicians should consider the use of flexibility, strengthening, and endurance exercises in patients with hip OA.

Evidence Update

I Abbott et al¹ conducted an RCT of usual medical care versus manual therapy and/or exercise therapy in addition to usual medical care in 206 patients with hip or knee OA. Results for hip and knee OA were similar and therefore combined. Each intervention group demonstrated statistically significant improvement at 1 year. The WOMAC composite score improvement was greater than the MCID of 28 points for the usual care-plus-manual therapy and usual care-plus-exercise therapy groups. The magnitude of improvement in the WOMAC composite score was smaller for usual care plus exercise than for usual care plus manual therapy.

I Krauß et al⁴⁵ performed an RCT comparing exercise therapy, ultrasound, and a control group in 218 patients with ACR clinical diagnosis of hip OA. The WOMAC showed significant differences between the ultrasound and exercise groups for pain reduction (5.1) and physical function (5.5). The WOMAC showed that the exercise group had significant improvement in pain reduction (7.4) and physical function (6.4) compared to the control group. The WOMAC stiffness subscale was not different between the groups.

I Villadsen et al⁶⁹ performed a secondary analysis of an RCT comparing the effects of an 8-week neuromuscular exercise and education program versus an education-only group on activity in 84 patients scheduled for THA. The exercise-plus-education group had significant improvement in the HOOS activities of daily living subscale compared to the education group (7.3 points; effect size, 0.63). The HOOS pain, sport and recreation function, and joint-related QOL subscale scores, as well as chair stands and the 20-m self-paced walk, all significantly improved in the exercise-plus-education group.

I The RCT by Juhakoski et al³⁵ investigated short- and long-term effects (2 years) of exercise on pain and function in 120 people with an ACR clinical

diagnosis of hip OA and a KL score greater than 1. The control group received usual care consisting of medication (NSAIDs and analgesics) and physical therapy (thermal modalities, transcutaneous electrical nerve stimulation, electrical stimulation, and acupuncture). The intervention group received usual care plus 12 supervised group exercise sessions plus a booster session at 1 year. No differences were found between groups for WOMAC pain and physical function scores and SF-36 physical component summary score at 2 years. There was statistically significant improvement in the WOMAC physical function score (7 points) for the intervention group at 6 and 18 months compared to the usual-care group. The exercise program was standardized, and intensity was not adjusted individually.

I In their RCT, Pisters et al⁵⁴ compared the effect at 5 years of usual exercise and exercise plus behavioral graded activity. Usual exercise followed the Dutch guideline⁷⁰ for hip OA (hip muscle strengthening, aerobic capacity, function, and gait, with focus on limitation of activities and restrictions on participation), including advice, and encouraged coping strategies. Behavioral graded activity consisted of a tailored exercise program using operant conditioning. A difference was found at 3 and 9 months for reduction of pain and improved physical function in favor of behavioral graded activity. At 60 months, both groups showed improvement, but no differences were found between groups. Behavioral graded activity also reduced the likelihood of joint replacement surgery and improved exercise adherence.

I Bennell et al⁷ randomized 102 patients with hip OA and compared a physical therapy intervention consisting of manual therapy to the hip and spine, deep tissue massage, stretching, strengthening of the hip and leg, functional balance, gait drills, home exercises, and education and advice for 12 weeks to a sham intervention consisting of inactive ultrasound. Differences between groups for pain and function were not significant, except at week 13 in the active group, with improvement noted in the balance step test.

II Fukumoto et al²⁴ randomized 46 women diagnosed with hip OA based on the Japanese Orthopaedic Association classification system to assess the difference between high-velocity and low-velocity resistance exercise programs at 8 weeks. Women were stratified into groups by age and hip OA severity. Both training approaches reduced hip pain and improved function (HHS), but did not demonstrate improvements beyond the MDCs for isometric strength, muscle power, clinical assessment, muscle mass, and composition. The results support the use of exercise in patients with hip OA, but indicate no preference for high- versus low-velocity resistive exercise.

III Ageberg et al² prospectively followed a group of 38 patients with severe hip OA based on pain, disability, and radiographic findings. Patients received up to 20 individualized goal-based interventions that consisted of neuromuscular training exercises. The HOOS scores for pain, symptom, activities of daily living, sport, and QOL had improvements of 6.1, 4.7, 5.0, 6.9, and 7.1 points (0-100) from baseline scores. Improvements found in this study of an individual approach to exercise should be confirmed in controlled studies.

III Paans et al³⁰ studied the effect of an 8-month combined exercise and weight-loss program in a prospective cohort of 35 patients with hip OA. Significant improvements were found at 3 months for WOMAC physical function and WOMAC pain and stiffness scores, pain VAS, SF-36 physical component summary score, body mass, and body fat. At 8 months, improvements were found for WOMAC physical function (33%), WOMAC pain and stiffness, SF-36, pain VAS, 6-minute and 20-m walk tests, and body mass and body fat. Adherence rates to exercise and diet components were 94% and 82%, respectively.

III Jigami et al³⁴ provided land-based and aquatic exercises to 2 groups of 36 patients. One group exercised weekly and the other group exercised biweekly, each for a total of 10 sessions. Muscle strength improved in the weekly group only (hip flexors, +5.7 kg; extensors, +5.8 kg; abductors, +4.3 kg). Both groups improved in the timed up-and-go test and timed 1-leg standing with eyes open test.

