

An overview of Systematic Review and Meta-Analysis

Suresh V, Associate Professor, Sumandeep Nursing College, Sumandeep Vidyapeeth deemed to be University, Piparia, Waghodia, Gujarat.

Abstract:

Systematic review and meta-analysis always targets to provide comprehensive, unbiased synthesis of various relevant studies in a single document using rigorous scrutiny. Systematic review differs from old-style narrative reviews in many ways. Narrative reviews tend to be descriptive; it is not involved in a systematic search of literature. Systematic reviews, as the name suggests, typically involve a detailed and complete plan and search strategies with the intention of reducing bias by identifying, appraising and synthesizing all the relevant research studies on a particular topic. Often, systematic review includes meta-analysis element which involves using statistical methods to synthesize the data from various studies into a single quantitative form. Although systematic review are published in academic forum, but there are some organizations and databases specially developed to promote and publish them. For example, Cochrane collaboration is widely accepted and recognized in health care field.

Key words: Systematic reviews, Synthesis, Quantitative, Meta-analysis & Cochrane

INTRODUCTION: This article is specially designed for Nurse Researchers and other health care professionals who are interested to perform systematic review and Meta-analysis. Following information covers effective formulation of answerable review question, determine inclusion and exclusion criteria, search for research evidences, extract data, assess and evaluate the risk of bias in clinical trials and perform meta-analysis.

1. FORMULATE THE REVIEW QUESTION

The first phase in performing systematic review is to formulate research question. Without a well-focused research question, it will be very challenging and time consuming to find appropriate resources and search for relevant literature evidence.¹

To prepare a well-built clinical question, Question must be directly relevant to the problem, Subsequently, the question must be phrased to facilitate search for a precise answer. To achieve these goals, the question must be well articulated for all four parts of its ANATOMY²

- 1) Patient or Problem being addressed
- 2) Intervention or Exposure being used
- 3) Comparison
- 4) Clinical outcome of interest.

For Eg: For Clinical Situation we began with, Following questions must be asked: “ Is animal assisted therapy more effective than Music therapy in Managing aggressive behavior in elderly people with Dementia?”³

Here, **P**- Elderly Patients with Dementia, **I**- Animal-assisted therapy, **C**- Music Therapy and **O**-Aggressive behavior

When we forming question using the **PICO**framework it is very useful to think on what type of question you are asking (Diagnosis, Etiology, Diagnosis, Prognosis &Prevention). The table given below illustrates way in which Problem, Intervention, Comparisons and Outcome will vary according to the type your review question.⁴

Question Type	P	I	C	O
	Patient, Problem or Population	Intervention or Exposure	Comparison or Control	Example Outcome Measures
Therapy (Treatment)	Patient's disease or condition.	A therapeutic measure, e.g., medication, surgical intervention, or life style change.	Standard care, another intervention, or a placebo.	Mortality rate, number of days off work, pain, disability.
Prevention	Patient's risk factors and general health condition.	A preventive measure, e.g., A lifestyle change or medication.	Another preventative measure OR maybe not applicable.	Mortality rate, number of days off work, disease incidence.
Diagnosis	Specific disease or condition.	A diagnostic test or procedure.	Current "reference standard" or "gold standard" test for that disease or condition.	Measures of the test utility, i.e. sensitivity, specificity, odds ratio.
Prognosis (Forecast)	Duration and severity of main prognostic factor or clinical problem.	Usually time or "watchful waiting".	Usually not applicable.	Survival rates, mortality rates, rates of disease progression.
Etiology (Causation)	Patient's risk factors, current health disorders, or general health condition.	The intervention or exposure of interest. Includes an indication of the strength/dose of the risk factor and the duration of the exposure.	Usually not applicable.	Survival rates, mortality rates, rates of disease progression.

A well formulated question will helps to determine your Inclusive and Exclusive criteria, creation of search strategy, collecting data and presentation of your results.

2. DEFINE INCLUSION AND EXCLUSION CRITERIA

Once you have developed your research question, you will need to determine your inclusion/exclusion criteria - these are the characteristics which make a study eligible or ineligible to be included in your review. One of the features that differentiate the systematic review and traditional narrative review is the Pre-specification of eligible criteria (Including and Excluding the studies in review)

A large number of abstracts will found at the searching stage of review. Potential studies for the systematic reviews are scrutinized for the eligibility on the basis of its relevance and acceptability.

