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Practice Guidelines and Consensus Recommendations**

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Exercises for Hand Osteoarthritis: A Systematic Review of Clinical Practice Guidelines and Consensus Recommendations

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Exercises for Hand Osteoarthritis: A Systematic Review of Clinical Practice Guidelines and Consensus Recommendations

Background: Individuals with hand osteoarthritis (OA) often experience hand pain, joint stiffness and reduced grip strength, which affect performance of everyday functional tasks. There is a need to evaluate evidence-based rehabilitation strategies that aim to lessen the burden and improve the quality of life of people living with hand OA.

Objectives: Our objectives were to: (1) identify guidelines and consensus recommendations on hand OA management to ascertain whether hand exercises are recommended as part of best practice; (2) identify the type and dosage of exercises recommended regarding frequency, intensity and duration and (3) provide a summary of exercise recommendations for the management of hand OA.

Methods: This systematic review followed the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines and was registered on Prospero (CRD42018086440). Seven published databases and 20 grey literature sources were searched (January 1997- January 2019). Quality assessment was conducted with the Appraisal of Guidelines, Research and Evaluation (AGREE) II instrument and, using a narrative approach, evidence was synthesized based on the levels of evidence and strength of recommendations.

Results: Eight guidelines and consensus recommendations were identified and included. Evidence from seven guidelines was rated between fair to high quality. Five out of seven guidelines recommended exercises for the management of hand OA. Limited information on exercise dosage (frequency, intensity and duration) was reported. Three strong and two weak recommendations for using different hand exercises were proposed in this systematic review.

Conclusion: Available guidelines and consensus recommendations on hand OA recommend exercises as part of current best practice for hand OA management. There is strong evidence to support the recommendation of strengthening, stretching and joint mobility exercises for the management of the hand OA. These recommended exercises, however, lacked specific details regarding the

type and dosage (frequency, intensity and time) for optimal uptake, which therefore need to be established through research.

Keywords: Exercises; Guidelines; Hand osteoarthritis; Recommendations

Introduction

Hand Osteoarthritis (OA) is a globally recognized disabling condition with a high prevalence in women and the elderly [1, 2]. Individuals with hand OA often experience pain, finger joint stiffness and reduced grip strength [3]. The impact of hand OA can be clearly identified in relation to reduced daily activity performance and restricted societal participation, with associated cost to healthcare and social security [4]. The Centre for Disease Control and Prevention (CDC) highlights the need for further research to evaluate current and emerging evidence-based management interventions to help lessen the burden of the disease and improve the quality of life for individuals living with hand OA[5]. Several rehabilitation interventions, such as self-management strategies, joint protection interventions, education programmes, low impact physical activity and muscle strength training exercises are reported as effective in managing general symptomatic OA [6, 7]. Amongst these, substantial evidence supports the recommendation of exercises [8]. Despite the acknowledged benefits of exercise, agreement is lacking on its specific benefits for people with hand OA [9, 10, 11]. Whilst some authors have criticized exercise for having minimal or no beneficial effect on hand muscle strength and range of motion [12], others report moderate to high effectiveness in improving pain, daily activity performance and grip strength [13]. A recent Cochrane review, which aimed to evaluate the harms and benefits of exercises in hand OA, concluded that exercises are beneficial for improving hand pain, finger joint stiffness and hand function and cause no adverse effects[11]. The Cochrane review also highlighted the lack of consensus among researchers on the type and the content of

exercise interventions most beneficial to this patient population. Currently, there is no clear indication or agreement of an optimal exercise intervention effective for people with hand OA.

Following an evidence-based perspective, such enquiries can only be made from credible sources that have considered and synthesized findings from the best available evidence, expert opinions and patient preferences. From the literature, clinical practice guidelines, referred to as “guidelines” from here, are recognized as the only valuable source for such synthesized evidence [14, 15]. Guidelines are written statements developed systematically with the aim of assisting clinicians and patients to decide on the optimal health care for a specific clinical circumstance [16] and are the appropriate evidenced-based information source to aid health professionals in their clinical decision making [17]. A few systematic reviews of guidelines on OA [8, 10, 18] are available but none has specifically focused on providing a summary of recommendations on exercise management for hand OA, hence a systematic review of guidelines on hand exercise interventions for hand OA management is warranted to inform the clinical management of the disease. The specific objectives of this systematic review were to:

- (1) Identify guidelines and consensus recommendations on hand OA management to ascertain whether hand exercises are recommended as part of best practice
- (2) Identify the type and dosage of exercises recommended regarding frequency, intensity and duration
- (3) Provide a summary of exercise recommendations for the management of hand OA.