2017 Recommendation

A Clinicians should use individualized flexibility, strengthening, and endurance exercises to address impairments in hip range of motion, specific muscle weaknesses, and limited thigh (hip) muscle flexibility. For group-based exercise programs, effort should be made to tailor exercises to address patients' most relevant physical impairments. Dosage and duration of treatment for effect should range from 1 to 5 times per week over 6 to 12 weeks in patients with mild to moderate hip osteoarthritis.

MODALITIES 2009

No recommendation.

Evidence Update

I Köybaşı et al⁴⁴ completed an RCT exploring the effects of ultrasound in 45 patients (mean age, 65.3 years) with primary hip OA and a KL score of 2 or 3 based on radiographs. Patients were randomized into 3

groups: (1) exercise and hot packs; (2) exercise, hot packs, and sham ultrasound; (3) exercise, hot packs, and ultrasound (1 MHz continuous; 1 W/cm² with 5-cm head size). Ultrasound was administered for 5 minutes to the anterior, posterior, and lateral hip for 10 treatments total. After 10 treatments, all 3 groups showed significant improvement in pain intensity, WOMAC total scores, and 15-minute timed walk. Only the improvements for the exercise-plus-ultrasound and hot packs (group 3) group remained significant at 1 and 3 months after completion of treatment. Ultrasound may be beneficial for short-term pain reduction in patients with hip OA.

2017 Recommendation

B Clinicians may use ultrasound (1 MHz; 1 W/cm² for 5 minutes each to the anterior, lateral, and posterior hip for a total of 10 treatments over a 2-week period) in addition to exercise and hot packs in the short-term management of pain and activity limitation in individuals with hip osteoarthritis.

BRACING 2009

No recommendation.

Evidence Update

IV Sato et al⁶² explored the effects of using an S-form hip brace in a cross-sectional survey of 16 patients (15 females) with mild hip OA, with an "on versus off" brace design. Two types of braces were studied, unilateral and bilateral, with usage depending on unilateral versus bilateral hip OA. Using the unilateral brace, the mean timed up-and-go test time when turning and rounding a cone with the unbraced leg, inside of the cone but not outside, showed improvements at 3 months, which were maintained at 12 months. Improvements were found in the timed up-and-go test at 6 or 12 months for the bilateral hip brace. The HHS improved in 9 out of 10 hips at 1 month. Economic cost and the demands of daily wear are drawbacks.

2017 Recommendation

F Clinicians should not use bracing as a first line of treatment. A brace may be used after exercise or manual therapies are unsuccessful in improving participation in activities that require turning/pivoting for patients with mild to moderate hip osteoarthritis, especially in those with bilateral hip osteoarthritis.

WEIGHT LOSS 2009 Recommendation

No recommendation.

Evidence Update

III Paans et al⁵⁰ investigated the effect of exercise and dietary guidance for weight loss on function in a cohort study with hip OA, with the following inclusion criteria: ACR hip OA criteria, 25 years of age or older, overweight (BMI, greater than 25 kg/m²), or obese (BMI, greater than 30 kg/m²). Significant decreases in body mass and body fat were found at 8 months (5% and 3.3%, respectively). Self-reported WOMAC physical function subscale scores also improved after 3 and 8 months, by 11% and 17%, respectively. The WOMAC pain subscale score decreased by 24.8% at 8 months.

Walking distance on the 6-minute walk test improved by 11.6%.

2017 Recommendation

C In addition to providing exercise intervention, clinicians should collaborate with physicians, nutritionists, or dietitians to support weight reduction in individuals with hip osteoarthritis who are overweight or obese.

A model to guide clinical decisions regarding examination and treatment planning for individuals with hip pain and mobility deficits—hip osteoarthritis is depicted in the **FIGURE**.

Key Clinical Findings of Hip Pain and Mobility Deficits—Hip OA

- Moderate anterior or lateral hip pain during weight-bearing activities
- Morning stiffness less than 1 hour in duration after waking
- Hip IR ROM less than 24°
- IR and hip flexion 15° less than the nonpainful side
- Increased hip pain associated with passive hip IR
- Absence of history, activity limitations, and/or impairments inconsistent with hip OA

Measures to Assess Level of Functioning, Presence of Associated Physical Impairments to Address With Treatment, and Response to Treatment*

Activity/Participation Measures (A)

- LEFS
- WOMAC
- BPI
- HOOS
- HHS
- Pain VAS
- Berg Balance Scale
- Timed up-and-go test
- Stair measure
- Self-paced walk test
- 4-square step test
- Step test
- Timed single-leg stance
- 30-second chair stand
- 6-minute walk test

Impairment Measures

- FABER test (A)
- Scour test (A)
- Hip flexion ROM (A)
- Hip IR ROM (A)
- Hip ER ROM (A)
- Hip extension ROM (A)
- Hip abduction/gluteus medius strength and motor control (A)
- Hip extension/gluteus maximus strength and motor control (A)
- Pain at rest: current level of pain (0-10, 0 best) (F)
- Pain at best: lowest level of pain in recent 24 hours (0-10, 0 best) (F)
- Pain at worst: highest level of pain in recent 24 hours (0-10, 0 best) (F)
- Pain frequency: percent of time in pain in recent 24 hours (0%-100% of time, 0% best) (F)

Figure continues on page A21.