Systematic review seeks: Is the study relevant and acceptable for review? All systematic reviewers formulate inclusion and exclusion criteria to answer the review question further each systematic review has own purpose therefore its inclusion and exclusion criteria are unique in nature. However, criteria typically belongs to one or more categories such as study population, Nature of intervention, outcome, time duration, Culture and language range, type of research design and Publication date.^(5,6)

Each study need to compare against the same inclusion and exclusion criteria and can be included in review.

3. DEVELOP SEARCH STRATEGIES AND LOCATE STUDIES

A proper use of database and search filters allow you to narrow your results hence, researcher can retrieve the articles that are most appropriate and relevant to the research question. Filter options are vary by database that include Article publication dates, language, age, sex, species and subject.

In a systematic review search, reviewer should take care when applying filters, as researcher may lose the articles. The significant in developing an ideal search strategy is to balance the sensitivity that is retrieving a high proportion of relevant studies and receiving lower proportion of irreverent studies.⁸

4. SELECT STUDIES

Onceafterretrieving the comprehensive list of abstract, reviewer must filter the studies on the basis of inclusion criteria. The process of review is usually done by at least two reviewers to establish inter-rater reliability.⁹

The researcher team must agree on inclusion and exclusion criteria for the articles you are interested to review. Selection of studies takes place under following guidelines

- Screen each potentially useful study by reading title of the study and apply your inclusion and exclusion criteria.
- Decide whether to include the study in the review.
- Record the decision and reason for inclusion/ exclusion of the study screening.¹⁰

5. EXTRACT DATA

Once after identifying the studies to be included in systematic review, Next step is to extract and analyze the data presented on that studies.¹¹

In case of small number of studies were included, were reviewer probably don't need to go for coding the data for computer analysis instead summarize the information from the data extracted from selected studies. If a reviewer conducts an analytical review meta-analysis to compare the data from several studies, reviewer has to computerize the data. Data extraction by at least two reviewers is always important again for establishing inter-rater reliability and to avoid errors.¹²

Elements of data extraction:

- Consider the review question and objective
- Consider inclusion and exclusion criteria
- Consider the study Characteristics: Such as Full citation, objectives, intervention, Location, Duration, Design and methodology, outcome measures and results.¹³

6. ASSESS THE QUALITY OF STUDIES

There are many tools available in recent years to assess the quality of each RCT included in systematic reviews

Quality assessment elements

- Clinical question clearly stated?
- Search methods used to identify relevant studies clearly described?
- Was a comprehensive literature search performed?
- Are the inclusion/exclusion criteria used to screen primary studies clearly described?
- Was there duplicate study selection and data extraction?
- Were the characteristics of the included studies provided?
- Was the scientific quality of the included studies assessed and documented?
- Were the methods used to combine the findings of studies appropriate?
- Was the scientific quality of the included studies used appropriately in formulating conclusions?
- Was publication bias assessed?
- Was the conflict of interest stated?
- Are the stated conclusions supported by the data presented?

Rate the overall quality of the SR as "Good," "Fair," or "Poor" using questions.¹⁴

There are other more comprehensive recommended guidelines and standards available such as the Consolidated Standards of Reporting Trials (CONSORT Statement), as well as articles providing recommendations for improving quality in RCTs and meta-analyses for psychological interventions.

7. ANALYSIS AND INTERPRET RESULTS

There are numerous statistical programs available to calculate the effect sizes for meta-analysis, such as review manager endorsed by Cochrane collaboration. Effect sizes of meta-analysis are stated along with 95% confidence interval, and presented in both quantitative and graphical form (e.g. Forest plots).

Forest plots visually depict every trial as a horizontal diamond shape with the middle representing the study effect size and end point represent the zero mark. Often the left side of the graph represents the side favoring to the treatment and right side represent favor to the control condition. Bottom of the graph is summarize effect size or diamond represent all of the individual studies pooled together. Preferably, we would like to see entire diamond falling below zero indicate that intervention is favored over the control. The last step in writing processes summarizing the findings, and providing recommendations for clinical work. (e.g, Interventions are effective, for whom and under what condition) and research(e.g, Intervention required further research)⁹

CONCLUSION:Article caters all the researchers and health care professionalsto carry out systematic review and meta-analysis effectively and thus helps to implement Evidence based practice appropriately.

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