

Article Title: Quantity and Quality of Rheumatoid Arthritis and Osteoarthritis Clinical Practice Guidelines: Systematic Review and Assessment Using AGREE II

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Abstract

Objectives: The purpose of this study was to identify the quantity and evaluate the quality of clinical practice guidelines for the treatment and/or management of rheumatoid arthritis (RA) and osteoarthritis (OA).

Methods: We conducted a systematic review, searching MEDLINE, EMBASE and CINAHL databases from 2008 to 2018. The Guidelines International Network website was also searched. Eligible guidelines were assessed using the AGREE II instrument.

Results: From 525 unique search results, 12 RA guidelines and 3 OA CPGs were found to be eligible. Scaled domain percentages from highest to lowest were clarity of presentation (89.8%), scope and purpose (88.0%), stakeholder involvement (67.6%), rigour of development (62.2%), editorial independence (56.4%) and applicability (53.3%). Quality varied within and across guidelines. None of the 15 guidelines were recommended by both appraisers; 11 were recommended as Yes or Yes with modifications.

Conclusions: A number of guidelines for the treatment and/or management of RA or OA are available to support informed decision-making among healthcare practitioners and patients. CPGs were of variable quality; those that received lower scaled domain percentages or overall recommendations could be improved by using the AGREE II instrument, or insight from tools that are available to support guideline development and implementation.

Background

Arthritis is one of the leading causes of disability in North America; approximately 25% of the US adult population suffers from arthritis [1, 2]. Osteoarthritis (OA), a degenerative condition that most commonly affects the joints of the knee, hip, hands and spine, is the most prevalent form of arthritis [3]. Inflammatory forms of arthritis differ from OA in that joint damage results from inflammation rather than cartilage degeneration [3]. Most forms of

inflammatory arthritis can also be classified as autoimmune diseases, including rheumatoid arthritis (RA) [3]. Symptoms often observed in arthritis include swelling, pain, stiffness and decreased range of motion [1]. In severe cases, these symptoms can result in chronic pain, permanent joint damage and decreased quality of life [1].

Nonsteroidal anti-inflammatory drugs (NSAIDs) and disease-modifying antirheumatic drugs (DMARDs) are the most commonly used drugs to relieve arthritis-related pain, swelling and stiffness [2]. Common joint procedures to combat debilitating arthritis pain include arthroscopy, joint resurfacing, osteotomy, synovectomy, arthrodesis and total joint replacement [2]. Complementary and alternative treatments (CAM) for dealing with arthritis-related pain include acupuncture, massage therapy, transcutaneous electrical nerve stimulation (TENS) and supplements and herbs [2]. For OA, a multimodal approach is common, with most treatments geared towards pain management and improving function and mobility [4]. When treated early and aggressively, RA patients are more likely to achieve remission. Methotrexate is the most commonly used DMARD for RA. Overall, medications for RA fall within two broad groups: firstly, those that help control RA symptoms, and secondly, medications for preventing long-term damage [4].

Arthritis is common among people with other chronic conditions. OA is associated with increased rates of comorbidity, including obesity, diabetes and heart disease [5]. Hip and knee OA, in particular, cause the largest burden in terms of pain, stiffness and disability, often necessitating prosthetic joint replacement in the most severe cases [6]. Moreover, a greater proportion of individuals with OA are reported to have depression, compared to the general population [7]. Psychiatric disorders associated with RA are also common; approximately 17% of RA patients suffer from depression, which is significantly higher

compared to rates of depression within the general population. From 1987 to 2012, men with RA were hospitalized for depression at a greater rate than men without RA [8]. In this same time frame, patients with RA were also hospitalized at a greater rate for diabetes mellitus than those without this condition [8]. In addition to significant health burdens imposed by RA and OA, there are notable work and employment losses associated with these diseases. Due to the progressive nature of RA, approximately 20 to 70% of individuals who were working at the inception of their RA were disabled after 7 to 10 years [9]. The indirect cost of RA attributed to lost productivity has been estimated to be almost three times greater than the costs of treating the disease [10].

