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Core Recommendations for Osteoarthritis Care: A Systematic Review of Clinical Practice Guidelines

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Objective. To evaluate the quality of clinical practice guidelines (CPGs) for interventions in management of osteoarthritis (OA) and to provide a synthesis of high-quality CPG recommendations.

Methods. Five databases (OvidSP Medline, Cochrane, Cumulative Index to Nursing and Allied Health Literature [CINAHL], Embase, and the Physiotherapy Evidence Database [PEDro]) and 4 online guideline repositories were searched. CPGs for the management of OA were included if they were 1) written in English and published from January 2015 to February 2022, focused on adults age ≥18 years, and met the criteria of a CPG as defined by the Institute of Medicine; and 2) were rated as high quality on the Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument. CPGs for OA were excluded if they were available via institutional access only, only addressed recommendations for the system/organization of care and did not include interventional management recommendations, and/or included other arthritic conditions.

Results. Of 20 eligible CPGs, 11 were appraised as high quality and included in the synthesis. Of interest were the hip, knee, hand, and glenohumeral joints and/or polyarticular OA. Consistent recommendations were that care should be patient centered and include exercise, education, and weight loss (where appropriate). Nonsteroidal antiinflammatory drugs and surgical interventions were recommended for disabling OA that had not improved with nonsurgical care. Hand orthoses should be recommended for patients with hand OA.

Conclusion. This synthesis of high-quality CPGs for OA management offers health care providers with clear, simple guidance of recommended OA care to improve patient outcomes.

INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease that can affect any joint, but it most commonly occurs in the hip, knee, and hand (1,2). Symptoms often include joint pain, stiffness, and reduced range of movement (2). OA affects 303 million people worldwide, with prevalence expected to increase with aging populations and rising obesity rates globally (3,4). OA is a leading cause of pain and disability among adults worldwide and inflicts a significant burden on the individuals affected, including activity limitations and reduced quality of life (5,6). OA is associated with substantial direct health care costs due to health care visits, diagnostic procedures, medications and surgery, and indirect costs related to lost workplace productivity (4,6).

Clinical practice guidelines (CPGs) are a set of health care recommendations developed by reviewing scientific literature and consensus from an expert panel (7). The aim of CPGs is to guide health care decision-making, thereby reducing practice variability and improving patient outcomes (8,9). Several global CPGs have been published in recent years for the management of OA

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SIGNIFICANCE & INNOVATIONS

- Eleven clinical practice guidelines for osteoarthritis (OA) were appraised as high quality.
- Consistent recommendations were that care should be patient centered and include exercise, education, and weight loss (where appropriate). Nonsteroidal antiinflammatory drugs and surgical interventions are recommended for disabling OA that had not improved with nonsurgical care. Hand orthoses should be recommended for patients with hand OA.
- To implement recommendations in practice, future priorities include identifying core skill sets and competencies among health care workers, developing training/education resources, and creating a framework to improve quality of OA care.

(10–29). These typically include nonpharmacologic (e.g., exercise and education), pharmacologic (e.g., acetaminophen and nonsteroidal antiinflammatory drugs [NSAIDs]), and surgical options such as total joint replacement (10–29). However, uptake of recommendations from CPGs into practice is variable, especially for first-line, nonpharmacologic treatments such as exercise (30). Gaps between evidence and practice may in part be due to a lack of clarity about what is being recommended and conflicting recommendations across different CPGs, a situation exacerbated when CPGs for OA are not developed rigorously and their recommendations are less trustworthy (30–36). As CPGs are costly to develop, this is an inefficient use of resources and further adds to the confusion for clinicians (37). To encourage the uptake of evidence and delivery of appropriate OA care, clinicians require clear, consistent management recommendations (31).

The purpose of this systematic review was to evaluate the quality of the CPGs for the management of OA and to provide a synthesis of high-quality CPG recommendations. By synthesizing recommendations across high-quality CPGs, the aim was to offer health care providers with clear, simple guidance of recommended OA care to improve patient outcomes.