Methods

Protocol and registration

The recommended Preferred Reporting Items for Systematic Review and Meta-analysis (PRISMA) approach was followed in the conduct of this systematic review [19]. The present systematic review protocol was published [20] and its details registered on PROSPERO

(https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=86440).

Eligibility criteria

This present systematic review considered guidelines and evidence-based recommendations on any exercise intervention targeted at the hand for the management of hand OA management. Table 1 shows the detailed inclusion and exclusion criteria.

[Please Insert Table 1 here]

Information sources

Seven published databases and 20 grey literature sources as previously published [20] were searched from January 1997 to December 2017 (see Supplementary File 1).

Additionally, a literature search update was conducted from December 2017 to January 2019 to ensure that all relevant guidelines published during the process of preparing the manuscript were identified.

Search

The comprehensive 3-step search approach [21] described in detail in the published protocol [20] was followed. The first limited search was undertaken to: (1) scope the literature for available records relevant to the review question; (2) analyse the text words contained in the titles and abstracts and (3) pilot the developed search strategy.

With the support of a librarian (PS), this initial search was refined, and the second and

main search was conducted in CINAHL (Appendix 1), MEDLINE (Appendix 2), AMED (Appendix 3), Cochrane library (Appendix 4), Web of Science (Appendix 5) and PEDro (Appendix 6) databases. Additionally, all the identified grey literature sources were also searched. Records published in the English language between January 1997 and December 2017 were applied as limiters. The third step was the search of citations, bibliographies and reference list of all included guidelines to achieve a more comprehensive search.

Study selection and Data collection process

The lead author (BS) conducted all database searches, managed the records identified with Endnote X8 (Clarivate Analytics, PA, USA) and screened for initial eligibility. All titles and abstracts were screened against the broad inclusion and exclusion criteria by BS and verified by MS. Full text articles were screened against the detailed inclusion and exclusion criteria independently by BS and MS and any disagreement was resolved through discussion with the third author (JA). As previously published [20], data extraction was performed by BS and independently verified by MS for consistency, accuracy and completeness using a predetermined form (See Supplementary File 2).

Data items

The reviewers defined PICO as follows: P-Population (hand Osteoarthritis); I-Intervention (hand exercises); C-Comparator (physical management strategies other than exercise [8]; O-Outcome (clinical practice guidelines). The reviewers also assumed “Risk of Bias” to be Quality Assessment, hence in the present reporting, using the PRISMA checklist as a guide, all topics describing “risk of bias” were replaced with “quality assessment”.

Quality assessment of Guidelines

The AGREE II instrument (<https://www.agreetrust.org/resource-centre/>) is a globally accepted and transparent tool for evaluating the quality of guidelines [22, 23]. It is a 23-item instrument arranged into six domains: scope and purpose (3 items), stakeholder involvement (3 items), rigor of development (8 items), clarity of presentation (3 items), applicability (4 items), and editorial independence (2 items). The instrument also includes two additional assessment items on “overall guideline assessment” which allows reviewers to make overall judgments about the use of the appraised guideline. The AGREE II instrument was used for the quality assessment of all included guidelines and consensus recommendations due to its established construct validity [24] and satisfactory inter-rater reliability [25]. BS and MS performed the quality appraisal and any disagreement that arose was arbitrated through discussion among all three reviewers (see Supplementary File 3 for details of the quality appraisal).

Individual Domain Assessment

Each AGREE II domain was scored by summing up all individual item scores and scaling the total as a percentage of the maximum possible score for that domain (see Figure 1). A domain was addressed effectively if its score was $\geq 60\%$, a choice reported to represent adequate coverage of a criterion in previous systematic reviews of arthritis guidelines [8, 26, 27].

[Please Insert Figure 1 here]

Overall Guideline assessment

The present reviewers rated the overall guideline quality following the approach published by Hennessy et al [28], where the overall AGREE II quality score was determined in the same way as the individual domain scores were calculated (see Figure

1). Through discussion among reviewers, an overall guideline quality score of 60% was considered as acceptable quality and guidelines were graded high ($\geq 60\%$), fair ($30\% > < 60\%$) or low quality ($< 30\%$) based on this criterion. Recommendations from high quality guidelines were adopted for use and those from low quality guidelines were excluded from this review. Fair quality guidelines were recommended with modifications and further classified as either high or low quality based on acceptable ($\geq 60\%$) “rigour of development” domain score before adopting their recommendations. This domain choice was made premised on Jackson and Feder [29] who reported that one of the key components of a useful guidelines is its evidence-based development wherein relevant and valid evidence to inform clinical decision-making has been synthesized. Only when the rigour of development domain was adequately met was a recommendation from a fair quality guideline considered as evidence for synthesis in this review.