Healthcare professionals often refer to evidence-based CPGs to determine whether use of a given therapy is recommended for specific clinical condition and to guide informed and shared decision-making with patients regarding associated benefits and risks of different therapy options [11, 12]. Previous studies have assessed the credibility of guidelines pertaining to arthritis, including RA (n =6), OA (n = 6), juvenile idiopathic arthritis (n = 1) and psoriatic arthritis (n = 1) [13,14,15,16,17,18,19,20,21,22,23,24]. The ability to facilitate treatment with the aid of evidence-based CPGs is important, as it is estimated that degenerative joint disease disorders such as OA will affect at least 130 million individuals globally by 2050 [25]. Moreover, mortality hazards are 60 to 70% higher in patients with RA in comparison to the general population, and these indicators continue to worsen [26]. Thus, the purpose of this study is to identify the quantity and evaluate the quality of CPGs for the treatment and/or management of RA and OA.

Methods

Approach

A systematic review was conducted to identify RA and OA guidelines using standard methods [27] and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) criteria [28]. A protocol was registered with PROSPERO, registered number CRD42019132447. Eligible guidelines were appraised with the Appraisal of Guidelines for Research and Evaluation II (AGREE II) instrument, a commonly-used and validated tool that has been validated [29]. The instrument consists of 23 items grouped in six domains: scope and purpose, stakeholder involvement, rigour of development, clarity and presentation, applicability and editorial independence.

Eligibility criteria

Eligibility criteria for RA and OA CPGs were based on the Population, Intervention, Comparison and Outcomes framework. Eligible populations were adults aged 19 years and older with RA and OA. With respect to interventions, we only included guidelines that provided treatment and/or management of RA and OA in order to determine what categories of therapies were most commonly recommended. Comparisons pertained to the assessed quality of RA and OA guidelines. Outcomes were AGREE II scores which reflect guideline content and format. The following conditions were also applied to define eligible guidelines: developed by non-profit organizations including academic institutions, government agencies, disease-specific foundations or professional associations or societies; published in 2008 or later, which provides a decade-long window into treatment/management guidelines for RA and OA providing at least 5 years since the publication of AGREE II which provides developers with criteria for developing high-quality guidelines; English language; and either publicly available or could be ordered through our library system. Publications in the form of

consensus statements, protocols, abstracts, conference proceedings, letters or editorials; based on primary studies that evaluated RA and OA management or treatment; or focused on RA and OA curriculum, education, training, research, professional certification or performance were not eligible.

Searching and screening

MEDLINE, EMBASE and CINAHL were searched on October 18, 2018, from 2008 to October 18, 2018 inclusive. The search strategy (Supplementary Table 1) included Medical Subject Headings and keywords that reflect terms commonly used in the literature to refer to RA and OA [30]. We also searched the Guidelines International Network, a repository of guidelines [<https://www.g-i-n.net/>] using keyword searches restricted based on the eligibility criteria including “arthritis”. AMA and another research assistant screened titles, abstracts and full-text items when warranted, to confirm eligibility. JYN reviewed the screened titles, abstracts and full-text items to standardize screening and helped to discuss and resolve selection differences between the two screeners.

Data extraction and analysis

The following data were extracted from each guideline and summarized: date of publication, country of first author and type of organization that published the guideline (academic institutions, government agencies, disease-specific foundations or professional associations or societies). Most data were available in the guideline; to assess applicability, the website of each developer was browsed and searched for any associated knowledge-based resources in support of implementation.

