Effective Medical Writing

Pointers to getting your article published

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Writing a systematic review

ABSTRACT

Evidence-based medicine (EBM) aims to combine the best available scientific evidence with clinical experience and individual judgment of patient needs. In the hierarchy of scientific evidence, systematic reviews (along with meta-analyses) occupy the highest levels in terms of the quality of evidence. A systematic review is the process of searching, selecting, appraising, synthesising and reporting clinical evidence on a particular question or topic. It is currently considered the best, least biased and most rational way to organise, gather, evaluate and integrate scientific evidence from the rapidly-changing medical and healthcare literature. Systematic reviews could be used to present current concepts or serve as review articles and replace the traditional expert opinion or narrative review. This article explains the structure and content of a systematic review.

Keywords: evidence-based medicine, medical writing, systematic review

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INTRODUCTION

Evidence-based medicine (EBM) integrates the best scientific evidence with clinical expertise and individual judgment of patient needs. While the evidence from one scientific trial may refer to a particular method or practice as the best in current clinical practice, the evidence may change over time as new treatments or methods are developed. EBM is based on clinical evidence derived from randomised controlled trials, systematic reviews, meta-analyses and clinical guidelines. The hierarchy of the strength of evidence for decision-making and treatment options flows from the top ranking of randomised controlled trials, to systematic reviews of these randomised trials, all the way down to unsystematic clinical observations.[1,2]

Therefore, systematic reviews and meta-analyses are regarded as popular evidence-based tools for analysis of clinical studies, and they are frequently used to answer complex research questions across many different clinical fields.[3] Meta-analysis is for the specific statistical technique of combining the data from individual studies.

A systematic review is a rigorous way of summarising the available scientific evidence that is derived from several clinical trials on a particular treatment or method. It uses a methodology of clearly-designed questions and methods to identify and critically evaluate relevant research, followed by the collection and analysis of data from the studies that are included in the review. Since the results of a single study apply only to a certain type of patient or a particular clinical setting, a systematic review of many studies on the same subject can provide information that is relevant to a broad range of patients across different clinical settings. Moreover, individual studies consist of different sample sizes, thus biased opinion is inevitably introduced into the studies. A systematic review limits bias while improving the reliability and accuracy of recommendations because it combines information from individual studies and has an overall sample size that is greater than that of any one study. This leads to an increase in the quality of the review. In short, a systematic review is currently considered to be the best, least biased and most rational way to organise, gather, evaluate and integrate scientific evidence from the rapidly-changing medical and healthcare literature.

STRUCTURE AND CONTENT OF A SYSTEMATIC REVIEW

A systematic review follows the same structure as an original research article.

Title: The title of the systematic review should accurately reflect the topic under review. Some examples of titles are:

- Is there a role for endorectal balloons in prostate radiotherapy? A systematic review
- Diagnostic value of non-invasive imaging techniques in the detection of carotid artery stenosis: A systematic review

- A systematic review of pharmacological interventions for acute ischaemic stroke

Abstract: A structured abstract that summarises the background, methods, results and conclusion should follow.

Introduction: The introduction should summarise the topic and explain the necessity for conducting such a systematic review. For example, were there gaps in the knowledge of the topic, or was there disagreement in the literature? The introduction should be brief and the last sentence should clearly state the aims of the review.


Box 1. Structure of a systematic review:
- Title
- Structured abstract
- Introduction
- Methods
- Results
- Discussion
- References (extensive number)

Methods: Explain the review methodology clearly and logically.

- Inclusion and exclusion criteria: Describe the studies to be included, e.g. a prospective study in a particular population testing a particular treatment. In this section, use subheadings, e.g. who the patients/subjects/animals were; what the interventions/characteristics sought were; and what the outcome measures and study characteristics were. Mention certain key features of the study such as the sample size, the main results, whether there was any language restriction or years within which the studies had to be done. What were the studies excluded from the review?
- Identification of studies: Provide details of the electronic database search carried out, including the databases used (e.g. MEDLINE, Scopus, ISI Web of Knowledge, Google Scholar), and the period of search. Provide a list of the search terms in an appendix. Keywords used in the searching of studies should be listed in this section. State whether any of the journals were identified using hand-searching (e.g. reference list of articles obtained) and whether review articles and other bibliographies were referenced. In most reviews, only studies published in the English language are included; however, some researchers may include non-English studies and

