Scope for Improvement in the Quality of Reporting of Systematic Reviews. From the Cochrane Musculoskeletal Group

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ABSTRACT. ***Objective.*** To assess the quality of reporting in Cochrane musculoskeletal systematic reviews (excluding back and injury reviews).

Methods. This study assessed all the Cochrane Musculoskeletal Group's systematic reviews from Issue 4, 2002, of the Cochrane Library Database of Systematic Reviews. Two reviewers independently extracted data and assessed quality. Two assessment tools were used, including an 18 item checklist and flow chart developed by the Quality of Reporting of Meta-analysis (QUOROM) consensus group, and a 10 item scale, the Oxman-Guyatt Overview Quality Assessment Questionnaire (OQAQ). One question on the latter scale (item 10) scores overall quality on a 7 point scale, with high scores indicating superior quality. Data were analyzed using univariate approaches.

Results. The 57 systematic reviews assessed were found to have good overall quality, with scores on individual items revealing only minor flaws. Documenting the flow of included and excluded studies and summarizing the results are 2 areas needing improvement in reporting. According to the Oxman-Guyatt scale the overall scientific quality of the Cochrane musculoskeletal reviews was good [mean 5.02 (95% CI 3.71–6.32)].

Conclusion. Our study found that the reporting quality of Cochrane musculoskeletal systematic reviews was generally good, although there was room for improvement. For example, it might be feasible to develop specific guidelines for reporting protocols. Certainly more work is needed in reporting search results, documentation of the flow of studies, identification of the type of studies, and summarization of the key findings. (J Rheumatol 2006;33:9-15; First Release: Nov 1, 2005)

Key Indexing Terms:
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It has been estimated that a physician would need to read 17–20 journal articles a day to keep abreast of all research relevant to a particular area of clinical practice[1]. Because this is clearly impractical, interest has been growing in the use of pre-appraised and synthesized evidence resources such as systematic reviews, metaanalyses, and evidence-based clinical practice guidelines as aids to clinical decision-making.

Recognition of the need for systematic reviews of healthcare studies continues to grow and is indicated by the number of articles and empirical studies dealing with methods used in reviews, the number of systematic reviews published in healthcare journals, and the rapid growth of the Cochrane Collaboration[2-4]. The Cochrane Library is a compilation of systematic reviews designed to provide high quality scientific evidence on the effectiveness of various healthcare interventions[5]. Cochrane reviews serve an invaluable function by summarizing healthcare literature and supporting decisions for more effective clinical practices. The Cochrane Musculoskeletal Group (CMSG) is one of more than 50 entities within the Cochrane Collaboration. Its members are dedicated to preparing and maintaining systematic reviews of musculoskeletal conditions. Many interventions for gout, lupus erythematosus, osteoarthritis, osteoporosis, rheumatoid arthritis, soft tissue conditions, spondyloarthropathy, systemic sclerosis, and vasculitis have been reviewed. Separate review groups study reviews of back and

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musculoskeletal injuries. We assessed the quality of reviews conducted by the CMSG.

Growing recognition of the key role of reviews in synthesizing and disseminating research results has prompted careful scrutiny of the validity of reviews. In the 1970s and early 1980s, psychologists and social scientists drew attention to the systematic steps needed to minimize bias and random errors in literature reviews[6-9]. In the late 1980s attention began to focus on the poor scientific quality of healthcare review articles[10,11].

An appreciation of the quality of a systematic review is essential to assessment of whether its recommendation of the use or avoidance of an intervention should be followed[12,13]. Two major areas are assessed in determining the quality of a systematic review. The first is its methodological quality, which is an assessment of how well the systematic review was conducted (literature search, pooling of data, etc.). The second is its quality of reporting, which is an assessment of how well its systematic reviewers have reported their methodology and findings. Separate tools were used to assess each quality area to obtain a comprehensive quality assessment. Assessors were sensitive to the fact that although methodological quality and reporting quality are intrinsically linked, a review may be strong in either area and weak in the other. It was also recognized that poor reporting makes it difficult to assess the methodological quality of a review.