Guideline quality assessment

The AGREE II instrument was used to assess each eligible CPG [29]. A preliminary pilot test of the AGREE II instrument was conducted whereby JYN, AMA and the other research assistant independently assessed three guidelines in order to identify and resolve any discrepancies in the interpretation and usage of the AGREE II instrument. AMA and another research assistant then independently evaluated all eligible guidelines. JYN resolved any differences through discussion with the two assessors. Average appraisal scores were calculated by averaging the ratings for all 23 items of each appraiser of a single guideline, followed by taking the average of this value for both appraisers. Average overall assessments were calculated as the average of both appraisers' "overall guideline assessment" scores for each guideline. Scaled domain percentages were calculated to compare results between domains by adding both appraisers' ratings of domain items, and scaling by maximum and minimum possible domain scores, before converting the result into a percentage. Average appraisal scores, average overall assessments and scaled domain percentages for each guideline were tabulated for comparison.

Results

Search results (Fig. 1)

Searches yielded 637 items, 525 of which were unique, and following screening 488 titles and abstracts were eliminated, leaving 37 full-text guidelines that were considered. Of those, 22 were not eligible, as they could not be retrieved ($n = 15$); newer guideline versions were available ($n = 6$) or did not meet other eligibility criteria ($n = 1$), leaving a total of 15 guidelines eligible for review.

Guideline characteristics (Table 1)

Eligible guidelines were published from 2008 to 2018 in the UK (n = 7), the USA (n = 3), the Netherlands (n = 1), Portugal (n = 1), Hong Kong (n = 1), Canada (n = 1) and Japan (n = 1) [35,36,37,38,39,40,41,42,43,44,45,46,47,48,49]. The guidelines were funded and/or developed by professional associations or societies (n = 12) and government agencies (n = 3). The guidelines were funded and/or developed by professional associations or societies (n = 12) and government agencies (n = 3). Common therapies mentioned by these guidelines included DMARD therapy (n = 10), biologic therapy (n = 10), CAM therapies (n = 7), NSAIDs (n = 5), arthroplasty or arthroscopy (n = 3) and analgesics (n = 2). Recommendations relating to these therapies were made in all guidelines and included DMARD therapy (n = 10), biologic therapy (n = 10), NSAIDs (n = 5), analgesics (n = 2), arthroplasty or arthroscopy (n = 3) and CAM therapies (n = 5).

Average appraisal scores, average overall assessments and recommendations regarding use of guidelines

Average appraisal scores, average overall assessments and recommendations regarding use for each guideline are shown in Supplementary File 2. The average appraisal scores for each of the 15 guidelines ranged from 2.9 to 6.1 on the 7-point Likert scale (where 7 equals strongly agree that the item is met); 12 guidelines achieved or exceeded an average appraisal score of 4.0, and 11 guidelines achieved or exceeded an average appraisal score of 5.0. Average overall assessments for the 15 guidelines ranged between 3.5 (lowest) and 6.5 (highest), including 11 guidelines equalling or exceeding a score of 5.0.

Overall recommendations

None of the 15 guidelines were recommended by both appraisers. Appraisers agreed in their overall recommendation for 6 of 15 both assessing these CPGs as “Yes with modifications”

[31,32,33, 36, 37, 44]. Of the remaining 9 guidelines, 4 were rated by the two appraisers as “No” and “Yes with modifications” [34, 38, 42, 45], while 5 guidelines were rated as “Yes” and “Yes with modifications” [35, 39,40,41, 43] (Table 2).

Scaled domain percentage quality assessment

With regard to scaled domain percentages, scope and purpose scores ranged from 58.3 to 97.2%, stakeholder involvement scores ranged from 36.1 to 91.7%, rigour-of-development scores ranged from 16.7 to 90.6%, clarity-of-presentation scores ranged from 77.8 to 100.0%, applicability scores ranged from 14.6 to 87.5% and editorial independence scores ranged from 0.0 to 91.7% (Table 3).

Scope and purpose

All guidelines generally provided specific descriptions of overall objectives, including the health intent (i.e. treatment/management), and the target patient population to whom the guideline applies. Health questions covered by the guidelines were similarly well-defined, with the exception of one guideline [38].