this issue should be addressed.
- Study selection: Describe the selection method and screening for eligibility for all the studies that were identified, removing duplicates and screening for relevance of the title, followed by abstract and full text article; and then screening of the full papers that passed all of these eligibility checks. A flow chart is recommended to demonstrate the search strategy utilised (Fig. 1).
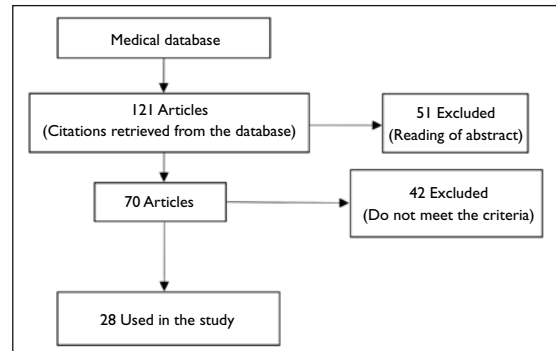
Fig. 1 Flow chart for identifying eligible articles.

- Data extraction: Describe what data were extracted from the studies, such as the description of patients/subjects/animals included, how many had what outcome, what the summary statistics were as given in the paper, and whether the data was read off graphs if these were not provided numerically. Data should be independently extracted from the studies by at least two researchers to avoid biased opinions.
- Quality assessment: Quality assessment criteria have been described for most literature types and many of these are available on the EQUATOR Network (www.equator-network.org).
- Data analysis: Describe briefly the statistical methods of handling the data. In a review on treatment, it is typical to calculate the odds ratios for each outcome with 95% confidence intervals and p-value for the magnitude of effect, and to perform tests of heterogeneity to ascertain if the studies were all coming broadly to the same conclusion or if there were significant variations between the studies. The analysis may also be influenced by the amount of data available. Heterogeneity needs to be assessed for each outcome. The studies or outcomes can be sorted into different subtypes to determine whether this reduces any heterogeneity, for example, in a systematic review of a treatment, the studies may be sorted by dose, by time of administration after the onset of disease or by time of assessment of outcome.

Results: As with the methods section, the results section needs to be described logically.

- Search results: Mention the number of studies the literature search had identified from each database as well as by other searching methods, how many were duplicates, how many were excluded on the basis of screening of an abstract, how many full text articles were assessed and of these, how many were excluded until the final number of papers to be included was determined. Also mention the number of papers not included in the review due to publication in the non-English literature.
- Study range and characteristics: Describe the demographic and descriptive statistics of the patients/subjects/animals included in the selected studies. Indicate the type of patients/subjects/animals that were included, such as an age range or disease severity range. Indicate other key study methodological features such as any variation in outcome measure. Be careful to ensure that the same patients/subjects/animals have not been included in multiple publications as this would artificially inflate the sample size. State the total number of actual individual studies within the total number of papers identified. Many of the study characteristics can be summarised in graphs or tables.
- Study quality and potential sources: Report the median quality score derived from the appropriate quality assessment method and indicate which studies had particularly poor quality score points. The study quality score can also be used to see whether any apparent heterogeneity between studies for outcome results can be explained by the inclusion or exclusion of poor quality studies.
- Effect of intervention on outcome: Describe the actual results of analysis to estimate the overall effect across the different studies. For example, describe the odds ratios for each outcome in a treatment review or the mean differences in an observational study. Explore any potential reasons for heterogeneity and describe what that showed.

Discussion: This section should begin with a simple statement summarising the major findings from the review. For example, is the weight of evidence in favour of the treatment having a beneficial effect? Do the studies suggest that some particular feature is associated with future risk of a disease? Is one diagnostic test better than another? Can a less invasive interventional procedure be reliably used as an alternative to the conventional invasive procedure? If there is not enough evidence to arrive at a definite conclusion, then the statement should clarify that.

The subsequent paragraphs should describe the limitations of the studies included and the reliability of the results. How robust are the results? Were there any biases? Next, describe the strengths and weaknesses of the review methods. For example, were non-English publications omitted? Does the review only include a handful of papers with a small sample size? Put the results in the context of other knowledge on the topic, for example, by comparing this review with previously-published systematic reviews or current opinions and guidelines.