FIGURE. Hip pain and mobility deficits—hip osteoarthritis examination/intervention guidelines decision-making model. *Letters in parentheses reflect the grade of evidence on which the recommendation for each item is based: (A) strong evidence; (B) moderate evidence; (C) weak evidence; (D) conflicting evidence; (E) theoretical/foundational evidence; (F) expert opinion.

Interventions

Note: Interventions should be tailored to address the specific hip OA-related impairments and limitations identified on examination.

Flexibility, Strengthening, and Endurance Exercises (A)

- Dosage: 1 to 5 times per week over 6 to 12 weeks for mild to moderate hip OA
- Hip capsule, fascia, and muscle stretching, including extension, flexion, IR, ER, abduction, and horizontal adduction, with attention to hip flexors and ERs
- Strengthening of hip abductors, ERs, extensors

Manual Therapy (A)

- Soft tissue mobilization of areas of soft tissue restriction, such as iliacus, hip ERs, posterior gluteus medius, quadratus femoris, and gluteus maximus
- Joint mobilizations to improve identified restrictions in joint mobility, such as hip distraction mobilizations, posterior glides, anterior glides, and distraction mobilizations with movement

Functional, Gait, and Balance Training (C)

- Balance, functional, and gait training to address identified limitations
- Proper use of assistive devices (canes, crutches, walkers)
- Individualized exercise prescription based on patient values, needs, and activities

Patient Education Combined With Exercise (B)

- Address weight-bearing activity modification as appropriate
- Provide exercises to address identified impairments and to support weight reduction as appropriate
- Discuss unloading the arthritic joints as appropriate

Weight Loss (C)

- Refer and collaborate as needed to physicians, nutritionists, or dietitians to support weight management plan

Modalities (B)

- Ultrasound may be used in addition to exercise for short-term pain and activity limitation management for up to 2 weeks

Revise Diagnosis, Change Plan of Care, or Refer to Appropriate Clinicians

- When the patient's symptoms do not diminish after targeted interventions within expected time frame, as identified in the tailored treatment plan

FIGURE (CONTINUED). Hip pain and mobility deficits—hip osteoarthritis examination/intervention guidelines decision-making model.

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ACKNOWLEDGMENTS: *The authors would like to acknowledge the contributions of Dartmouth Biomedical Libraries Research and Education Librarians, Heather Blunt, and Pamela Bagley for their guidance and assistance in the design and implementation of the literature search and documentation.*

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MORE INFORMATION
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APPENDIX A

SEARCH STRATEGIES FOR ALL DATABASES SEARCHED

Assessment

PubMed

((Questionnaires [mesh]) OR (womac[tiab] OR hoos[tiab] OR mactar[tiab] OR lish[tiab] OR oakhqol[tiab] OR "walk test"[tiab] OR "stair measure"[tiab] OR "timed up and go"[tiab] OR "lower extremity functional scale"[tiab] OR lefs[tiab] OR "harris hip score"[tiab] OR "faber test"[tiab] OR "scour test"[tiab] OR "sit to stand test"[tiab] OR "step test"[tiab] OR "stance test"[tiab] OR "stair climb"[tiab] OR "performance-based"[tiab] OR Questionnaire [tiab] OR Questionnaires[tiab] OR Instrument[tiab] OR Instruments[tiab] OR Scale[tiab] OR Scales[tiab] OR Measurement[tiab] OR Measurements[tiab] OR Index[tiab] OR Indices[tiab] OR Score[tiab] OR Scores[tiab]) ((diagnosis[sh] OR "Diagnosis"[Mesh])) OR (radiograph*[tiab] OR radiologic*[tiab] OR diagnos*[tiab] OR misdiagnos*[tiab] OR ultrasonography[tiab] OR sonography[tiab] OR ultrasound*[tiab] OR sonogram*[tiab] OR CT[tiab] OR tomography[tiab] OR xray[tiab] OR x-ray[tiab] OR mri[tiab] OR imaging[tiab] OR examination[tiab] OR exam[tiab] OR evaluat*[tiab] OR classific*[tiab] OR specificity[tiab] OR kellgren*[tiab] OR mankin[tiab]) ("osteoarthritis, hip"[mesh] OR ((hip[mesh] OR "hip joint"[mesh] OR hip[tiab] OR hips[tiab]) AND (osteoarthritis[mesh:noexp] OR osteoarthr*[tiab]))

Cochrane Library

((CT or radiograph* or radiologic* or diagnos* or misdiagnos* or ultrasonography or sonography or ultrasound* or sonogram* or tomography or xray or x-ray or mri or imaging or examination or exam or evaluat* or classific* or specificity or kellgren* or mankin:womac or hoos or mactar or lish or oakhqol or "walk test" or "stair measure" or "timed up and go" or "lower extremity functional scale" or lefs or "harris hip score" or "faber test" or "scour test" or "sit to stand test" or "step test" or "stance test" or "stair climb" or "performance-based" or Questionnaire or Questionnaires or Instrument or Instruments or Scale or Scales or Measurement or Measurements or Index or Indices or Score Scores)