Synthesis of Data (guideline outcomes)

Using a narrative approach, all acceptable recommendations on hand exercises for OA management were synthesized based on the levels of evidence and strength of recommendations. As previously published [20], the present systematic reviews’ recommendations were formulated using the approach employed by Hennessy et al. [28] where recommendations are graded based on the level of underlying research evidence (A = grade of recommendation based on systematic reviews; B = grade of recommendation based on randomized controlled trials; C = grade of recommendation based on quasi-experimental studies; D = grade of recommendation based on non-experimental descriptive studies; GCP = Good Clinical Practice based on expert opinion). In addition, the reviewers decided iteratively during the conduct of the review

to report the strength of the formulated recommendations. This choice was made premised on expert reports[30] which suggests that strengths of recommendations provide clear direction to patients, clinicians and policy makers on the implications of recommended interventions and reflects the extent to which one can be confident that the desirable effects of an intervention outweigh the undesirable. The strength of recommendations formulated in this review was therefore rated using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) binary classification approach where “strong” represents strong recommendation for using an intervention and “weak” represents weak recommendation for using an intervention [30, 31].

Results

Study Selection

The published databases searched generated 667 records. Of the grey literature sources searched, 10 full records were retrieved, and one identified to be in the process of development (See Supplementary File 1). Nine records were identified from citation checking and reference tracking of all full text records making a total of 686 relevant records. Figure 2 shows the detailed study identification process. Of the 686 relevant records identified, 42 duplicates were removed. Titles and abstracts of the remaining 644 records were screened against the broad inclusion and exclusion criteria, and 625 irrelevant records were excluded. Nineteen suitable full text records that met the detailed a priori eligibility criteria were retrieved and scrutinized for inclusion after which 13 were excluded. Six relevant records were identified. Two additional records; one eligible guideline [32] and an evidence-based recommendation [33] were identified from the updated literature search conducted from December 2017 to January 2019.

Overall, eight available published guidelines and recommendations were identified and included in this systematic review.

[Please insert Figure 2 here]

Characteristics of Guidelines and Recommendations

Table 2 shows the summarized characteristics of the guidelines and recommendations included in this systematic review. Of the eight records, three (43%) were developed in North America (ACR, Ottawa 2018, Ottawa 2005), three (43%) in Europe (EULAR, NICE, SIR) and one each (12%) in Africa (SAMA) and Latin America (PANLAR).

In the present systematic review, both the Ottawa 2005 and 2018 guidelines were included and although both guidelines were developed from the same organization, they had different purposes. Whilst the Ottawa2005 guideline was developed to provide evidence for the use of therapeutic exercises and manual therapy in the management of adult with OA, the Ottawa2018 was developed to identify therapeutic exercise programmes effective for hand OA management and provide stakeholders with updated, moderate to high-quality recommendations supporting exercises for hand OA.

Additionally, the 2018 guideline was published during the preparation of our manuscript and as reviewers, we decided to keep the 2005 guideline in our review as we realized that although it may appear as an older version of the 2018 guideline, it reviewed different evidence from that in the 2018, as explained above.

[Please insert Table 2 here]

Quality assessment of Guidelines and Recommendations

Individual Domain Assessment

Domain 1. Scope and Purpose

This domain deals with the potential health impact of guidelines on society and patients.

Except for the SAMA [34], all other guidelines and recommendations met and addressed this domain effectively, as recommended by the AGREE Consortium (see Table 3).

Domain 2. Stakeholder involvement

All included guidelines and recommendations adequately covered and effectively addressed this domain with an average domain score above 60% (see Table 3).

Domain 3. Rigor of development

Except for SAMA [34] (<30%), all others demonstrated adequate and effective coverage ($\geq 60\%$) of this domain by reporting the systematic processes used in gathering and synthesizing evidence, and the methods employed to formulate and update their recommendations (Further details in Supplementary File 3).

Domain 4. Clarity of presentation

This domain deals with the clarity of presentation of the guideline document with specific focus on the language, structure and format. All guidelines and recommendations addressed this domain adequately as recommended by the AGREE Consortium except for the SAMA [34] (see Table 3) (Further details in Supplementary File 3).

Domain 5. Applicability

Of the eight guidelines and recommendations reviewed, only EULAR [33] and NICE [35] demonstrated effective coverage of this domain ($\geq 60\%$) (see Table 3). These guidelines fully considered the barriers and facilitators to their implementation and

additionally provided all the necessary materials to facilitate their easy applicability as recommended [22] (Further details in Supplementary File 3).

Domain 6. Editorial independence

This domain addresses issues of competing interests in the guideline development groups and except for SIR [36] that failed to address this domain, all others demonstrated adequate coverage ($\geq 60\%$) (see Table 3).