MATERIALS AND METHODS

Search strategy and eligibility criteria. This systematic review was registered on the Open Science Framework (DOI 10.17605/OSF.IO/UB3Y7) and followed the Preferred Reporting Items for Systematic Reviews (PRISMA) guidelines. A database search of Medline, Cochrane, CINAHL, Embase, and the Physiotherapy Evidence Database (PEDro), and a further search of 4 online guideline repositories (Guidelines International Network, National Health and Medical Research Council, Agency for Health Care Research and Quality, and the National Institute for Health and Care Excellence) was conducted to identify all relevant CPGs. The search strategy was developed in consultation with a reference librarian. Medical subject headings and key words associated with CPGs (e.g., guideline*.mp. or Practice Guideline/ or Guideline/) and OA were used (see Supplementary Appendix A, available on the *Arthritis Care & Research* website at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101). Other arthritis conditions were included in the search terms as this systematic review is part of a wider body of work to inform arthritis management. Eligibility criteria are presented in Table 1. The search included CPGs published between January 2015 and December 2020 and was updated to include CPGs published between December 2020 and February 14, 2022. This cutoff date was selected as CPGs >5 years old may be out of date (7).

Protocol changes. In the original protocol, CPGs addressing 1 treatment modality (e.g., medication prescribing) were excluded. To improve comprehensiveness, the scope was expanded during the study selection phase to include all OA management options. Due to time that has elapsed since the original search, the original timeline (January 2015 and December 2020) was extended to include CPGs published up until February 2022.

Study selection. After importing search results into EndNote (Clarivate), duplicates were removed and titles/abstracts were uploaded into Covidence systematic review software (Veritas Health Innovation; available at www.covidence.org). Titles and abstracts were screened by 2 independent reviewers (BC and TG or IL); any disagreements were resolved through consensus discussion with a third reviewer. Following this, full texts were uploaded into Covidence and screened through the same process.

Data appraisal (quality assessment of guidelines). The Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument was used to assess CPG quality (38). This is an internationally validated tool that has been widely applied in CPG research (38,39). It consists of 23 items grouped into 6 domains: 1) scope and purpose; 2) stakeholder involvement; 3) rigor of development; 4) clarity of presentation; 5) applicability; and 6) editorial independence. Seven reviewers (BC, SB, JB, PO, JP, TG, and IL) were

Table 1. Clinical practice guidelines (CPGs) selection criteria

Inclusion criteria
Published between January 2015 and February 14, 2022
For the interventional management of osteoarthritis
For adults (individuals age ≥18 years)
Published in the English language or has a complete English language version available
Is a CPG, as defined by inclusion of a systematic review of the literature, and developed by an expert multidisciplinary panel (33)
Represents an original body of work, i.e., not solely an adaptation or systematic review of existing guidelines
Exclusion criteria
Does not include interventional management recommendations
Includes other arthritic conditions
Only addresses recommendations for the system/organization of care
Unavailable via institutional access, i.e., requires additional payment

provided with the AGREE II user manual and undertook the online AGREE II practice exercise to participate in CPG quality appraisal (38,40). In accordance with the AGREE II manual, each item was rated independently by 2 reviewers using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree) (38). To calculate scores for each domain, the following formula was used: obtained score – minimum possible score / maximum possible score – minimum possible score (38). There is no uniform criterion for overall quality; the AGREE II developers recommend that research teams define their own criteria based on their own study context (38). For the purposes of this review, and consistent with previous reviews in musculoskeletal pain management, the authors defined a quality cutoff score of ≥60% of the maximum possible score in 3 domains deemed the most important for validity: stakeholder involvement (domain 2); rigor of development (domain 3); and editorial independence (domain 6) (36,37,41,42). CPGs that did not meet this definition were excluded.

Interrater agreement. The domain percentages and overall quality rating (%) were independently calculated for each reviewer. We defined acceptable interrater agreement as excellent with intraclass coefficient values of ≥80 and domain percentages and an overall quality rating of ≤20% difference between reviewers (43,44). Where variation of ≥20% between scores existed, a consensus discussion took place with a third reviewer engaged when necessary to agree on a rating (see Supplementary Table 1, available on the *Arthritis Care & Research* website at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101).