CINAHL

((womac OR hoos OR mactar OR lish OR oakhqol OR "walk test" OR "stair measure" OR "timed up and go" OR "lower extremity functional scale" OR lefs OR "harris hip score" OR "faber test" OR "scour test" OR "sit to stand test" OR "step test" OR "stance test" OR "stair climb" OR "performance-based" OR Questionnaire OR Questionnaires OR Instrument OR Instruments OR Scale OR Scales OR Measurement OR Measurements OR Index OR Indices OR Score Scores) ORAB (womac OR hoos OR mactar OR lish OR oakhqol OR "walk test" OR "stair measure" OR "timed up and go" OR "lower extremity functional scale" OR lefs OR "harris hip score" OR "faber test" OR "scour test" OR "sit to stand test" OR "step test" OR "stance test" OR "stair climb" OR "performance-based" OR Questionnaire OR Questionnaires

OR Instrument OR Instruments OR Scale OR Scales OR Measurement OR Measurements OR Index OR Indices OR Score Scores

T1(radiograph* OR radiologic* OR diagnos* OR misdiagnos* OR ultrasonography OR sonography OR ultrasound* OR sonogram* OR tomography OR xray OR x-ray OR mri OR imaging OR examination OR exam OR evaluat* OR classific* OR specificity OR kellgren* OR mankin) ORAB (radiograph* OR radiologic* OR diagnos* OR misdiagnos* OR ultrasonography OR sonography OR ultrasound* OR sonogram* OR tomography OR xray OR x-ray OR mri OR imaging OR examination OR exam OR evaluat* OR classific* OR specificity OR kellgren* OR mankin)

Intervention

PubMed

Search ((Combined Modality Therapy[mesh] OR Electric Stimulation Therapy[mesh] OR Electric Stimulation[mesh] OR Transcutaneous Electric Nerve Stimulation[mesh] OR Traction[mesh] OR Laser Therapy[mesh] OR Rehabilitation[mesh] OR rehabilitation[sh] OR Phototherapy[mesh] OR Lasers[mesh] OR Physical Therapy Modalities[mesh] OR Cryotherapy[mesh] OR Cryoanesthesia[mesh] OR Ice[mesh] OR Acupuncture Therapy[mesh] OR Acupuncture[mesh] OR modalit*[tiab] OR "electric stimulation"[tiab] OR "electrical stimulation"[tiab] OR electrotherapy[tiab] OR tens[tiab] OR "transcutaneous electric nerve stimulation"[tiab] OR electroacupuncture[tiab] OR acupuncture[tiab] OR needling[tiab] OR heat[tiab] OR cold[tiab] OR traction[tiab] OR laser[tiab] OR lasers[tiab] OR rehabilitation[tiab] OR "physical therapy"[tiab] OR "physical therapies"[tiab] OR physiotherap*[tiab] OR cryotherapy[tiab] OR hyperthermia[tiab] OR "vapocoolant spray"[tiab] OR cryoanesthesia[tiab] OR ice[tiab] OR faradic[tiab] OR traction[tiab] OR iontophoresis[tiab] OR phonophoresis[tiab] OR phototherapy[tiab] OR hydrotherapy[tiab] OR "light therapy"[tiab] OR diathermy[tiab] OR ultraviolet[tiab] OR infrared[tiab]))

Search (("Exercise Therapy"[Mesh] OR Exercise[mesh] OR "Self-Help Devices"[Mesh] OR "education" [Subheading] OR "Patient Education as Topic"[Mesh] OR crutches[Mesh] OR Canes[Mesh] OR Walkers[Mesh] OR "orthotic devices"[mesh] OR therapy[sh:noexp])) OR (exercis*[tiab] OR massag*[tiab] OR "manual therapy"[tiab] OR accupressure[tiab] OR manipulat*[tiab] OR "applied kinesiology"[tiab] OR stretching[tiab] OR stretch[tiab] OR stretches[tiab] OR "continuous passive movement"[tiab] OR "continuous passive motion"[tiab] OR plyometric[tiab] OR plyometrics[tiab] OR "resistance training"[tiab] OR "strength training"[tiab] OR strengthening[tiab] OR "weight-bearing"[tiab] OR weightbearing[tiab] OR "weight-lifting"[tiab] OR weightlifting[tiab] OR "physical conditioning"[tiab] OR education[tiab] OR balneotherapy[tiab] OR "aquatic therapy"[tiab] OR "pool therapy"[tiab] OR "water aerobics"[tiab] OR "water running"[tiab] OR "water training"[tiab] OR "gait aids"[tiab] OR "gait aid"[tiab] OR "gait training"[tiab] OR crutches[tiab] OR walker[tiab] OR

APPENDIX A

walkers[tiab] OR cane[tiab] OR canes[tiab] OR orthotic*[tiab] OR orthoses[tiab] OR orthosis[tiab] OR "activity modification"[tiab] OR "balance training"[tiab] OR "functional training"[tiab] OR "assistive devices"[tiab] OR "assistive device"[tiab] OR mobilization[tiab] OR mobilisation[tiab] OR "flexibility training"[tiab] OR "endurance training"[tiab] OR "proprioceptive neuromuscular facilitation"[tiab] OR "manual resistance"[tiab] OR "aerobic activity"[tiab]

("osteoarthritis, hip"[mesh]) OR ((hip[mesh] OR "hip joint"[mesh] OR hip[tiab] OR hips[tiab]) AND (osteoarthritis[mesh:noexp] OR osteoarthr*[tiab]))