Finally, provide conclusions and any implications for current practice, and particularly for future research. Has the review highlighted gaps in knowledge that future studies should address? Is there enough new information to modify existing clinical practice?

Like any other research paper, a systematic review should acknowledge the funding agencies and grants received, as well as any other persons who helped during the review. References for the selected studies should be listed. The use of effective tables and figures would enhance the readability of the review.

Box 2. Common problems with systematic reviews:
- Important studies are missing due to an inadequate literature search.
- Too many biases introduced.
- No clear hypothesis or research question.
- Review methodology is not clearly stated.
- No clear conclusion or statement to summarise the findings of the review.

SUMMARY

A systematic review is a process of searching, selecting, appraising, synthesising and reporting clinical evidence on a particular question or topic. A quality systematic review requires substantial preparation and planning before it is written. After thorough development of the research question and protocol, a considerable amount of effort is required to search the literature, appraise the quality of the selected studies, and finally reach thoughtful, appropriate conclusions. A systematic review should be written just

like any other research paper, with a logical flow of the methods, results, discussion and conclusion.

Box 3. Key points of a systematic review:

- A systematic review searches, selects, appraises, synthesises and reports on current clinical evidence on a particular question or topic.
- A systematic review uses strategies that limit bias and random error.
- A systematic review helps medical practitioners keep up-to-date with the rapidly changing medical literature.
- A systematic review ranks among the highest in the hierarchy of quality clinical evidence for evidence-based medicine.

REFERENCES

1. Green S. Systematic reviews and meta-analysis. Singapore Med J 2005; 46:270-3.
2. Guyatt G, Drummond R. Part 1. The basics: Using the medical literature. 1A. Introduction: The philosophy of evidence based medicine. In: Guyatt G, Rennie D, eds. Users' Guides to the Medical Literature: A Manual for Evidence-Based Clinical Practice. Chicago. AMA Press, 2002: 3-12.
3. Petrie A, Bulman JS, Osborn JF. Further statistics in dentistry Part 8: Systematic reviews and meta-analyses. Br Dent J 2003; 194:73-8.

USEFUL RESOURCES

- EQUATOR Network. Available at: www.equator-network.org.
- The Cochrane Collaboration. The reliable source of evidence in healthcare. Available at: www.cochrane.org.
- CEBM Centre for Evidence-based Medicine. Available at: www.cbem.net
- The Campbell Collaboration. Available at: www.campbellcollaboration.org.

SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME
Multiple Choice Questions (Code SMJ 201005A)

	True	False
Question 1. A systematic review is aimed at:		
(a) Studying the benefits of a treatment method within a small sample size.	☐	☐
(b) A comprehensive narrative analysis of recent developments in a specific topic.	☐	☐
(c) Finding and selecting appropriate literature in the first part of the process.	☐	☐
(d) Appraising, synthesising and reporting based on current clinical evidence.	☐	☐
Question 2. The structure of a systematic review includes:		
(a) A structured abstract	☐	☐
(b) A list of all selected studies in the methods section.	☐	☐
(c) An introduction providing background on the research question.	☐	☐
(d) A results section describing the analysis of the studies.	☐	☐
Question 3. The methods section of a systematic review includes:		
(a) Identification of studies.	☐	☐
(b) Study selection.	☐	☐
(c) Data extraction.	☐	☐
(d) Quality assessment.	☐	☐
Question 4. When describing the results of the literature review:		
(a) State the number of studies identified and from which database.	☐	☐
(b) Describe the study range and characteristics.	☐	☐
(c) Provide a summary of each study.	☐	☐
(d) Describe the limitations of the studies included and of the systematic review.	☐	☐
Question 5. A quality systematic review should:		
(a) Reach appropriate conclusions.	☐	☐
(b) Improve the reliability of recommendations.	☐	☐
(c) Provide definitive answers for clinical practice.	☐	☐
(d) Identify gaps in the knowledge.	☐	☐

Doctor's particulars:

Name in full: _____

MCR number: _____ Specialty: _____

Email address: _____