Stakeholder involvement

Most guidelines provided detailed descriptions of the members of the guideline development group, often identifying individual disciplines and expertise, institutional associations, geographical location, and occasionally descriptions of members’ roles in the guideline development group [31,32,33, 35,36,37, 39,40,41, 44], while guidelines that scored lower in this item tended to omit a combination of these elements [34, 38, 42, 43, 45]. Approximately half of the guidelines incorporated the views and preferences of the target population [31, 33, 35, 37, 39,40,41, 44] while the remaining guidelines did not [32, 34, 36, 38, 42, 43, 45]. Most

guidelines provided clear descriptions of the intended guideline audience, for example, type of practitioner or specialty [31,32,33,34,35,36,37, 39,40,41, 43,44,45], while some guidelines provided fewer details about target users [38, 42].

Rigour of development

Systematic methods were used to search for evidence and the criteria for selecting the evidence were well-reported in about half of the guidelines, which typically provided the full search strategies performed to gather evidence [31,32,33, 35,36,37, 39]. Other guidelines did not offer full search strategies and methods employed to identify evidence for use in the guideline development process [34, 38, 40,41,42,43,44,45]. The strengths and limitations of the body of evidence were clearly described in most guidelines, consisting of explanations of how the evidence was assessed for bias and interpreted by guideline developers [31,32,33, 35,36,37, 39,40,41]. The reporting of methods for formulating the recommendations varied across guidelines; while some guidelines provided considerable detail of the recommendation development process and how consensus was reached [31,32,33, 35,36,37, 39], other guidelines provided minimal or no information on this process [34, 38, 40,41,42,43,44,45]. All authors considered some health benefits, side effects and/or risks in formulating their recommendations, although to varying degrees, and those that scored particularly high on this item offered supporting data and reporting of benefits and harms and trade-offs between these elements [31, 33,34,35,36,37, 39,40,41,42,43,44], while other guidelines were not as detailed in these areas [32, 38, 45]. Almost all guidelines provided an explicit link between their recommendations and the supporting evidence, with the exception of two guidelines in which the association between recommendations and supporting evidence was not as clearly presented [38, 45]. While most guidelines stated that expert external review was completed prior to publication [31,32,33, 35,36,37, 39,40,41,42, 45], a few did not [34, 38, 43, 44].

Some guidelines failed to mention the purpose and intent for, or the methods undertaken in the external review process [31, 40,41,42, 45]. Most guidelines provided a procedure for updating the guideline [31,32,33, 35,36,37,38,39,40,41, 43, 44] and, among those, three guidelines provided a detailed methodology including explicit time intervals and criteria for updates [39,40,41].

Clarity of presentation

In general, all guidelines provided specific and unambiguous recommendations. However, many typically lacked some of the following criteria: identification of the intent/purpose of the recommendation, and caveats or qualifying statements to be considered before proceeding with the recommended action [32, 34, 38, 39, 45]. All 15 guidelines scored highly in presenting different options for the management of the condition or health issue, resulting in a high scaled domain percentage in this category. Key recommendations were also generally very easily identifiable across guidelines, with guidelines often grouping recommendations or presenting guideline summaries and algorithms for use [31,32,33, 35, 39,40,41, 43,44,45].

Applicability

The majority of guidelines described facilitators and barriers to the application of the recommendations, although these descriptions varied in depth [31,32,33,34,35, 37, 39,40,41, 43,44,45]. All guidelines included advice and/or tools to support the implementation of recommendations in practice, with the exception of one [37]. Many guidelines addressed the potential resource implications of executing the recommendations, though generally not in great detail and sometimes lacking description of the methodology by which cost information was sought, for instance [31,32,33,34,35,36,37, 39,40,41, 43, 44]. Four guidelines provided

monitoring and auditing criteria [34, 39, 43, 44], while 11 guidelines contained little to no such information in this area [31,32,33, 35,36,37,38, 40,41,42, 45].

Editorial independence

The reporting of the funding body or competing interests of the guideline developers varied across guidelines. Several guidelines that declared a funding source did include a statement specifically addressing whether or not the funding source influenced the content of the guideline [31, 33, 35, 36, 39, 42].