Our objective was to review both the methodological and reporting quality of all published Cochrane systematic musculoskeletal reviews. This review should serve as a baseline, enabling the CMSG to measure improvement in both the methodological and the reporting quality of its reviews over time.

MATERIALS AND METHODS

Choosing the assessment instruments. A review of published scales and checklists was performed to inventory the instruments available for assessing the quality of systematic reviews. Each item of a scale is scored numerically, and individual numerical scores are combined to generate an overall quality score. To be considered a scale, an instrument should be able to measure across a continuum. On the other hand, a checklist provides an estimate of the overall quality of a review by using itemized criteria to assess individual aspects of reviews and facilitate their qualitative comparisons. Individual checklist items do not have numerical scores attached to them.

A literature search was conducted using Medline from January 1966 to February 1999 to identify all published quality assessment instruments. Three independent searches were completed using the following keywords: metaanalysis, review literature, systematic or quantitative or methodologic review, overview, review, information synthesis, integrative research review, guideline, checklist, tool, scoring, scale, clinimetric, quality, critical reading, methodology, and Medline. The "related articles" function was also used[14].

Twenty-four assessment instruments were found, including 21 checklists and 3 scales. The 2 instruments selected were a methodological assessment tool that had been rigorously developed by Oxman and Guyatt, known as the Overview Quality Assessment Questionnaire (OQAQ)[15,16] quality of reporting tool (Quality of Reporting of Meta-analysis (QUOROM)) developed by consensus[17].

The Overview Quality Assessment Questionnaire. The specified purpose of the OQAQ[15] is to evaluate the scientific quality (i.e., adherence to scientific principles) of systematic reviews published in medical literature. It is not designed to measure literary quality, importance, relevance, originality, or any other esthetic or philosophical attribute of reviews.

The scale is divided into 9 areas (Table 1). Question 10, the final question of the scale, requires each assessor to rate the overall scientific quality of each report. Possible scores on question 10 range from 1 to 7. This global question is answered based on how well the review scored on the first 9 questions[16].

The Quality of Reporting of Meta-analysis (QUOROM) Checklist. The only tool found that was designed to assess the reporting quality of systematic reviews was the Quality of Reporting of Meta-analysis[17] statement consisting of a checklist and flow diagram. This checklist of standards for the reporting of metaanalyses describes the preferred way to present the Abstract, Introduction, Methods, Results, and Discussion sections of a report of metaanalysis. The checklist includes 18 items (Table 2). It requires authors of reviews to include a flow diagram that provides information about the number of studies identified, included, and excluded, and the reasons for excluding them.

The OQAQ and the QUOROM statement were found to be the instruments of choice for assessing the quality of systematic reviews.

Literature. The study examined all published CMSG systematic reviews from the Cochrane Database of Systematic Reviews of the Cochrane Library, Issue 4, 2002[5].

Pilot testing. Two assessors (DF, BS) conducted a pilot study to test the 2 quality assessment tools. As recommended by Glass, *et al*[7], agreement among assessors was maximized through consensus training involving discussion among reviewers. All inconsistencies identified were discussed and resolved during weekly meetings, and assessments were revised after consensus was reached. The pilot exercise was conducted to achieve a high level of interrater agreement. It was decided that an interclass correlation coefficient (ICC) of 0.60 would be the lowest acceptable level of interrater reliability. An ICC was calculated for a subset of questions on the OQAQ, and the ICC results > 0.60 were eventually obtained. However, initially there was less agreement between reviewers on the questions on the OQAQ. Therefore, each item was reviewed and discussed in detail, with agreement being reached on its scoring in cases where there had been disagreement. This pilot was repeated until an ICC > 0.60 was achieved. Final ICC of 0.81 (95% CI 0.74–0.89), 0.83 (0.77–0.90), and 0.88 (0.85–0.93) were obtained for the questions on the OQAQ. Minor refinements were incorporated into the interpretation of the scale, permitting a greater degree of precision when performing assessments. A kappa test was also performed on a subset of the CMSG reviews. The kappa was 0.321 (95% CI 0.136–0.498) prior to discussion and consensus. Additional pilot testing improved the level of agreement slightly 0.420 (95% CI 0.322–0.514).