Data extraction. Data extraction was performed by the first author (BC) using a purpose-designed Excel (Microsoft) spreadsheet. Extracted data comprised CPG characteristics (e.g., title, country of publication), methodology, and guideline topic target users (see Supplementary Table 2, available on the *Arthritis Care & Research* website at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101). From each CPG, extracted recommendations were ranked as either "should do," "could do," "do not do," or "uncertain" (see Supplementary Table 3, available on the *Arthritis Care & Research* website at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101). Recommendation ratings were consistent with language used in the CPGs and definitions from a previous musculoskeletal systematic review of CPGs (36) (Table 2). Language among the CPGs varied, although recommendations were ranked according to the same criteria, either the Grading of Recommendations Assessment, Development and Evaluation (GRADE) method (10,12,13,20,22,26,29), Oxford Centre for Evidence-Based Medicine standards (13,24), or PEDro scores (17). Extracted data and recommendation rankings were checked by 2 authors (SB and IL), and any discrepancies were resolved by consensus discussion between the 3 reviewers while consulting the original citation.

Narrative summary. A narrative summary was drafted by the first author (BC) and then reviewed and refined by 2 authors (SB and IL). The summary detailed how many CPGs reported on an intervention, what the recommendations involved, and how consistent/inconsistent recommendations were across CPGs regarding OA interventions (see Supplementary Table 4, available on the *Arthritis Care & Research* website at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101).

Table 2. Recommendation classification, definition, and examples of terminology for each classification*

Recommendation classification	Definition (37)	Examples of terminology from CPGs
Should do	"Should do" recommendations were those that the authors determined should be applied in all circumstances unless there is a rationale not to. These were based on strong evidence, for example, multiple high-quality studies reporting clinically relevant positive effects, benefits that outweigh risks, or when in the opinion of CPG development group members the benefits were unequivocal.	"Should do" (18) and "strongly recommend" (11)
Could do	"Could do" recommendations were those that the authors determined could be applied depending on the circumstances of individual patients. They were usually based on consistent evidence from multiple lesser-quality studies or 1 high-quality study and where benefits outweigh harms.	"Could be used" (18), "may be beneficial" (9,18), "can" and "consider" (26)
Do not do	"Do not do" recommendations were those for which the authors determined that there was strong evidence of no benefit and/or harms outweighing benefits.	"Are not recommended" (18), "do not recommend" (11), and "do not offer" (26)
Uncertain	"Uncertain" recommendations were those for which the authors determined that there was no recommendation for or against a practice because of incomplete or inconsistent research findings. Not all CPGs provided uncertain recommendations.	"Cannot recommend for or against" (9) and "unable to recommend either for or against" (11)

* CPG = clinical practice guideline.

RESULTS

Characteristics of included CPGs. Twenty CPGs met the eligibility criteria, and 11 were CPGs appraised as high quality and included (11–13,17–19,21,24,25,27,29) (Figure 1). Most CPGs were developed by medical societies (n = 9, 82%), while the remaining were developed by an expert panel (n = 2, 18%). Five CPGs were published by medical societies or expert panels in the US (10,11,19,25,29), 4 in Europe (13,21,24,27), 1 in Canada (17), and 1 in Australia (12). Of interest were the hip (n = 6), knee (n = 7), hand (n = 4), and glenohumeral (n = 1) joints and/or polyarticular OA (n = 1). Target users included health professionals, decision/policy makers, patients, their families, the pharmaceutical industry, health insurance companies, and those responsible for commissioning care (see Supplementary Table 2, available at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101).

