

A REPORT
BY
DR.V. GOPIKA
MBA HOSPITAL AND HEALTH MANAGEMENT
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REPORT
ON
SYSTEMTIC REVIEW AND META-ANALYSIS



COURSE LEARNINGS

TITLE: Systematic review and meta-analysis.

HOURS: 15hours

CREDITS: Coursera.

COURSE OBJECTIVE:

- To facilitate efficient integration of information for rational decision making.
- To provide a clear and transparent process.
- To minimize bias (systematic errors).
- To obtain a single summary report.
- To explain differences among studies on the same questions.

CONTENT COVERED:

- Introduction of systematic review.
- Features of systematic review.
- Purpose.
- Structure of systematic review.
- Steps involved.
- Bias in systematic review.
 - Source of bias.
 - Types of bias.
 - Assessment of bias.
- Standards of systematic review.
- Introduction to meta-analysis.
- Steps involved in meta-analysis.
- Models .
- Limitations.
- Conclusion.

METHODOLOGY:

- Videos
- Reading materials.
- Lectures.
- Assignment.
- Quiz.

KEY LEARNINGS

SYSTEMATIC REVIEW AND META – ANALYSIS.

INTRODUCTION

Systematic review plays a major role among health professionals in the delivery of healthcare and public health. It is much more than a literature review. Mainly carried out by medical researchers to synthesize all the available evidence on a question.

It is a process that determines a question and sets inclusion/exclusion criteria, finds the literature, selects the literature, critically appraises, and synthesis the literature. It also formulates the research questions that are broad or narrow in scope. They are designed to provide a complete, exhaustive summary of current evidence, published and unpublished that is methodical, comprehensive, and transparent. A good systematic review is described as the most reliable source of evidence that is used in the guidelines of clinical practice. It improves the method to conduct research. Meta-analysis is a type of systematic review. It is a statistical analysis of a large collection of results from individual studies. It is an optional component of the systematic review. It combines the results of several independent studies.

FEATURES OF SYSTEMATIC REVIEW

1. Clearly defined questions with inclusion and exclusion criteria.
2. A Systematic search of the literature.
3. Critical appraisal of included studies.
4. Data extraction and management.

5. Analysis and interpretation of results.
6. Report for publication.
7. Allows decisions based on the totality of the available evidence.
8. Meta-analysis can provide more precise estimates than individual studies.

PURPOSE OF SYSTEMATIC REVIEW

The main purpose of systematic review is to deliver a meticulous summary of all the available primary research in response to a research question that contributes to evidence-based practice.

STRUCTURE OF SYSTEMATIC REVIEW

- Background and description for meta-analysis.
- Methods
 - ☐ Description of the search strategy.
 - ☐ Eligibility criteria.
 - ☐ Description of data abstraction and management.
 - ☐ Quality assessment.
 - ☐ Statistical method.
- Results.
 - ☐ Search yield
 - ☐ Qualitative synthesis.
 - ☐ Quantitative synthesis.

STEPS INVOLVED IN SYSTEMATIC REVIEW

Step 1: Frame research question (Pico)



Step 2: Develop a search strategy.



Step 3: Develop a protocol.



Step 4: Run search strategy in at least two databases.



Step 5: Retrieve and de-duplicate citations.



Step 6: Develop a system for screening titles/abstracts and full texts



Step 7: Develop forms for assessing 'risk of bias's and extracting data.



Step 8: Assess the 'risk of bias's and extract data.



Step 9: Clean and manage data.



Step 10: Conduct a qualitative synthesis.



Step 11: Conduct meta-analysis (if appropriate).



Step 12: Write a report of the systematic review.



Step 13: Update systematic review.

FRAMING A QUESTION

It involves: -

- Resources in framing a question.
- Deciding the type and scope of the question.
- Elements of the question.
- Refining the question.
- Analytical framework(optional)

SEARCH STRATEGY

- Identification of evidence (development of protocol)
- Identification of techniques for searching
 - Key electronic database.
 - Indexing of randomized controlled trials and observational studies.
 - Other sources – trial registers, Gray literature searching.
- Building a high-quality search strategy.
 - Development of MEDLINE search strategy.
 - Searching PubMed.

COLLECTING DATA

The major aspect of conducting and writing a systematic review is reporting the exact methods for data collection. The most recent guidelines on conducting and reporting systematic reviews are the PRISMA statement (Preferred Reporting Items for Systematic reviews and Meta -Analyses). These guidelines facilitate the reporting of appropriate information.