Cochrane Library

((hip or hips) and osteoarthr*modalit* or "electric stimulation" or "electrical stimulation" or electrotherapy or tens or "transcutaneous electric nerve stimulation" or electroacupuncture or acupuncture or needling or heat or cold or traction or laser or lasers or rehabilitation or "physical therapy" or "physical therapies" or physiotherap* or cryotherapy or hyperthermia or "vapocoolant spray" or cryoanesthesia or ice or faradic or traction or iontophoresis or phonophoresis or phototherapy or hydrotherapy or "light therapy" or diathermy or ultraviolet or infrared; exercis* or massag* or "manual therapy" or accupressure or manipul* or "applied kinesiology" or stretching or stretch or stretches or "continuous passive movement" or "continuous passive motion" or plyometric or plyometrics or "resistance training" or "strength training" or strengthening or "weight-bearing" or weightbearing or "weight-lifting" or weightlifting or "physical conditioning" or education or balneotherapy or "aquatic therapy" or "pool therapy" or "water aerobics" or "water running" or "water training" or "gait aids" or "gait aid" or "gait training" or crutches or walker or walkers or cane or canes or orthotic* or orthoses or orthosis or "activity modification" or "balance training" or "functional training" or "assistive devices" or "assistive device" or mobilization or mobilisation or "flexibility training" or "endurance training" or "proprioceptive neuromuscular facilitation" or "manual resistance" or "aerobic activity":ti,ab,kw)

CINAHL

((MH Exercise+ OR MH Assistive Technology Devices+ OR MW ED OR MH "Patient Education+ OR MH orthoses + OR MW TH) OR TI (exercise * OR massage* OR manual therapy OR accupressure OR manipul* OR applied kinesiology OR stretching OR stretch OR stretches OR "continuous passive movement" OR "continuous passive motion" OR plyometric OR plyometrics OR resistance training OR strength training OR strengthening OR weight-bearing OR weightbearing OR weight-lifting OR weightlifting OR physical conditioning OR education

OR balneotherapy OR aquatic therapy OR pool therapy OR water aerobics OR water running OR water training OR gait aids OR gait aid OR gait training OR crutches OR walker OR walkers OR cane OR canes OR orthotic* OR orthoses OR orthosis OR activity modification OR balance training OR functional training OR assistive devices OR assistive device OR mobilization OR mobilisation OR flexibility training OR endurance training OR proprioceptive neuromuscular facilitation OR manual resistance OR aerobic activity) OR AB (exercise * OR massage * OR manual therapy OR accupressure OR manipulate * OR applied kinesiology OR stretching OR stretch OR stretches OR "continuous passive movement" OR "continuous passive motion" OR plyometric OR plyometrics OR resistance training OR strength training OR strengthening OR weight-bearing OR weightbearing OR weight-lifting OR weightlifting OR physical conditioning OR education OR balneotherapy OR aquatic therapy OR pool therapy OR water aerobics OR water running OR water training OR gait aids OR gait aid OR gait training OR crutches OR Search modes - walker OR walkers OR cane OR canes OR orthotic* OR orthoses OR orthosis OR activity modification OR balance training OR functional training OR assistive devices OR assistive device OR mobilization OR mobilisation OR flexibility training OR endurance training OR proprioceptive neuromuscular facilitation OR manual resistance OR aerobic activity))

(MH "Combined Modality Therapy" OR MH Physical Therapy + OR MH Rehabilitation OR MW RH OR MH Traction OR MH Laser Therapy OR MH Ice OR MH Acupuncture+ OR MH Acupressure) OR TI (modalities * OR "electrical stimulation" OR "electrical stimulation" OR electrotherapy OR tens OR "transcutaneous electric nerve stimulation" OR electroacupuncture OR acupuncture OR needling OR heat OR cold OR traction OR laser OR lasers OR rehabilitation OR "physical therapy" OR Physical therapies OR physiotherap* OR cryotherapy OR hyperthermia OR "vapocoolant spray" OR cryoanesthesia OR ice OR faradic OR traction OR iontophoresis OR phonophoresis OR phototherapy OR hydrotherapy OR "light therapy" OR diathermy OR ultraviolet OR infrared) OR AB (modalit * OR "electric stimulation" OR "electrical stimulation" OR electrotherapy OR tens OR "transcutaneous electric nerve stimulation" OR electroacupuncture OR acupuncture OR needling OR heat OR cold OR traction OR laser OR lasers OR rehabilitation OR "physical therapy" OR physical therapies OR physiotherap* OR cryotherapy OR hyperthermia OR "vapocoolant spray" OR cryoanesthesia OR ice OR faradic OR traction OR iontophoresis OR phonophoresis OR phototherapy OR hydrotherapy OR "light therapy" OR diathermy OR ultraviolet OR infrared)

PEDro

hip* AND osteoarthr*
body part: hip or thigh

APPENDIX B

SEARCH RESULTS
Assessment

Database/Platform	Time Covered	Date Conducted	Results, n
MEDLINE			
PubMed	2008-date	August 4, 2014	3464
PubMed	July 2014-date	April 8, 2016	100
CINAHL			
EBSCO	2008-July 2014	August 4, 2014	183
ESSCO	July 2014-date	April 8, 2016	47
Cochrane Library			
Wiley	Current as of August 4, 2014	August 4, 2014	412
Wiley	2014-date: DSR, issue 4 (April 2016); DARE, issue 2 (April 2015); CENTRAL, issue 3 (March 2016); HTA, issue 1 (January 2016)	April 8, 2016	258 (DSR, 13; other, 2; CENTRAL, 242; HTA, 1)
PEDro	2008-date	August 4, 2014	83
		April 8, 2016	29
Total		August 4, 2014	4142
With duplicates removed		August 4, 2014	3691
Total		April 8, 2016	1734
With duplicates removed		April 8, 2016	1589

Abbreviations: CENTRAL, Cochrane Central Register of Controlled Trials; DARE, Database of Abstracts of Reviews of Effects; DSR, Database of Systematic Reviews; HTA, Health Technology Assessment.