Quality of CPGs. The AGREE II quality assessment scores for each CPG are provided in Supplementary Table 1, available at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101. The quality assessment results of each guideline included in the systematic review are provided in Table 3. Those that were excluded based on not achieving a high-quality cutoff score are presented in Supplementary Table 1. The quality of the included CPGs was assessed across the following 6 domains: scope and purpose (range 75–100%); stakeholder involvement (range 58–89%); rigor

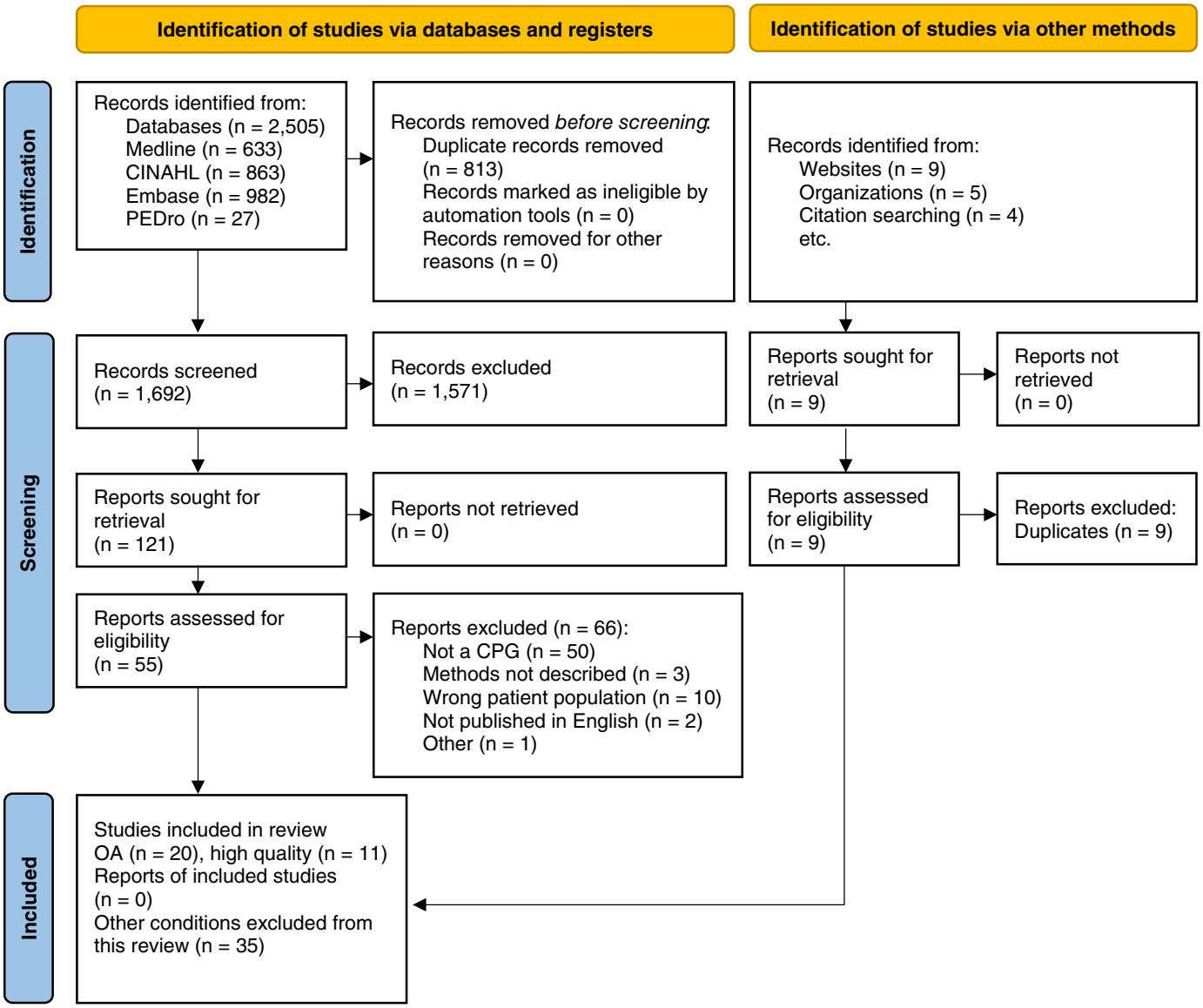

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 flow diagram for new systematic reviews that included searches of databases, registers, and other sources. CINAHL = Cumulative Index to Nursing and Allied Health Literature; CPG = clinical practice guideline; OA = osteoarthritis; PEDro = Physiotherapy Evidence Database.

of development (range 59–96%); clarity of presentation (range 53–100%); applicability (range 2–42%); and editorial independence (range 33–100%). The mean ± SD AGREE II scores for each item, domain, and overall scores across all guidelines are displayed in Supplementary Table 5, available on the *Arthritis Care & Research* website at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101. The domain with the lowest mean ± SD score was applicability (21.14% ± 15.0%), and the highest mean ± SD score was for scope and purpose (88.77% ± 9.8%).