DATA EXTRACTION

The data extraction component of a scientific review is determined by a well-organized spreadsheet. The spreadsheet is carefully piloted on a few select studies before

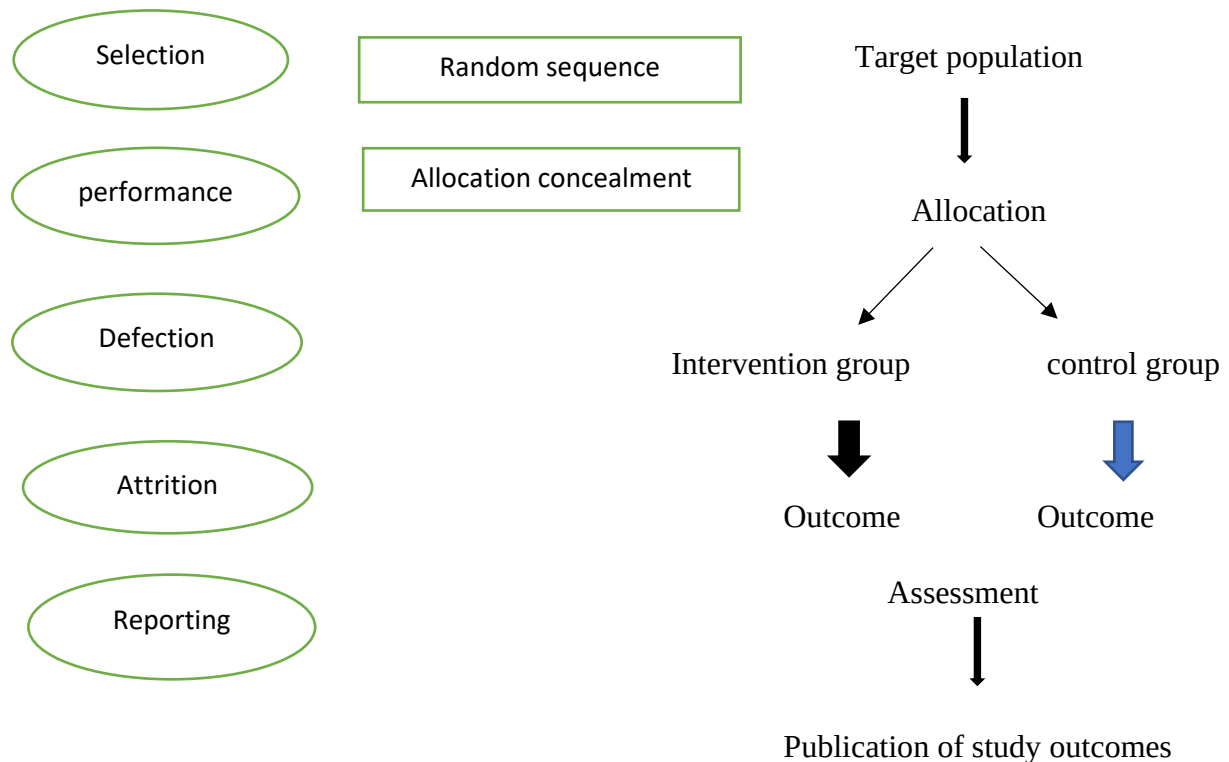
incorporating it into the entire review. The structure of the data collection form will vary between different systematic reviews. Thus, counting on the systematic review, more specific data collection items may have to be extracted for full appropriate review.

BIAS IN SYSTEMATIC REVIEW

The main role of a systematic review is to minimize the bias at all stages of the review process. They are not immune to the introduction of bias. Much of the literature around bias in systematic reviews concerns itself mainly with the assessment of bias within the first primary research reports included in systematic reviews. only studies with valid results of association can be included

The below mentioned flow chart is of source of bias. It explains about how a bias occurs in various stage of research. It might be favourable or unfavourable.

SOURCES OF BIAS



There are different types of bias:

- **Selection bias:**
occurs when a scientific review does not identify all available data on a subject.
- **Performance bias:**
A systematic difference in attention and treatment between two groups.
- **Attrition bias:**
A systematic difference in the loss to follow up (or withdrawals) between two groups.
- **Detection bias:**
The Systematic difference between the two groups in how outcomes are determined.
- **Reporting bias:**
The Systematic difference between reported and unreported findings.

Awareness of these sources of bias is vital for authors and consumers of the scientific literature as they conduct and skim systematic reviews and incorporate their findings into clinical practice and policymaking.

ASSESSING RISK OF BIAS

- Domain-based assessment: Cochrane recommendation.
- Impossible to know the rule risk of bias.
- Involves subjectivity.

TOOLS FOR ASSESSMENT

Categorizes each domain into

- Low risk.
- High risk.
- Unclear.

Support for judgement

- Direct quotes from the article.
- Additional comments with rationale.

STANDARDS OF SYSTEMATIC REVIEW

IOM STANDARDS FOR SYSTEMATIC REVIEW.