APPENDIX B

SEARCH RESULTS
Intervention

Database/Platform	Time Covered	Date Conducted	Results, n
MEDLINE			
PubMed	2008-July 2014	July 14, 2014	1057
PubMed	July 2014-date	March 11, 2016	431
CINAHL			
EBSCO	2008-date	July 14, 2014	445
ESSCO	2014-date	March 11, 2016	131
Cochrane Library			
Wiley	April 2014-July 2014: DSR, issue 7 (July 2014); DARE, issue 2 (April 2014); CENTRAL, issue 6 (June 2014); EED, issue 2 (April 2014)	July 14, 2014	204 (DSR, 13; DARE, 14; CENTRAL, 171; EED, 6)
Wiley	April 2015-March 2016: DSR, issue 3 (March 2016); DARE, issue 2 (April 2015); CENTRAL, issue 2 (February 2016); HTA, issue 1 (January 2016)	March 11, 2016	132 (DSR, 8; DARE, 3; CENTRAL, 120; HTA, 1)
PEDro	2008-date	July 15, 2014	81
		March 11, 2016	27
Total		July 15, 2014	1787
With duplicates removed		July 15, 2014	1297
Total		March 11, 2016	721
With duplicates removed		March 11, 2016	579

Abbreviations: CENTRAL, Cochrane Central Register of Controlled Trials; DARE, Database of Abstracts of Reviews of Effects; DSR, Database of Systematic Reviews; EED, NHS Economic Evaluation Database; HTA, Health Technology Assessment; NHS, National Health Service.

APPENDIX C

ARTICLE INCLUSION AND EXCLUSION CRITERIA**Inclusion Criteria**

We included articles providing evidence of the following types: systematic reviews, meta-analyses, experimental, cohort, and cross-sectional studies reporting on:

- Must have diagnostic hip OA with either radiographic or clinical confirmation (using established criteria such as the ACR criteria)

AND

- Have at least a sample size of 15 or greater

AND

- If the study included both hip and knee OA, the results must be reported separately

OR

- Tests and measures for diagnosis and/or differential diagnosis of hip OA within the scope of physical therapy practice (including but not limited to lumbar spine, sacroiliac joint, hernia, and cancer)

OR

- Tests and methods for diagnosis and/or differential diagnosis of hip OA using imaging (including but not limited to ultrasound, plain-film radiography, and MRI)

OR

- Measurement properties of tests and measures specific to hip OA-related symptoms and outcomes (WOMAC, HHS, HOOS, Lequesne Index of Severity for Osteoarthritis of the Hip [LISH], Osteoarthritis Knee and Hip Quality of Life Questionnaire, American Academy of Orthopaedic Surgeons Hip and Knee Outcomes Questionnaire, Oxford hip and knee score, Lower Limb Core Scale, VAS, LEFS, SF-36, World Health Organization Disability Assessment Schedule [WHODAS], QOL)

OR

- Measurement properties of tests/measurements using data from a sample of patients with hip OA, including active and passive ROM; pain; manual muscle tests; muscle length measures; and special

tests, including but not limited to the flexion, abduction, and external rotation (FABER), flexion, adduction, and internal rotation (FADIR), log roll, and scour tests

OR

- Measurement properties of tests and measures specific to hip OA-related functions, activity, and participation (including but not limited to the 6-minute walk test, self-paced walk test, stair measure, timed up-and-go test, Berg Balance Scale, 5-time sit-to-stand test, functional gait, 10-m walk test, and EQ-5D)

AND

- Interventions within the scope of the practice of physical therapy, including coordination training, functional training, gait training, balance training, modalities (including but not limited to heat, electrical stimulation, ultrasound, diathermy), manual therapy (including but not limited to manipulation, joint mobilization, soft tissue mobilization, massage), exercise (including but not limited to stretching/flexibility, proprioceptive neuromuscular facilitation, manual resistance, resistance/strength training, aerobic and endurance activities, community-based and self-management programs), assistive devices, and education