Consensus recommendations ("should do"). After synthesis (see Supplementary Table 4, available at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101), 7 "should do" recommendations were identified. The following recommendations were all found in at least 2 CPGs, where the majority strongly recommended the intervention.

Exercise. Eight CPGs strongly recommended strengthening, aerobic exercise, and tai chi exercise therapy for management of knee, hip, polyarticular, and/or hand OA (12,13,18,19,21,24,25,27). CPGs recommended several modes of exercise therapy, acknowledging that there is currently no consensus on the type of exercise that elicits the greatest benefit (12). Programs should be individualized and progressively overloaded with frequency, duration, and intensity consistent with the patient's preference and capability and the availability of local facilities (12,13).

Education. Five CPGs strongly recommended patient education for managing knee, hip, hand, and polyarticular OA (13,19,21,24,25). They recommended that education be an ongoing intervention that is patient centered and include information to enhance understanding about OA, its management options, education and training in exercise therapy, ergonomic principles, and pacing and assistive devices (13,21,24).

NSAIDs. Five CPGs strongly and 2 CPGs conditionally recommended the use of oral NSAIDs for people with knee, hip, hand, and/or polyarticular OA unless contraindicated (11–13,19,21,24,25). CPGs recommended that clinicians prescribe a low dose for a short period of time and discontinue if not effective, monitoring for side effects or adverse events (12,24).

Four CPGs strongly recommended the use of topical NSAIDS for knee, hip, and/or hand OA (13,19,24,25). Two CPGs conditionally recommended topical NSAIDS for patients with hand, knee, hip, and/or polyarticular OA and some comorbidities (21,25). One CPG was unable to recommend for or against the use of topical NSAIDS for people with knee and/or hip OA (12). However, the authors stated that it might be reasonable to trial topical NSAIDs for a short period and then discontinue use if not effective. Topical NSAIDs are seen to be safe and effective and should be recommended for older adults (>75 years) with only a few symptomatic joints (13). Clinicians should monitor for side effects or adverse events (12,21).

Weight loss. Four CPGs strongly recommended weight loss or management for people who are either overweight (body mass index [BMI] ≥25 kg/m^2) or obese (BMI ≥30 kg/m^2) with hip and/or knee OA (12,13,19,25). People with OA should be educated about the importance of maintaining a healthy body weight, while those who are overweight or obese should be encouraged to achieve a minimum weight loss target of 5.0–7.5% of body weight, with greater weight loss being linked to symptomatic benefits (12).

Hand orthosis. Three CPGs strongly recommended the use of a hand orthosis for OA of the carpometacarpal joint and conditionally recommended it for OA of other hand joints (13,24,25). Two CPGs stated that hand orthoses are suitable for both short-term and long-term use as they provide symptom relief, improve function, and prevent progression of degenerative changes (13,24).

Patient-centered care. Two CPGs strongly recommended that care be patient centered for people with OA of the knee, hip, and/or hand (13,24). This included shared decision-making between the patient and health professional and care that is individualized to the patient's circumstances.

Surgery. Two CPGs strongly recommended considering surgery for people with hip, knee, and hand OA in certain circumstances (13,24). The patient should have radiographic evidence of OA, marked disability, and reduced quality of life, and other treatment modalities should have been unsuccessful in relieving pain (13,24).