No authors explicitly stated that no funding supported the development of their guideline. Guidelines also varied in their reporting of competing interests. The majority of guidelines recorded and addressed competing interests, but among these, most did not specify how potential competing interests were identified or considered, or how they may have influenced the guideline development process [31,32,33, 36, 39,40,41,42,43]. Several guidelines did not record nor address competing interests in any capacity [34, 37, 38, 45].

Discussion

The purpose of this review was to systematically search for, and assess the quantity and quality of, CPGs for the treatment and/or management of RA and OA. We identified 15 eligible CPGs published between 2008 and 2018. Guideline quality was assessed using the 23-item AGREE II instrument; it was found that this varied across guidelines overall and by domain. Eleven guidelines scored 5.0 or higher in both average appraisal score and average overall assessment [31,32,33, 35,36,37, 39,40,41, 43, 44], and 4 guidelines scored 4.0 or lower in both of these metrics [34, 38, 42, 45] (1=strongly disagree; 7=strongly agree that criteria are met).

To our knowledge, no previous studies have assessed the quantity and quality of guidelines on both RA and OA therapies. Thus, this is the first study to assess the credibility and nature of guidelines providing treatment and/or management recommendations for both RA and OA. In this study, the scaled domain percentages of this subset of CPGs, from highest to lowest were as follows: clarity of presentation (89.8%), scope and purpose (88.0%), stakeholder involvement (67.6%), rigour of development (62.2%), editorial independence (56.4%) and applicability (53.3%). Previous studies that have conducted appraisals of arthritis CPGs have reported similar findings in terms of the scoring of AGREE II domains, whereby scope and purpose items are generally well-addressed [16, 17, 22], while three domains that commonly score more poorly include stakeholder involvement, editorial independence and applicability [14,15,16,17,18, 20,21,22,23,24]. Thus, this similar variable quality of arthritis guidelines is not uncommon.

By describing the quantity and quality of CPGs for the treatment and/or management of RA and OA, this study revealed that a number of guidelines are available to support informed and shared decision-making between patients and health care professionals. Despite this, the quality of this subset of CPGs varied across domains, both within individual guidelines, and across them. All guidelines identified in this study, including those we found to be of highest quality, could be improved by making modifications to fulfil criteria established by the AGREE II instrument. This finding should be considered by those who will produce guidelines for the treatment and/or management of RA or OA in the future, and to guideline developers who aim to update their existing guidelines. In addition to the AGREE II instrument, numerous guideline development tools are available to support guideline development and application [46,47,48,49].

Strengths and limitations

Strengths of this study included a comprehensive systematic review methodology used to identify eligible CPGs for the treatment and/or management of RA and OA, in addition to the use of the AGREE II instrument, a tool that has been validated for guideline quality appraisal [29]. A potential limitation to the findings presented in this study is that guidelines were independently assessed by two appraisers rather than four as recommended by AGREE II manual. To minimize this limitation's effect and standardize scoring, JYN, AMA and another research assistant conducted an initial pilot-test consisting of three separate guidelines in order to achieve consensus regarding the application of the AGREE II instrument. Following appraisal of the eligible guidelines, JYN met with AMA and the additional research assistant to resolve discrepancies without unduly modifying legitimate discrepancies.

Conclusions

This study identified a total of 15 CPGs published between 2008 and 2018 for the treatment and/or management of RA and OA. Therapies recommended across this subset of CPGs included: DMARD therapy, biologics, NSAIDs, surgical interventions and CAM. Appraisal of these guidelines using the AGREE II instrument revealed that quality varied within and across guidelines. Guidelines with higher AGREE II scores and favourable overall recommendations could be used by patients and health care professionals as reference in discussions and decision making procedures about RA and OA therapies. To support the application and availability of high-quality RA and OA guidelines, those that achieved variable or lower scaled domain percentage and overall recommendations could be improved by adhering to criteria established by the AGREE II instrument, in addition to tools available to support guideline development and dissemination. Although a number of RA and OA guidelines are available to support informed and shared decision-making between patients

and health care professionals, the reporting of recommendations should still be improved in accordance with the AGREE II instrument in cases where the quality of particular domains are subpar. This is important in order to ensure that health care professionals and patients with RA or OA are provided with credible guidelines that are all subject to the same standards of reporting.