Data analysis. Data were extracted using prepared forms that included all the items of both quality instruments. All included reviews were assessed using this structured format. Frequencies were provided on all items of both instruments using SPSS 12.0. Percentages were recorded, along with an overall mean score and confidence intervals.

Main study. The quality of all 57 included systematic reviews[18-74] was assessed by 2 independent reviewers using the 2 selected tools, with a third reviewer available when needed to reach a consensus (GW). One reviewer (DF) had been involved with the Cochrane Collaboration for two and a half years, and continues to work as a reviewer with the Acute Respiratory Infections Review Group in Brisbane, Australia. The second reviewer (BS) had been involved with the CMSG over the previous 10 years and was a coauthor of some of the reviews.

RESULTS

Using the OQAQ, the mean overall scientific quality of the 57 Cochrane Musculoskeletal Reviews evaluated was mean 5.02 (95% CI 3.71–6.32). The scores for each item were of

Table 1. Scores for Cochrane musculoskeletal group (CMSG) systematic reviews from the Overview Quality Assessment Questionnaire (OQAQ).

	Questions	Yes, n (%)	Partially or can't tell, n (%)	No, n (%)
Item 1	1. Were the search methods used to find evidence reported?	50 (88)	3 (5)	4 (7)
Item 2	2. Was the search strategy for evidence reasonably comprehensive?	36 (63)	3 (5)	18 (32)
Item 3	3. Were the criteria used for deciding which studies to include in the overview reported?	57 (100)	0 (0)	0 (0)
Item 4	4. Was bias in the selection of studies avoided?	30 (53)	23 (40)	4 (7)
Item 5	5. Were the criteria used for assessing the validity of the included studies reported?	55 (97)	2 (3)	0 (0)
Item 6	6. Was the validity of all the studies referred to in the text assessed using appropriate criteria (either in selecting studies for inclusion or in analyzing the studies that are cited)?	41 (72)	4 (7.0)	12 (21)
Item 7	7. Were the methods used to combine the findings of the relevent studies (to reach a conclusion) reported?	54 (95)	1 (2)	2 (3.5)
Item 8	8. Were the findings of the relevent studies combined appropriately relative to the primary question the overview addressed?	57 (100)	0 (0)	0 (0)
Item 9	9. Were the conclusions made by the author(s) supported by the data and/or analysis reported in the overview?	55 (97)	1 (2)	1 (2)
Item 10	10. How would you rate the scientific quality of this overview?	5.02, 95% CI 3.71, 6.32		

Table 2. Scores for Cochrane musculoskeletal group (CMSG) systematic reviews from Quality of Reporting of Meta-analysis (QUOROM).

	Questions	Yes, n (%)	No, n (%)
Item 1	Does the title identify the report as a metaanalysis (or systematic review) of randomized trials?	3 (5)	54 (95)
Item 2	Is the abstract in a structured format?	56 (98)	1 (2)
Item 3	Do the objectives describe the clinical question explicitly?	56 (98)	1 (2)
Item 4	Are the data bases (i.e., list) and information sources described?	55 (96.5)	2 (3.5)
Item 5	Are the selection criteria (population, intervention, outcome, and study design), methods for validity assessment, data abstraction, study characteristics, and quantitative data synthesis described in sufficient detail to permit replication?	47 (82)	10 (18)
Item 6	Is there a description of the main results?	49 (86)	8 (14)
Item 7	Are the conclusions presented?	57 (100)	0 (0)
Item 8	Is the clinical, biologic rationale for the intervention and rationale for the review provided?	54 (95)	3 (5)
Item 9	Were the information sources in detail (e.g., databases, registers, personal files, expert informants, agencies, hand-searching), and any restrictions (years considered, publication status, language of publication) provided?	52 (91)	5 (9)
Item 10	Were the inclusion and exclusion criteria (defining population, intervention principal outcomes, and study design) presented?	57 (100)	0 (0)
Item 11	Were the criteria and process used (e.g., masked conditions, quality assessment and their findings) in the validity assessment reported?	57 (100)	0 (0)
Item 12	Was the process provided (e.g., completed independently, in duplicate)?	50 (88)	7 (12)
Item 13	Were the type of study design, participants' characteristics, details of intervention, outcome definitions, and how clinical heterogeneity was assessed reported?	56 (98)	1 (2)
Item 14	Were the principal measures of effect (e.g., relative risk), method of combining results (statistical testing and confidence intervals), handling of missing data, how statistical heterogeneity was assessed, a rationale for any a priori sensitivity and subgroup analyses, and any assessment of publication bias reported?	53 (93)	4 (7)
Item 15	Was a metaanalysis profile summarizing trial flow provided?	0 (0)	57 (100)
Item 16	Were the descriptive data for each trial presented?	57 (100)	0 (0)
Item 17	Was the agreement on the selection and validity assessment reported? Were the simple summary results (for each treatment group in each trial, for each primary outcome), and data needed to calculate effect sizes and confidence intervals in intention-to-treat analyses (e.g., 2×2 tables of counts, means and standard deviations, proportions) reported?	56 (98)	1 (2)
Item 18	Were a summarization of the key findings, discussion of clinical inferences based on internal and external validity, interpretation of the results in light of the totality of available evidence, description of potential biases in the review process (e.g., publication bias), and suggestion of a future research agenda presented?	47 (82)	10 (18)