Consensus recommendations ("could do"). The following recommendations were found in at least 2 CPGs in which the majority conditionally recommended (or where there was an even number of strongly and conditionally recommended recommendations) that these could apply in a given patient's circumstances: balance exercises; yoga; weight management and exercise; cognitive behavioral therapy; assistive devices; ultrasound-guided injections; duloxetine; and glucocorticoid injections for knee and hand OA. In surgical contexts, preoperative physical therapy and postoperative physical therapy or exercise can be recommended after joint replacement surgery. General and neuraxial anesthesia and tranexamic acid could be considered during surgery (see Supplementary Table 4, available at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101).

Consensus recommendations ("do not do"). After synthesis (see Supplementary Table 4), 5 "do not do" recommendations were identified (Table 4). The following recommendations were found in at least 2 CPGs, where the majority recommended against the intervention.

Therapeutic ultrasound and pharmacologic interventions (bisphosphonates, colchicine, methotrexate, diacerein). Three CPGs recommended against the use of therapeutic ultrasound for people with knee, hip, and/or polyarticular OA (12,21,27). Two CPGs recommended against the use of bisphosphonates, colchicine, hydroxychloroquine, and methotrexate in people with knee, hip, and/or hand OA (12,25). Similarly, 1 CPG recommended against the use of biologic disease-modifying

Table 3. Clinical practice guidelines included in the systematic review*

Author, year (ref.)	Title/type	Domain 1, scope and purpose	Domain 2, stakeholder involvement	Domain 3, rigor of development	Domain 4, clarity of presentation	Domain 5, applicability	Domain 6, editorial independence	Over all assessments core	Domains 2,3, and 6 combined value
RACGP, 2018 (12)	RACGP	97	58	81	89	35	79	83	73
Bannuru et al, 2019 (21)	OARSI	89	72	59	89	8	100	58	77
Kolasinski et al, 2020 (25)	ACR	97	89	85	86	21	63	75	79
AAOS, 2020 (10)	AAOS (GH joint)	94	61	90	69	15	92	75	81
AAOS, 2017 (11)	AAOS (hip OA)	97	61	92	53	42	71	75	75
Ariani et al, 2019 (13)	ISR	81	64	65	72	2	67	58	65
Kloppenburg et al, 2019 (24)	EULAR	78	81	77	81	6	79	67	79
Van Doormaal et al, 2020 (27)	–	75	67	81	75	42	33	58	60
Brosseau et al, 2018 (17)	OTTAWA	75	61	75	56	6	92	92	76
AAOS, 2015 (29)	AAOS (knee OA surgical)	100	81	96	100	21	100	92	92
AAOS, 2021 (19)	AAOS (knee OA non-arthroplasty)	94	61	96	100	35	92	92	83

* Values are the domain scores in % on the Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument. AAOS = American Academy of Orthopaedic Surgeons; ACR = American College of Rheumatology; GH = glenohumeral; ISR = Italian Society for Rheumatology; OA = osteoarthritis; OARSI = Osteoarthritis Research Society International; OTTAWA = Ottawa Panel; RACGP = Royal Australian College of General Practitioners; Ref. = reference.

antirheumatic drugs for people with hand OA (24). Two CPGs recommended against the use of diacerein for people with knee and/or hip OA (12,21).

Glucosamine and chondroitin combined. Two CPGs recommended against the use of glucosamine and chondroitin for knee, hip, and polyarticular OA (12,21). One CPG was unable to recommend for or against their combined use in people with OA of the glenohumeral joint (10). Moreover, 1 CPG conditionally recommended this intervention for people with knee OA, noting that further research is warranted to determine structural effects, patients' suitability, and cost-to-benefit ratio (13).

Postsurgical continuous passive motion (CPM) and postsurgical cryotherapy devices. Two CPGs recommended against the use of CPM after total joint replacement for patients with knee and/or hip OA, as research found no improvement in outcomes (27,29). One CPG recommended against the use of cryotherapy devices for patients after total knee arthroplasty (TKA) (29). In contrast, 1 CPG conditionally recommended the use of cryotherapy or cold packs following total shoulder replacement while acknowledging that this decision was based on the opinion of the working group and not strong/reliable evidence (10).