It addresses the entire systematic review process, from locating, screening, and selecting studies for the review, to synthesizing the findings (including meta-analysis) and assessing the overall quality of the body evidence, in producing the final report. The charge to this IOM committee was twofold:

- To assess the potential methodological standards that would assure objective, a transparent, and scientifically valid systematic review of comparative effectiveness research.
- To recommend a set of methodological standards for developing and reporting systematic reviews.
 - Initiating a systematic review.
 - Finding and assessing individual studies.
 - Use a prespecified method to evaluate the body of evidence.
 - Conduct qualitative synthesis.
 - In addition to qualitative analysis, the systematic review will include a quantitative analysis (meta-analysis).

QUALITATIVE SYNTHESIS

An assessment of the body of evidence that goes beyond factual descriptions or tables. It systematically searches for research on a topic and draw the findings from the individual studies and combines them together. It is also described as interpretative.

PURPOSE OF QUALITATIVE SYNTHESIS

- Is to develop and convey a deeper understanding of how an intervention might be working.
- It involves numerous judgments.
- Synthesis must be appropriately balanced and driven by the underlying data.
- Orient the reader to the clinical background.
- Identify the difference in the design.
- Interpret and assess the robustness of the meta-analysis result.

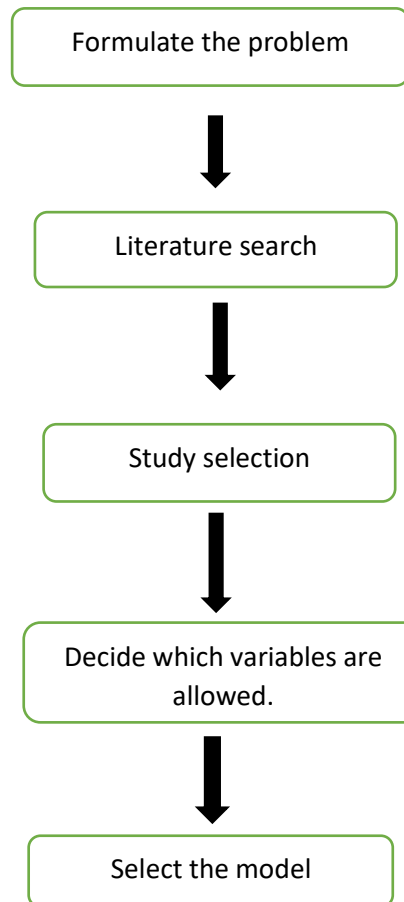
INTRODUCTION TO META-ANALYSIS

It is different from a systematic review. A statistical analysis that combines the results of several independent studies considered by the analyst to be combinable. It is done conceptually following major advantages:

- Generalization of results.
- Hypothesis testing can be applied on summary statistics.
- Investigate the presence of publication bias.
- Quantify inconsistency in results between studies.
- Improved power and precision due to a larger sample size.
- Also forms a crucial part of the “research synthesis” process.

A key benefit of this approach is the aggregation of information leading to a higher numerical power and more point estimate than is possible from the measure derived from any individual study.

STEPS TO CONDUCT META -ANALYSIS



MODELS OF META-ANALYSIS

There are two models of meta-analysis. They are: -

- Fixed effect model.
- Random effect model.

FIXED EFFECT MODEL.

It assumes that:

- All the studies are measuring the same, common(true) effect size.
- If not for random(sampling) error, all results would be identical.
- Denote the true(unknown) effect size by θ .

RANDOM EFFECT MODEL

It assumes that: -

- There are two components of variation:
 - Sampling variation as in our fixed-effect model assumption.
 - Random variation because the effect sizes themselves are samples from the population of effect sizes.
 - The confidence interval for the estimates of the random effects indicates our uncertainty about the location of the centre of random effects distribution, not its width.

LIMITATIONS

- Many SRs fail to assess the quality of the included research and neglect to report funding sources.
- The summary provided in a systematic review and meta-analysis of the literature is only as reliable as the methods used to estimate the effect in each of the primary studies.
- Controversies also arise around the interpretation of summarized results, particularly when the results of discordant studies are pooled in a meta-analysis.

CONCLUSION

Like all kinds of research, systematic reviews and meta-analyses have both potential strengths and weaknesses. Healthcare-decision makers in search of the simplest evidence to inform clinical decisions have come to rely on systematic reviews. It also gives us a clear idea of what is known, is not known, and about the potential benefits and harms of alternative drugs, devices, and other healthcare services. The systematic review represents an improvement because the methods for searching the relevant literature and synthesizing information are described clearly.

Thus, it is used to set agendas and funding for primary research by highlighting gaps in evidence.