Abbreviations

AGREE II: Appraisal of Guidelines for Research & Evaluation II

CAM: Complementary and Alternative Medicine

DMARD: Disease-Modifying Antirheumatic Drug

NSAID: Nonsteroidal anti-inflammatory drug

OA: Osteoarthritis

PICO: Patients, Intervention, Comparison and Outcomes

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

RA: Rheumatoid arthritis

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Data and Materials Availability

All relevant data are included in this manuscript.

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Contributions

JYN: designed the study, collected and analysed the data, drafted the manuscript and gave final approval of the version to be published.

AMA: assisted with the collection and analysis of data, revised the manuscript critically and gave final approval of the version to be published.

Ethics declarations

Ethics Approval and Consent to Participate

This study involved a systematic review of peer-reviewed literature only; it did not require ethics approval or consent to participate.

Consent for Publication

All authors consent to this manuscript's publication.

Conflict of Interest

Jeremy Y Ng declares that he has no conflict of interest. Ashlee M Azizudin declares that she has no conflict of interest.

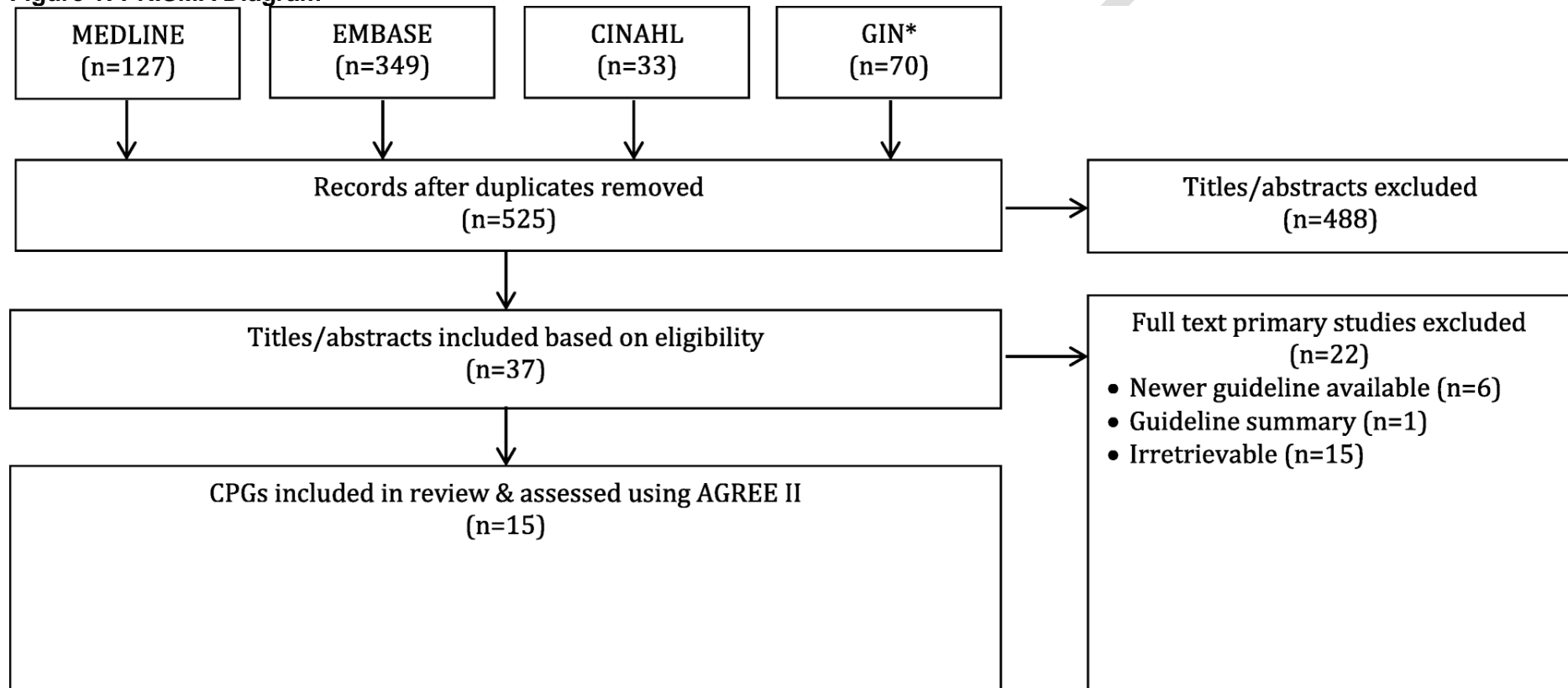
Supplementary Information

Supplementary File 1: MEDLINE Search Strategy for Arthritis Treatment and/or Management Guidelines Executed October 19, 2018

Supplementary File 2: Average Appraisal Scores and Average Overall Assessments of Each Guideline

Figures

Figure 1: PRISMA Diagram



Tables

Table 1: Table 1 Characteristics of Eligible Guidelines

Guideline	Country (First Author)	Developer	Treatment category mentioned	Guideline topic
NICE 2018 [31]	UK	National Institute for Health and Care Excellence	DMARD therapy, biologic therapy, NSAIDs, analgesics, CAM	Management of Rheumatoid Arthritis in Adults