[Please insert Table 3 here]

Overall Guideline Assessment

From the quality assessment, five guidelines and recommendations (ACR [37], EULAR [33], NICE [35], Ottawa2018 [32], Ottawa2005 [38]) were rated high quality, recommended for use without modification and their recommendations were considered acceptable and adopted for further synthesis (see Table 3). Three (PANLAR [39], SAMA [34], SIR [36]) were rated fair quality, recommended for use with modifications and as previously explained, these guidelines were further classified as high or low quality based on adequate rigour of development” domain ($\geq 60\%$). Therefore, among the three fair quality guidelines, PANLAR [39] and SIR [36] were further classified high quality for meeting this criterion and SAMA [34] was rated as low quality, as such was not considered as evidence for further synthesis. Therefore, seven out of the eight included guidelines (NICE [35] Ottawa2018 [32], Ottawa2005 [38]) and recommendations (ACR [37], EULAR [33], PANLAR [39], SIR[36]) were found to be of acceptable quality, recommended for use and their recommendations were considered acceptable and synthesized as evidence in this review.

Results of Guidelines and Consensus Recommendations

Identified Exercise recommendations

Except for the ACR [37] and Ottawa 2018 [32] guidelines, all other guidelines and recommendations considered to be of acceptable quality either tentatively or strongly recommended exercises for hand OA management (see Table 4). Whilst the ACR [37] did not make any recommendations regarding the use of exercises for hand OA management, Ottawa2018

[32] made no strong recommendations. Amongst the five guidelines that recommended exercises, EULAR [33], NICE [35] and Ottawa2005 [38] recommended exercises as a core part of interventions for the management of hand OA based on quality evidence, whilst PANLAR [39] and SIR [36] recommended exercises in combination with other interventions, such as education, joint protection techniques and splinting based on substantial evidence. The PANLAR [39], for example, agreed that a combination of an exercise regimen and splinting to improve pain and functionality is effective in the management of hand OA. To conclude, of the seven available high-quality guidelines and recommendations, five (EULAR [33], NICE [35], Ottawa2005 [38], PANLAR [39], SIR [36]) were found to recommend exercises.

[Please insert Table 4 here]

Type and Dosage of Recommended exercises

Regarding the type of exercises, three specific (strengthening, stretching and ROM) and two generic ones (general aerobic fitness and exercise regimens) were recommended (see Table 5). All the five guidelines and recommendations recommended strengthening exercises, either as core or in combination with other therapies. Two (PANLAR [39], SIR [36]) recommended ROM exercises and one each recommended general aerobic fitness (NICE [35]) and an exercise regimen to improve pain and functionality

(PANLAR [39]). Limited information regarding exercise dosage (i.e. frequency, intensity and duration) was reported. Regarding exercise frequency, only EULAR [33] amongst the five guidelines and recommendations, reported the frequency of its recommended exercises. The EULAR [33] reported that strengthening and stretching exercises for hand OA can be performed at variable frequencies and although these recommendations were non-explicit, they did recommend that these exercises can either be home-based and performed for several weeks after a single instruction or multiple supervised sessions per week for several weeks. Regarding exercise intensity, the EULAR [33] reported, although not adequately, the intensity at which their recommended exercises can be performed. According to EULAR [33], these recommended strengthening and stretching exercises can be performed at variable numbers of repetitions per exercise. All other guidelines and recommendations provided no information on exercise intensity. With regards to the duration of exercise performance, no information was provided by these guidelines and recommendations except for EULAR [33] who although unspecific, reported that their recommended exercises can be performed for several weeks. In conclusion, the present reviewers have identified that for hand OA management, the type of specific exercises recommended by good quality guidelines and recommendations are strengthening, stretching and joint mobility exercises.

[Please insert Table 5 here]

Summary of hand exercise recommendations for hand OA management.

Table 6 shows the summary of five hand exercise recommendations produced from this systematic review based on the underling guideline evidence and balance between the desirable and undesirable effects of exercises. Having considered the grades of the recommendations (A and B), few and non-severe adverse effects (undesirable effects)

and the proposed benefits of these exercises on function and pain (desirable effects), three of the five recommendations were classified as strong, as the present reviewers were certain that the desirable effects outweighed the undesirable. The remaining two were rated weak based on the low quality of underpinning evidence (expert opinion) and the uncertainty of the reviewers regarding the trade-offs between the desirable and undesirable effects as no information on adverse effects were reported.