Table 4. Consensus recommendations*

Should do
Exercise therapies (strengthening, aerobics, and/or tai chi)
Education
Weight loss
Hand orthosis
Patient-centered care
Nonsteroidal antiinflammatory drugs (oral and topical)
Surgery
Could do
Balance exercises
Yoga
Assistive devices
Weight management and exercise
Cognitive behavioral therapy
Glucocorticoid injection (knee and hand OA)
Ultrasound-guided injections
Duloxetine
Preoperative physical therapy
Tranexamic acid
Neuraxial anesthesia
Pre- and postoperative physical therapy
Do not do
Therapeutic ultrasound
Bisphosphonates
Colchicine
Methotrexate
Diacerein
Glucosamine and chondroitin combined (hip and polyarticular OA)
Postsurgical continuous passive motion and cryotherapy devices
No consensus
Aquatic therapy
Balneotherapy
Manual therapy
Acupuncture
Massage therapy
Dry needling
Heat and cold therapy
Electrotherapy
Taping and braces
Shoe orthotics
Footwear
Topical capsaicin
Glucocorticoid injection (hip and polyarticular OA)
Intraarticular hyaluronic acid injections
Platelet-rich plasma injections
Stem cell injection
Acetaminophen
Oral opioids
Glucosamine and chondroitin, individually or combined (GH joint OA)
Nutraceuticals

* GH = glenohumeral; OA = osteoarthritis.

Recommendations with no consensus. The following were conflicting recommendations found in at least 2 CPGs: aquatic therapy; balneotherapy; massage therapy; manual therapy; acupuncture; dry needling; heat and cold therapy; electrotherapy; taping and braces; shoe orthotics; footwear; opioids; injections; topical capsaicin; glucosamine and chondroitin individually or combined for OA of the glenohumeral joint; acetaminophen; and nutraceuticals (see Supplementary Table 4).

DISCUSSION

Following quality assessment, 9 CPGs were rated as low quality, and 11 CPGs were high quality and included in the final synthesis. Overall, CPGs recorded the highest score for the AGREE II domain "scope and purpose" and the lowest score for the domain "applicability." This is consistent with the findings of similar systematic reviews (37,45). The AGREE II "applicability" domain assesses whether CPGs provide advice and/or tools for how to apply the guideline in practice, considers the facilitators, barriers, and resource implications, and includes monitoring and/or auditing criteria (38). Poor applicability has been identified as a barrier to the uptake of CPG recommendations into practice (37). Given that developing CPGs is expensive, development of fewer, higher-quality CPGs that focus on implementation (as reflected in higher scoring in the applicability domain on the AGREE II tool) is recommended.

Recommendations from 11 high-quality CPGs were that first-line care should be patient centered and include exercise therapy, patient education, and weight loss (if appropriate). These interventions can be beneficial in reducing pain and in improving function, performance, and quality of life outcomes (46–49). This should be followed by pharmacologic strategies such as NSAIDs in oral or topical form before considering surgical interventions as second- and third-line care. For people with hand OA, orthosis should be used for symptom relief and improved function and to prevent progression of degenerative changes (13,24). This synthesis of recommendations provides evidence-based guidance for clinicians on what should be delivered for best practice in OA care. These recommendations could also be used as a minimum

standard for health services to assess OA care and to provide the basis for clear consumer information about recommended OA management.

We identified a substantial number of recommendations that were inconsistent between CPGs, which may contribute to confusion among clinicians and to varied management. For example, manual therapy recommendations were inconsistent across the CPGs, with a majority recommending against, yet these are still widely used in clinical practice (50). Similarly, the majority of CPGs recommended against opioids, although 2 CPGs recommended that opioids can be considered in particular circumstances, when pain is severe or if patients do not respond, are intolerant, or contraindicated to NSAIDs, or when other alternatives have been exhausted (13,25). Despite this, opioids are often prescribed for persistent musculoskeletal pain conditions, including OA, and opioid-related harms are of increasing concern (51,52). Additional conflicting recommendations included acupuncture/dry needling, shoe orthotics, taping/braces, glucosamine and chondroitin, and injection therapies, e.g., platelet-rich plasma, stem cell, and intra-articular hyaluronic acid (for a comprehensive list of conflicting recommendations, see Supplementary Table 4, available at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101).