Cibulka 2017 [32]	USA	American Physical Therapy Association, Journal of Orthopaedic & Sports Physical Therapy	Manual therapy, electrotherapy (ultrasound)	Hip Pain and Mobility Deficits in Hip Osteoarthritis
Lau 2015 [33]	Hong Kong	Asia Pacific League of Associations for Rheumatology	DMARD therapy, biologics, general CAM, electrotherapy (TENS)	Treatment Recommendations for Rheumatoid Arthritis
Bornstein 2014 [34]	Canada	Canadian Rheumatology Association	DMARDs, biologics	Pharmacological Management of Rheumatoid Arthritis
NICE 2014 [35]	UK	National Institute for Health and Care Excellence	NSAIDs, opioids, assistive devices, arthroscopy, CAM	Management of Osteoarthritis in Adults
AAOS 2013 [36]	USA	The American Academy of Orthopaedic	NSAIDs, opioids, corticosteroids, surgical interventions (arthroscopy, osteotomy),	Treatment of Osteoarthritis of the Knee

Guideline	Country (First Author)	Developer	Treatment category mentioned	Guideline topic
		Surgeons	Acupuncture, electrotherapy, manual therapy, nutraceuticals, yoga	
Singh 2012 [37]	USA	American College of Rheumatology	DMARDs, biologics	Use of Disease-Modifying Antirheumatic Drugs and Biologic Agents in Treatment of Rheumatoid Arthritis
Fonseca 2011 [38]	Portugal	Portuguese Society of Rheumatology	DMARDs, biologics	Use of Biological Agents in Rheumatoid Arthritis
SIGN 2011 [39]	Scotland	Scottish Intercollegiate Guidelines Network	DMARDs, biologics, analgesics, NSAIDs, corticosteroids, occupational therapy, tai chi, hydrotherapy, thermotherapy, electrotherapy (laser therapy, ultrasound), dietary supplements, general CAM	Management of Early Rheumatoid Arthritis
Deighton 2010 [40]	UK	British Society for Rheumatology, British Health Professionals in Rheumatology	DMARDs, biologics	Rheumatoid Arthritis Guidelines on Eligibility for Biological Therapy
Ding 2010 [41]	UK	British Society for Rheumatology, British Health Professionals in	DMARDs, biologics	Rheumatoid Arthritis Guidelines on Safety of Anti-TNF Therapies