[Please insert Table 6 here]

Discussion

Summary of Evidence

A systematic review with an overall aim to identify all available guidelines and consensus recommendations on hand exercise interventions for hand OA management was undertaken. Eight available guidelines and evidence-based recommendations were identified and critically appraised using the AGREE II instrument. Of the eight, seven (NICE [35], Ottawa2018 [32], Ottawa2005 [38], ACR [37], EULAR [33], PANLAR [39], SIR [36]) were found to be of fair to high quality based on the robust quality assessment performed, and thus recommended for use, and their recommendations were considered acceptable and synthesized as evidence in this systematic review. Of this seven, five (EULAR [33], NICE [35], Ottawa 2005 [38], PANLAR [39], SIR [36]) were found to recommend exercises for hand OA management. To address objective 1, the reviewers confidently state that amongst all the available guidelines and recommendations on hand OA management, exercises are indeed recommended as part of current best practice for the management of hand OA. To address objective 2, the reviewers identified that for hand OA management, the type of specific exercises recommended are strengthening, stretching and joint mobility exercises, which can be

prescribed as either weekly home-based or supervised sessions for several weeks with very few or non-severe adverse effects. Additionally, the reviewers also identified that an exercise regimen that improves pain and functionality of the hand, and general aerobic fitness may also be helpful in managing hand OA. These exercises however lacked specific details regarding the dosage, as no information relating to the frequency, intensity and duration of exercise performance was identified. These findings are consistent with the previous Cochrane review [11], which highlighted the lack of consensus among researchers on the type and the content of exercise interventions most beneficial to this patient population. Finally, to address objective 3, three strong and two weak recommendations for using different hand exercise approaches for hand OA management were proposed (see Table 6). The present review provides evidence to support patients and clinicians in using the strongly recommended hand OA exercises because they are based on high quality evidence and the reviewers are confident that their desirable effects outweigh the undesirable.

Additionally, policy makers can adopt these strong recommendations, as policies in their institutions, providing time for staff training and delivery of a self-management approach that can impact on hand pain and function. However, the present reviewers are less confident in recommending the weak recommendations for hand OA management as they were largely premised on expert opinion, which, according to experts [31] should be considered as very low evidence. Having said this, we believe that these weak recommendations can suffice as good clinical practice points, which over the years have aided in standardizing the delivery of care in the absence of sound clinical evidence [28].

In recommending this review's exercise recommendations for hand OA management, the present reviewers acknowledge that their implementation particularly

within clinical practice may not be without challenges. Firstly, there is still the need for clear and specific details regarding the type of recommended exercises, which are currently lacking in the guidelines similar to previous review findings [11].

Unfortunately, the type of strengthening exercises (e.g. isometric or isotonic strengthening) which would help realize this benefit in these people was not indicated in the guidelines reviewed, so could not be reported in this systematic review. The present reviewers therefore anticipate and share in the uncertainty of target users of this systematic review by challenging the research community to identify the type of strengthening exercises beneficial for these patients. Secondly, the lack of definite reporting on the performance of these recommended exercises may also influence their implementation as these decisions are left to the discretion of users. The above findings are consistent with previous evidence [27], which reported that physiotherapy interventions lacked detailed information regarding the mode of delivery, intensity, frequency and duration. To identify the cause of this gap, we appraised some of the key "underpinning research evidence" [11, 40, 41, 42] of the guidelines included in our systematic review. From this appraisal, we found that whilst some of the underpinning research evidence described the content of exercises which was not reported by the guidelines, majority provided limited or no content for guideline developers to report on subsequently. We therefore advocate that, for guidelines to inform clinical decision-making, future primary research studies should describe comprehensively the exercise content effective for hand OA management. Additionally, it would help if future guideline developers provide precise and comprehensive description of the exercise interventions recommended to facilitate their implementation by target users.

The implementation of guidelines is reported to be influenced by cultural context or geographical locations [43]. Among the five guidelines and consensus

recommendations that recommended exercises for hand OA management, one (20%) was developed in North America (Ottawa2005 [38]), three (60%) in Europe (EULAR [33], NICE [35], SIR [36]) and one (20%) in Latin America (PANLAR [39]). This largely biases the findings of the review towards a European context, which may consequently influence its generalizability to other geographical locations. The present reviewers therefore report that perhaps the findings of this systematic review may not be beneficial within the African, Asian and Australasian context as either guidelines of inadequate quality were identified in the case of Africa or no published guidelines or recommendations were found in the case of Asia and the Australasia regions.

Recent guidelines are expected to contain more up-to-date evidence and in the present review, it is worth commenting on the discrepancy between the Ottawa2005 guideline, which provides strong evidence to support exercise for hand OA, whilst the Ottawa2018 provides little or no support. The recommendations of the Ottawa2005 was based on a single RCT and the Ottawa2018 guideline was based on two systematic reviews of RCTs and a protocol. Whilst this shows how the field has evolved over time with the growth in the conduct of trials in hand OA, clinically relevant recommendations for exercise management is inconclusive in the Ottawa2018 guideline. From the present reviewers' perspective, such findings may be attributed to the marked heterogeneity in the exercise programmes evaluated and the outcomes assessed in trials which limits comparison and the performance of meta-analysis to identify intervention effects.