similar quality (Table 1). Of the 10 items making up the scale, the Cochrane musculoskeletal systematic reviews scored poorly on items 2 and 4: 63% of CMSG systematic reviews reported whether the search strategy for the evidence was reasonably comprehensive (item 2) and 53% reported whether study selection bias was avoided (item 4). All CMSG systematic reviews reported the criteria used for deciding which studies to include in the overview (item 3) and combined the findings of the relevant studies appropriately relative to the primary question addressed (item 8). The methods used for combining studies were reported in 95% of the reviews (item 7), while 97% of CMSG reviews reported the criteria used for assessing the validity of included studies (item 5) and drew conclusions that were support-

ed by the data and/or analysis reported in the overview (item 9). Eighty-eight percent of the reviews reported the search methods used to find evidence (item 1). However, only 72% reported whether the validity of all the studies referred to in the text was assessed using appropriate criteria (either in selecting studies for inclusion or in analyzing the studies that are cited) (item 6).

Scores on individual QUOROM items ranged from 5.0% (item 1) to 100% (items 7, 10, 11, 16) (Table 2). Only 5% of CMSG reviews identified the review as a metaanalysis or systematic review of randomized trials in their title (item 1). Almost all CMSG reviews had an abstract with a structured format (item 2) and included objectives (item 3) and data sources (item 4) in the abstract. Items on which they were less likely to report adequately were results (item 6) and selection criteria (item 5) (i.e. population, intervention, outcome, study design, methods for validity assessment, data abstraction, study characteristics, and quantitative data synthesis).

Almost 90% of the reviews described their method of data abstraction (item 12), while no review provided a flow chart for the included and excluded studies (item 15).

More than half the CMSG reviews received a rating of "adequate" on 50% or more of the 10 OQAQ quality items. On the overall quality item (range 0–7) (item 10), the CMSG reviews scored relatively well, with only minor flaws identified [mean 5.02 (95% CI 3.71–6.32)] (Table 1). Of the 18 QUOROM items, the CMSG systematic reviews scored more than 50% on all but 2 of the items (items 1 and 15).

One item (18) was noted as being more difficult to assess and certainly needs further exploration [i.e., the summarization of the key findings, discussion of clinical inferences based on internal and external validity, interpretation of the results in light of the totality of available evidence, description of potential biases in the review process (e.g., publication bias), and suggestion of a future research agenda presented].

Documenting the flow of included and excluded studies and summarizing the results are 2 areas needing improvement in reporting.

DISCUSSION

Assessments made using both quality instruments indicated that the quality of Cochrane musculoskeletal systematic reviews was good, although minor flaws were observed. This is important to users of CMSG reviews, as it provides assurance that their results are relatively reliable. Although their methodological quality and quality of reporting were found to be fair to good, there is room for improvement. For example, it might be feasible to develop specific guidelines for reporting protocols and improve on reporting search results, and documentation of the flow of studies.