Guideline	Country (First Author)	Developer	Treatment category mentioned	Guideline topic
		Rheumatology		
Koike 2009 [42]	Japan	Japan College of Rheumatology	Biologics (tocilizumab)	Use of Tocilizumab in Rheumatoid Arthritis
Luqmani 2009 [43]	UK	British Society for Rheumatology, British Health Professionals in Rheumatology	DMARD therapy, biologic therapy, NSAIDs, anti-depressants, surgical interventions, occupational therapy, joint protection assistive devices, steroid injections, physiotherapy, arthroplasty	Management of Rheumatoid Arthritis (After First 2 Years)
Chakravarty 2008 [44]	UK	British Society for Rheumatology, British Health Professionals in Rheumatology	DMARDs	Disease-Modifying Anti-Rheumatic Drug Therapy for Rheumatoid Arthritis
KNGF 2008 [45]	Netherlands	Royal Dutch Society for Physical Therapy	Hydrotherapy, electrotherapy, manual therapy (massage, chiropractic), thermotherapy	Physical Therapy in Patients with Rheumatoid Arthritis

Table 2 Overall Recommendations for Use of Appraised Guidelines

Guideline	Appraiser 1	Appraiser 2
NICE 2018 [31]	Yes with modifications	Yes with modifications
Cibulka 2017 [32]	Yes with modifications	Yes with modifications
Lau 2015 [33]	Yes with modifications	Yes with modifications
Bornstein 2014 [34]	Yes with modifications	No
NICE 2014 [35]	Yes with modifications	Yes
AAOS 2013 [36]	Yes with modifications	Yes with modifications
Singh 2012 [37]	Yes with modifications	Yes with modifications
Fonseca 2011 [38]	Yes with modifications	No
SIGN 2011 [39]	Yes with modifications	Yes
Deighton 2010 [40]	Yes with modifications	Yes
Ding 2010 [41]	Yes with modifications	Yes
Koike 2009 [42]	No	Yes with modifications
Luqmani 2009 [43]	Yes with modifications	Yes
Chakravarty 2008 [44]	Yes with modifications	Yes with modifications
KNGF 2008 [45]	No	Yes with modifications

Table 3 Scaled Domain Percentages for Appraisers of Each Guideline

Guideline	Domain score (%)					
	Scope and purpose	Stakeholder involvement	Rigour of development	Clarity of presentation	Applicability	Editorial independence
NICE 2018 [31]	88.9	63.9	79.2	97.2	54.2	70.8
Cibulka 2017 [32]	88.9	58.3	81.3	83.3	58.3	70.8
Lau 2015 [33]	94.4	72.2	83.3	94.4	52.1	75.0
Bornstein 2014 [34]	91.7	44.4	27.1	77.8	66.7	0.0
NICE 2014 [35]	97.2	77.8	90.6	94.4	62.5	83.3
AAOS 2013 [36]	86.1	58.3	81.3	94.4	31.3	70.8
Singh 2012 [37]	88.9	88.9	86.5	91.7	35.4	4.2
Fonseca 2011 [38]	58.3	36.1	16.7	77.8	14.6	8.3
SIGN 2011 [39]	88.9	75.0	84.4	77.8	72.9	62.5
Deighton 2010 [40]	97.2	91.7	71.9	97.2	66.7	91.7
Ding 2010 [41]	94.4	91.7	68.8	94.4	54.2	91.7

Guideline	Domain score (%)					
	Scope and purpose	Stakeholder involvement	Rigour of development	Clarity of presentation	Applicability	Editorial independence
Koike 2009 [42]	75.0	52.8	34.4	86.1	27.1	58.3
Luqmani 2009 [43]	94.4	55.6	46.9	100.0	87.5	75.0
Chakravarty 2008 [44]	88.9	88.9	57.3	91.7	75.0	83.3
KNGF 2008 [45]	86.1	58.3	22.9	88.9	41.7	0.0