Interestingly, we observed from the literature, that our assumptions were consistent with a recent systematic review [40] that reported that despite the marked improvement in the overall design and conduct of RCTs, further large RCTs with more robust methodological approaches specific to hand OA are needed to make clinically relevant conclusions about the efficacy of the diverse treatment options available.

Strengths and Limitations of Included Guidelines and Consensus

Recommendations

Generally, the majority of the guidelines and recommendations reviewed adequately addressed all the six AGREE II domains and overall, the scope and purpose domain were the highest scored domain (see Table 3). Previous systematic reviews have reported poor rigour of development domain as most guidelines failed to report the systematic approaches employed in their development [44, 45]. In the present review, this domain was one of the high scoring domains and contrary to the above report, it was adequately addressed by all the guidelines and recommendations except for the SAMA guideline [34]. The ACR [37], NICE [35] and Ottawa2018 [32] guidelines scored highest for this domain and premised on this, the present reviewers are confident that the recommendations from these rigorously developed guidelines are applicable evidence-based resources to inform clinical decision-making as proposed by Jackson and Feder [29]. That said, the Ottawa2018 guideline [32] despite providing explicit information regarding its development, failed to adequately address other key aspects of quality guidelines such as the clarity of presentation of its formulated key recommendations as recommended by experts [22]. For example, the panel provided extensive evidence for different comparisons of interventions which was good, but this also made it difficult for recommendations to be extracted from the guideline document as the information provided, although detailed, was not concise. These observations on the Ottawa2018 guideline are consistent with previous systematic review of guidelines [8]. Alongside others [8], the present reviewers therefore recommend that panels use concise language and user-friendly formats for easy identification, reporting and interpretation.

Some seminal authors have argued that the development of good guidelines does not

necessarily ensure its optimal uptake [14]. Guidelines developers are therefore advised to provide ways to ensure the effective implementation of their products [45]. The applicability domain deals with this integral aspect of guidelines and in the present systematic review, it was the most poorly addressed domain. It would be preferable for guideline developers to follow a more structured approach to developing and reporting guidelines, such as the AGREE II instrument [22, 44] or the recently published AGREE reporting checklist [46] to ensure the comprehensiveness, completeness and transparency of reporting of all salient components of guidelines. From the literature [8, 44, 45], it was particularly conspicuous that, the applicability domain has fared poorly over the years because guideline developers have either inadequately or not addressed this domain at all. To enhance the applicability of guidelines, the present reviewers urge guideline developers to provide the necessary resources to aid in their successful dissemination, implementation and uptake. Positive examples to inform future works are provided by NICE [35] and EULAR [33], who addressed this domain effectively by providing ways to operationalize their recommendations.

Previous systematic reviews have reported that, stakeholder involvement, rigour of development and editorial independence domains have been poorly addressed in guidelines [8, 27, 45]. Conversely, these domains were adequately addressed in the present systematic review. The present reviewers therefore suggest that the quality of guidelines have improved over time due to continuous calls by experts for improvements in the guideline development process [21, 45]. Noted amongst such improvements is the editorial independence domain, which although performed generally well in all the guidelines reviewed, had one of its items (item 22) poorly addressed (See Supplementary File 3). We noticed in grading this item that, whilst most of the guidelines reported their sources of funding, they failed to provide an explicit

statement declaring the lack of influence of the funding bodies on the formulated recommendations as required for a full score. Whilst users appreciate the improved reporting of the editorial domain, it would be helpful if explicit statements regarding the influence of funders are articulated to increase the confidence of users in the formulated recommendations.

Strengths and Limitations of the Current Systematic Review

One of the strengths of this systematic review is the thorough and transparent search strategy adopted to ensure that all or the presumed available published and unpublished guidelines and recommendations on hand OA management were identified. Although this may have increased the reliability of this review, the reviewers acknowledge that perhaps the inclusion of grey literature sources may have included guidelines of poor quality, which unintentionally may have biased the review findings. Whilst acknowledging this limitation, the reviewers highlight that this is well balanced by its greater gains in reducing the impact of publication bias [47]. Another strength of this systematic review is the registration of its protocol (CRD42018086440) on PROSPERO, an open access international prospective register for systematic reviews [48, 49]. Although this is integral to the systematic review process and recommended as good practice, it was also conducted to enhance the transparency of the review process and prevent the duplication of effort by other reviewers who may be commissioning the idea of reviewing this systematic review's topic[50]. Finally, one noted limitation of this review is that only records published in the English language were selected. The reviewers therefore acknowledge the possibility of language bias based on the likelihood that other non-English records may present findings contrary to what was found in the present systematic review.