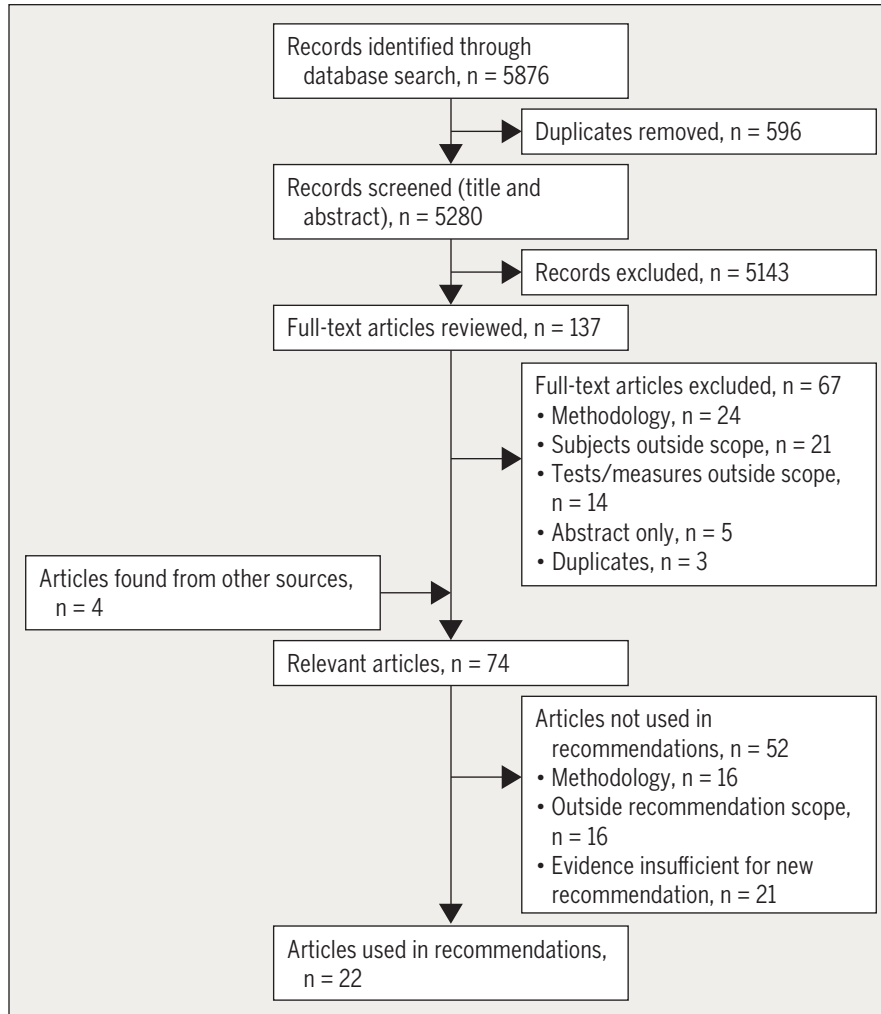
Exclusion Criteria

We excluded abstracts, press reports, editorial letters, and articles reporting on:

- Study protocols
- Animal studies
- Children (aged less than 18 years)
- Primary surgical studies
- Legg-Calve-Perthes disease
- Congenital hip dislocation
- SCFE
- Hip dysplasia
- FAI

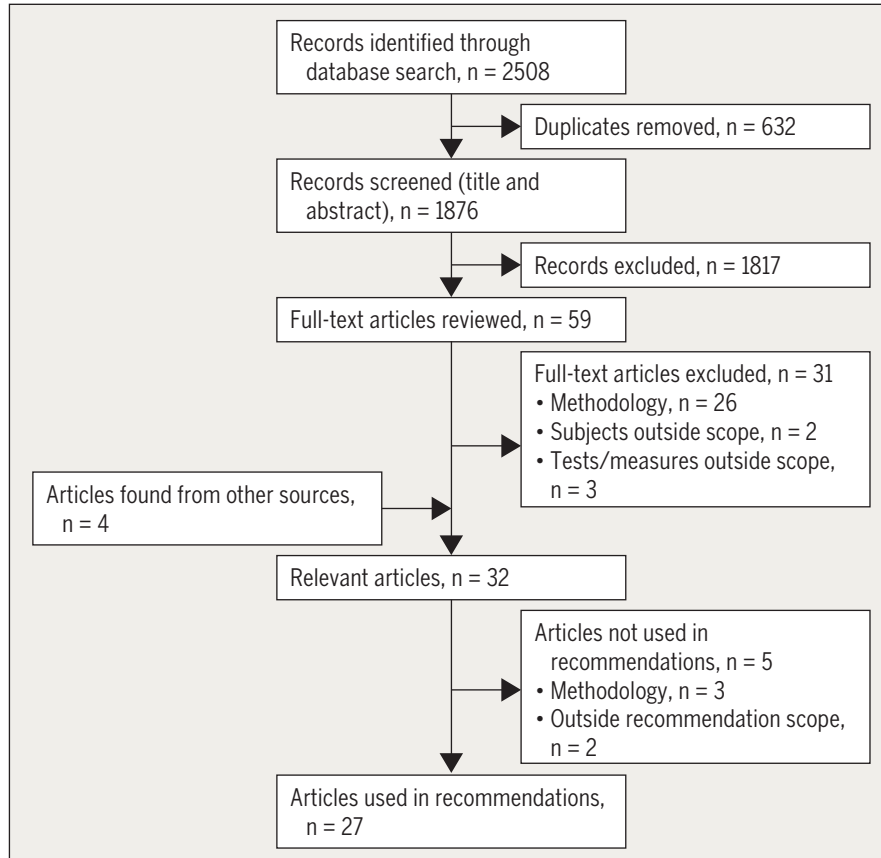
APPENDIX D

FLOW CHART OF ARTICLES
Assessment



APPENDIX D

FLOW CHART OF ARTICLES
Intervention



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APPENDIX E

ARTICLES INCLUDED IN RECOMMENDATIONS BY TOPIC**Diagnosis/Classification**

Holla JF, Steultjens MP, van der Leeden M, et al. Determinants of range of joint motion in patients with early symptomatic osteoarthritis of the hip and/or knee: an exploratory study in the CHECK cohort. *Osteoarthritis Cartilage*. 2011;19:411-419. <https://doi.org/10.1016/j.joca.2011.01.013>