Many of these recommendations are routinely utilized in clinical care. Further high-quality trials are needed to determine their efficacy and/or their suitability for certain subgroups of individuals with OA in order to guide clinicians' practice. CPG recommendations vary, potentially due to differences in evidence included based on the year of CPG publication, assessment of evidence quality, and involvement of expert panels or societies members. For example, 1 CPG recommended against heat therapy, while another CPG recommended that it can be considered as an adjunctive management option for people with hip and/or knee OA (12,27). Both CPGs acknowledged limited evidence supporting this intervention; however, interpretation of evidence by the respective guideline development groups led to conflicting recommendations.

While exercise, weight management, and education were supported across the CPGs and have been recommended as first-line interventions for almost 2 decades, translation into practice remains an issue (53). In Western health care settings including Australia, Europe, the UK, and the US, a majority of patients do not receive care consistent with CPGs (54). Conservative management interventions are often overlooked in favor of pharmacologic and surgical care despite being associated with higher financial costs and risks (e.g., medication side effects or surgical complications) (6,30,55,56). Globally, utilization of exercise and education is low, while pharmacologic therapy and surgical referrals are common (54,57). In Australia, joint replacement surgeries are a substantial cost to the health care system, estimated at between $19,000 and $30,000 (Australian; between $13,000 and $20,600 US dollars) per patient for total knee or hip replacement, resulting in an expenditure of $1.2 billion (Australian) annually on both public and private hospital services (58–60); similar findings have been documented in the UK and the US (61,62). Surgery is a successful and cost-effective intervention for people with end-stage hip and knee OA, although overuse of surgery in patients who could benefit from conservative care remains a challenge (63–66).

Implementation of high-value care such as exercise and weight loss is needed (67). One way is through OA management programs such as OA models of care that operationalize what and how recommended care should be delivered (68). In order to achieve better care, priorities include training/education of OA health care workers, identifying core skill sets and competencies, developing resources, and creating a framework to improve quality of care (69). Outcomes from models of care suggest that this has been an effective way to translate evidence into practice, although definitive evidence for OA management is currently lacking (70). Structured exercise therapies, with or without education and dietary interventions, are cost effective and clinically effective (71). Implementation research that operationalizes recommended care, especially for populations who experience a higher burden of OA, including low- and middle-income countries and First Nations people, is a pressing future priority (72,73). We excluded CPGs that were not published in the English language and that addressed assessment and/or diagnosis of OA without management or treatment recommendations. It is possible that we may have overlooked other CPGs containing recommendations related to OA care. To mitigate this risk, all authors checked the list of full-text CPGs to augment the search process, including authors who are expert clinician researchers in the field of OA (MMD and PC).

Strengths of this systematic review include the involvement of a multidisciplinary team and the use of the AGREE II tool. The research team defined high-quality CPGs as ≥60% in the 3 domains of interest on the AGREE II instrument. These domains are consistent with other high-quality musculoskeletal reviews (36), while 60% is supported by other arthritis and osteoporosis reviews (41,42). Grading of interventions and consensus statements (e.g., "should do," "could do," "do not do," or "unsure") were based on the language used in CPGs and required interpretation by the research team. Consensus statements were cross-checked by 2 authors (SB and IL) to mitigate the risk of misinterpretation. It is important to acknowledge that the majority of the literature regarding OA management is based on hip and knee OA, often neglecting OA in other joints. For transparency, we have listed the affected joint for each recommendation in Supplementary Tables 3 and 4, available on the *Arthritis Care & Research* website at http://onlinelibrary.wiley.com/doi/10.1002/acr.25101.

In conclusion, 7 consistent "should do" recommendations were identified across the 11 CPGs. Exercise therapy, education, and weight loss (if relevant) should be recommended for people with OA before considering pharmacologic or surgical

interventions, with care being patient centered. Hand orthosis should be considered for those with hand OA. These core tenets of OA care can be used by health care providers to improve consistency and quality of OA care.

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All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be submitted for publication. Ms. Conley had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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