Conclusions

Available guidelines and consensus recommendations recommend exercises as part of current best practice for hand OA management. There is strong evidence to support the recommendation of strengthening, stretching and joint mobility exercises for the management of the hand OA due to their beneficial effects on hand function, muscle strength and pain. These exercises can be prescribed as either weekly home-based or supervised sessions for several weeks. However, their implementation by clinicians in practice may be challenging due to the lack of specific details regarding the type, intensity and duration of the exercises, which therefore need to be established.

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Appendices

Appendix 1: CINAHL search strategy

#	Query
S1	(MM "Osteoarthritis/RH")
S2	(MM "Osteoarthritis, Wrist")
S3	arthritis
S4	osteoarthritis OR "osteoarthriti*"
S5	"degenerative joint disease"
S6	"OA"
S7	S1 OR S2 OR S3 OR S4 OR S5 OR S6
S8	(MM "Hand") OR "hand" OR (MH "Finger Joint")
S9	(MM "Carpal Joints") OR "carpals" OR wrist
S10	"phalangeal"
S11	(MM "Metacarpophalangeal Joint") OR "metacarpophalangeal"
S12	(MH "Fingers") OR (MH "Thumb")
S13	S8 OR S9 OR S10 OR S11 OR S12
S14	S7 AND S13
S15	(MM "Practice Guidelines")
S16	"clinical practice guideline"
S17	Clinical W1 (practice guideline*)
S18	"clinical recommendations"
S19	"Expert consensus reports"
S20	"Delphi Consensus report"
S21	"best clinical practice"
S22	"OARSi guidelines"
S23	"EULAR guidelines"
S24	"NICE guidelines"
S25	"SIGN guidelines"
S26	"consensus guidelines"
S27	"Discussion reports"
S28	"Clinical protocols"
S29	"Consensus meeting reports"
S30	"Evidence summaries"
S31	"Guideline summar*"
S32	"consensus statement"

S33	"Guideline statement"
S34	"Good Practice Points"
S35	"care pathways" or "clinical pathway" or "protocol based care" or "integrated care pathways"
S36	"standard operating procedures"
S37	S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35 OR S36
S38	S14 AND S37

Appendix 2: MEDLINE (Ebsco host) search strategy

#	Query
S1	(MM "Osteoarthritis")
S2	Osteoarthriti*
S3	""degenerative arthritis""
S4	S1 OR S2 OR S3
S5	(MM "Hand") OR "hand" OR (MM "Hand Joints")
S6	(MH "Wrist") OR "wrist" OR (MH "Wrist Joint")
S7	(MH "Metacarpophalangeal Joint") OR (MH "Carpometacarpal Joints") OR "metacarpals"
S8	(MH "Finger Phalanges") OR (MH "Osteoarthropathy, Secondary Hypertrophic") OR "phalangeal"
S9	S5 OR S6 OR S7 OR S8
S10	S4 AND S9
S11	(MH "Practice Guidelines as Topic") OR (MH "Practice Guideline") OR (MH "Guideline")
S12	"clinical practice guidelines"
S13	(MH "Clinical Protocols")
S14	"clinical recommendations"
S15	""evidence-based recommendations""
S16	(MH "Consensus") OR (MH "Consensus Development Conference") OR ""Expert Consensus reports""
S17	""Delphi consensus report""
S18	"Delphi statement"
S19	""Best clinical practices""
S20	""EULAR guidelines""
S21	"NICE guidelines"
S22	"OARSI guidelines"
S23	"OARSI recommendations"
S24	"SIGN guidelines"
S25	consensus statement
S26	""Discussion papers""
S27	"Guideline summary"
S28	""Evidence-based practice summary""
S29	"Guideline statement"
S30	""Expert opinion consensus""

S31	""Good Practice Points""
S32	care pathways or clinical pathway or protocol based care or integrated care pathways
S33	S11 OR S12 OR S13 OR S14 OR S15 OR S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32
S34	S10 AND S33