The quality of systematic reviews requires examination in order to substantiate the claim that they are the best evidence available to clinicians, health policymakers, and consumers. The use of assessment tools to structure peer review systems can encourage quality improvement in systematic reviews. The Cochrane Collaboration has begun to achieve this objective through continual peer review of protocols, reviews, and updated reviews from the analytical process through to the report. The use of evidence-based criteria such as the QUOROM statement can contribute to the improvement of reporting quality over time by establishing consistent guidelines for the conduct of systematic reviews. At least 2 studies have addressed improvement or lack of improvement over time. A review of 86 English-language metaanalyses assessed every report on 14 items from 6 content areas believed to be critical in the conduct and reporting of metaanalyses. These items included study design, combinability, control of bias, statistical analysis, sensitivity analysis, and problems of applicability. They found that only 24 of the 86 (28%) metaanalyses addressed all 6 content areas[75]. This survey was updated in 1992 with little change in the results[76]. A similar study by the authors of this paper showed that the quality of systematic reviews does improve over time, but that the differences on specific items remain variable[77]. A comparison of Cochrane versus paper-based reviews revealed similar results[78].

Inadequate reporting[79,80-82] is a significant impediment to the assessment of the quality of systematic reviews! Essential criteria may be met in a given study without being adequately reported in a review. In such a case, a study of high quality may appear to be poor in a review. It may be inaccurate to assume that items not included in a systematic review were missing in the study it reviews, but this is what users of systematic reviews are likely to do. Assessors of a systematic review may invest the time and effort required to obtain additional data directly from the investigators who conducted the systematic review, but ordinary readers cannot reasonably be expected to do so.

The ongoing use of the quality of reporting checklists[6,80–82] is to be encouraged, because it will facilitate assessment of study validity by ensuring a high level of congruence between the quality of individual studies and their depiction in systematic reviews. Such an improvement in the quality of reporting of reviewed studies will serve to make systematic reviews more accurate, reliable, persuasive, and useful to those who depend on them.

We tried to address the issue of potential conflict of interest by inviting someone from outside the Musculoskeletal group who would be willing to work with the team on a voluntary basis to carry out this study, a common practice for Cochrane work, especially methods work. One of the main reviewers of the studies is from Brisbane, Australia, and had worked with the Respiratory Airways group for about 3 years. He is very well informed of the format of a Cochrane review. The authors felt that because he was not involved in any of the CMSG reviews he would be considered a nonbiased reviewer. We believe this will negate any potential biases.

Although the 2 instruments used in this study proved useful, the challenges that had to be overcome in applying them clearly demonstrated the need for better measurement instruments. Both instruments proved to be difficult to apply; the main problem encountered was a lack of published guidance on their application. It was only after 3 rounds of pilot testing and resolution of several questions that arose concerning the application of the OQAQ assessment tool that the assessors were ready to apply it. Moreover, while using this scale, reviewers continued to encounter difficulties with its application. Although the QUOROM checklist was rather long and time-consuming to apply, it was accompanied by more detailed directions regarding its use.

One additional item that was not addressed adequately because the measurement tool does not address this well is the inferences based on the results of the systematic reviews. More work is needed in this area.

The statistical analysis revealed that the reliability was poor to fair. There may be several explanations for this. First, the relative magnitude of the kappa value (i.e., the proportion of agreement beyond that expected by chance alone) is difficult to interpret. In the pilot test, the kappa values were categorized and labeled as suggested by Fleiss[83], but this classification is purely arbitrary. Kappa coefficient is a popular measure for chance-corrected nominal scale agreement between 2 raters. Future methodological work must include alternative options for calculating agreement among raters, such as exploring Bayesian inferences.

This study found that the overall quality of reports of Cochrane musculoskeletal systematic reviews was generally good, although there was room for improvement. Areas in particular that need special attention include the title and protocol, documentation of the flow of the studies, and inferences made by the conclusions. A recent study reported that the methods for assessment of methodological quality of systematic reviews are still in their infancy and there is substantial room for improvement[84].

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