Kim C, Nevitt MC, Niu J, et al. Association of hip pain with radiographic evidence of hip osteoarthritis: diagnostic test study. *BMJ*. 2015;351:h5983. <https://doi.org/10.1136/bmj.h5983>

Examination**Outcome Measures: Activity Limitations – Self-report Measures**

Aranda-Villalobos P, Fernández-de-las-Peñas C, Navarro-Espigares JL, et al. Normalization of widespread pressure pain hypersensitivity after total hip replacement in patients with hip osteoarthritis is associated with clinical and functional improvements. *Arthritis Rheum*. 2013;65:1262-1270. <https://doi.org/10.1002/art.37884>

Arendt-Nielsen L, Graven-Nielsen T. Translational musculoskeletal pain research. *Best Pract Res Clin Rheumatol*. 2011;25:209-226. <https://doi.org/10.1016/j.berh.2010.01.013>

Arnold CM, Faulkner RA. Does falls-efficacy predict balance performance in older adults with hip osteoarthritis? *J Gerontol Nurs*. 2009;35:45-52.

Davis AM, Perruccio AV, Canizares M, et al. The development of a short measure of physical function for hip OA HOOS-Physical Function Shortform (HOOS-PS): an OARSI/OMERACT initiative. *Osteoarthritis Cartilage*. 2008;16:551-559. <https://doi.org/10.1016/j.joca.2007.12.016>

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APPENDIX F

LEVELS OF EVIDENCE TABLE*

Level	Intervention/Prevention	Pathoanatomic/Risk/ Clinical Course/Prognosis/ Differential Diagnosis	Diagnosis/Diagnostic Accuracy	Prevalence of Condition/Disorder	Exam/Outcomes
I	Systematic review of high-quality RCTs	Systematic review of prospective cohort studies	Systematic review of high-quality diagnostic studies	Systematic review, high-quality cross-sectional studies	Systematic review of prospective cohort studies
	High-quality RCT [†]	High-quality prospective cohort study [‡]	High-quality diagnostic study [§] with validation	High-quality cross-sectional study	High-quality prospective cohort study
II	Systematic review of high-quality cohort studies	Systematic review of retrospective cohort study	Systematic review of exploratory diagnostic studies or consecutive cohort studies	Systematic review of studies that allows relevant estimate	Systematic review of lower-quality prospective cohort studies
	High-quality cohort study [‡]	Lower-quality prospective cohort study	High-quality exploratory diagnostic studies	Lower-quality cross-sectional study	Lower-quality prospective cohort study
	Outcomes study or ecological study	High-quality retrospective cohort study	Consecutive retrospective cohort		
	Lower-quality RCT [†]	Consecutive cohort			
III	Systematic reviews of case-control studies	Outcomes study or ecological study	Lower-quality exploratory diagnostic studies	Local nonrandom study	High-quality cross-sectional study
	High-quality case-control study	Lower-quality retrospective cohort study	Nonconsecutive retrospective cohort		
	Lower-quality cohort study	High-quality cross-sectional case-control study			
IV	Case series	Case series	Case-control study		Lower-quality cross-sectional study
V	Expert opinion	Expert opinion	Expert opinion	Expert opinion	Expert opinion

Abbreviation: RCT, randomized clinical trial.

*Adapted from Phillips et al⁵² (<http://www.cebm.net/index.aspx?o=1025>). See also APPENDIX G.

[†]High quality includes RCTs with greater than 80% follow-up, blinding, and appropriate randomization procedures.

[‡]High-quality cohort study includes greater than 80% follow-up.

[§]High-quality diagnostic study includes consistently applied reference standard and blinding.

^{||}High-quality prevalence study is a cross-sectional study that uses a local and current random sample or censuses.

^{††}Weaker diagnostic criteria and reference standards, improper randomization, no blinding, and less than 80% follow-up may add bias and threats to validity.

APPENDIX G

PROCEDURES FOR ASSIGNING LEVELS OF EVIDENCE

- Level of evidence is assigned based on the study design using the Levels of Evidence table (**APPENDIX F**), assuming high quality (eg, for intervention, randomized clinical trial starts at level I)
- Study quality is assessed using the critical appraisal tool, and the study is assigned 1 of 4 overall quality ratings based on the critical appraisal results
- Level of evidence assignment is adjusted based on the overall quality rating:
 - High quality (high confidence in the estimate/results): study remains at assigned level of evidence (eg, if the randomized clinical trial is rated high quality, its final assignment is level I). High quality should include:
 - Randomized clinical trial with greater than 80% follow-up, blinding, and appropriate randomization procedures
 - Cohort study includes greater than 80% follow-up
 - Diagnostic study includes consistently applied reference standard and blinding
 - Prevalence study is a cross-sectional study that uses a local and current random sample or censuses
 - Acceptable quality (the study does not meet requirements for high quality and weaknesses limit the confidence in the accuracy of the estimate): downgrade 1 level
 - Based on critical appraisal results
 - Low quality: the study has significant limitations that substantially limit confidence in the estimate: downgrade 2 levels
 - Based on critical appraisal results
 - Unacceptable quality: serious limitations—exclude from consideration in the guideline
 - Based on critical appraisal results