Appendix 3: AMED

#	Query
S1	Osteoarthritis
S2	osteoarthriti*
S3	"degenerative joint disease"
S4	"Joint arthritis"
S5	OA
S6	S1 OR S2 OR S3 OR S4 OR S5
S7	hand
S8	wrist
S9	"Carpal joints"
S10	"metatarsophalangeal joint"
S11	"Phalangeal joints"
S12	Finger OR Fingers OR Digits
S13	Thumb
S14	S7 OR S8 OR S9 OR S10 OR S11 OR S12 OR S13
S15	S6 AND S14
S16	"Clinical Practice Guideline"
S17	"Practice Guidelines"
S18	"Clinical Recommendations" OR "Evidenced-based recommendations"
S19	"Expert Consensus Reports"
S20	"Expert Consensus"
S21	"Delphi Consensus"
S22	"Best Clinical Practices"
S23	EULAR guidelines
S24	NICE Guidelines
S25	SIGN guidelines
S26	"OARSI guidelines" OR "OARSI recommendations"
S27	"Consensus guidelines"
S28	"Clinical Protocols"
S29	"Discussion Papers"
S30	"Evidence Summar*"
S31	Guideline Summar*
S32	Consensus statement
S33	"Good Practice Points"
S34	"Good Practice Points"
S35	care pathways or clinical pathway or protocol based care or integrated care pathways

S36	S16 OR S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31 OR S32 OR S33 OR S34 OR S35
S37	S15 AND S36

Appendix 4: Cochrane Library

ID	Search
#1	Osteoarthritis:ti,ab
#2	Osteoarthriti*:ti,ab
#3	(Degenerative joint disease):ti,ab
#4	(non inflammatory joint disease)
#5	Osteoarthrosis:ti,ab
#6	OA:ti,ab
#7	(#1 or #2 or #3 or #4 or #5 or #6)
#8	hand
#9	(wrist joints):ti,ab or (carpal joints):ti,ab or trapeziometacarpal:ti,ab
#10	(metacarpophalangeal):ti,ab or (interphalangeal):ti,ab or phalangeal:ti,ab
#11	(Finger* or Digit* or phalange* or thumb*):ti,ab
#12	(#8 or #9 or #10 or #11)
#13	(#7 and #12)
#14	(clinical practice guideline):ti,ab or (Practice guidelines):ti,ab or guidelines:ti,ab or (consensus guidelines):ti,ab
#15	(Clinical recommendations):ti,ab or (Clinical protocols):ti,ab
#16	(Expert consensus):ti,ab or (expert consensus report*):ti,ab or (Delphi consensus report*):ti,ab or (Discussion report*):ti,ab or (Consensus statement*) or (guideline statement*):ti,ab
#17	(Best clinical practice):ti,ab or (Good Practice Points):ti,ab
#18	(OARSI guideline*):ti,ab or (EULAR guideline*):ti,ab or (SIGN guideline*):ti,ab or (NICE guideline*):ti,ab
#19	(Guideline summar*):ti,ab or (Evidence summar*):ti,ab
#20	(Care pathway*):ti,ab or (clinical pathway*):ti,ab or (integrated care pathway*):ti,ab
#21	(#14 or #15 or #16 or #17 or #18 or #19 or #20)
#22	(#13 and #21) Publication Year from 1997 to 2017

Appendix 5: Web of Science

Set	Search Terms
# 1	TS=("Osteoarthriti*") OR TS=("Arthriti*") OR TS=("Degenerative joint disease*")
# 2	TS=(Hand) OR TS=(wrist) OR TS=(Finger*) OR TS=(Digit*) OR TS=(Thumb)
# 3	TS=(carpal*) OR TS=(Metacarpal*) OR TS=(Trapeziometacarpal) OR TS=(interphalangeal) OR TS=(phalangeal)
# 4	#3 OR #2
# 5	#4 AND #1
# 6	TOPIC: ("Clinical practice guideline*") OR TOPIC: ("Practice guideline*") OR TOPIC: (Guideline*) OR TOPIC: ("Consensus guideline*")
# 7	TS=("Clinical recommendation*") OR TS=("Clinical protocol*") OR TS=("Expert consensus") OR TS=("expert consensus report*") OR TS=("Consensus statement*") OR TS=("Guideline statement*")

# 8	TS=("Best Clinical Practice") OR TS=("Good Practice Points") OR TS=("Guideline summar*") OR TS=("Evidence Summar*")
# 9	TS=("NICE guideline*") OR TS=("OARSI guideline*") OR TS=("SIGN guideline*") OR TS=("EULAR guideline*")
# 10	TS=("Care pathway*") OR TS=("integrated care pathway*") OR TS=("clinical pathway*")
# 11	#10 OR #9 OR #8 OR #7 OR #6
# 12	#11 AND #5
# 13	(#11 AND #5) Limiters: LANGUAGE= (English) <i>Timespan=1997-2017</i>

Appendix 6: PEDro

Steps	Search Terms and Boolean Operators
1.	Hand osteoarthritis*clinical practice guidelines*
2.	osteoarthritis*clinical practice guidelines*