Step-by-Step Guide to Writing a Systematic Review

Module Overview:

This module provides a comprehensive step-by-step guide for conducting and writing a systematic review. It begins with an introduction to systematic reviews, highlighting their significance and distinguishing features. The module covers key aspects such as formulating a research question, developing a review protocol, and implementing effective search strategies to identify relevant studies. It also emphasizes the critical appraisal of study quality and risk of bias assessment. The module guides learners on data extraction, synthesis techniques, and interpreting the findings. It addresses the process of presenting the results and drawing meaningful conclusions. Furthermore, it offers insights into the reporting and publication of systematic reviews, including adherence to reporting guidelines. Practical tips, best practices, and a compilation of resources and tools relevant to systematic reviews are also provided to assist learners in successfully navigating the review process.

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Introduction to Systematic Review Writing

- Importance of well-written systematic review papers
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Writing the Abstract

Writing the Introduction

- Articulating the background and rationale for the systematic review
- Describing the relevance and scope of the research question
- Providing an overview of the structure of the systematic review paper

Writing Methods and Study Selection

- Detailing the search strategy and databases used for literature search
- Describing the inclusion and exclusion criteria for study selection
- Discussing the process of study screening and data extraction

Presenting the Results

- Summarizing the characteristics of included studies (e.g., study design, sample size)
- Presenting the main findings of each study in a clear and concise manner
- Considering the use of tables, graphs, or other visual aids to enhance data presentation

Interpreting the Findings and Discussion

- Analyzing and interpreting the results in light of the research question
- Addressing potential biases or limitations of the included studies
- Discussing the implications of the findings and their relevance to the broader field

Conclusion and Future Directions

- Summarizing the key findings and implications of the systematic review

- Providing recommendations for future research or practice based on the review's outcomes
- Concluding the systematic review paper with a concise and impactful final statement

Editing, Formatting, and References

- Reviewing the systematic review paper for clarity, coherence, and consistency
- Ensuring adherence to journal-specific formatting guidelines
- Properly citing and referencing all sources used in the systematic review

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Fundamentals of In-Text Citations and References in Systematic Review Papers

Practice Exercises and Systematic Review Papers Writing Tips

# SECTION I: UNDERSTANDING SYSTEMATIC REVIEWS

Introduction to Systematic Reviews

What is a systematic review?

A systematic review can be defined as "a review of a clearly formulated question that uses systematic and explicit methods to identify, select and critically appraise relevant research, and to collect and analyze data from the studies that are included in the review. Statistical methods (meta-analysis) may or may not be used to analyze and summarize the results of the included studies.
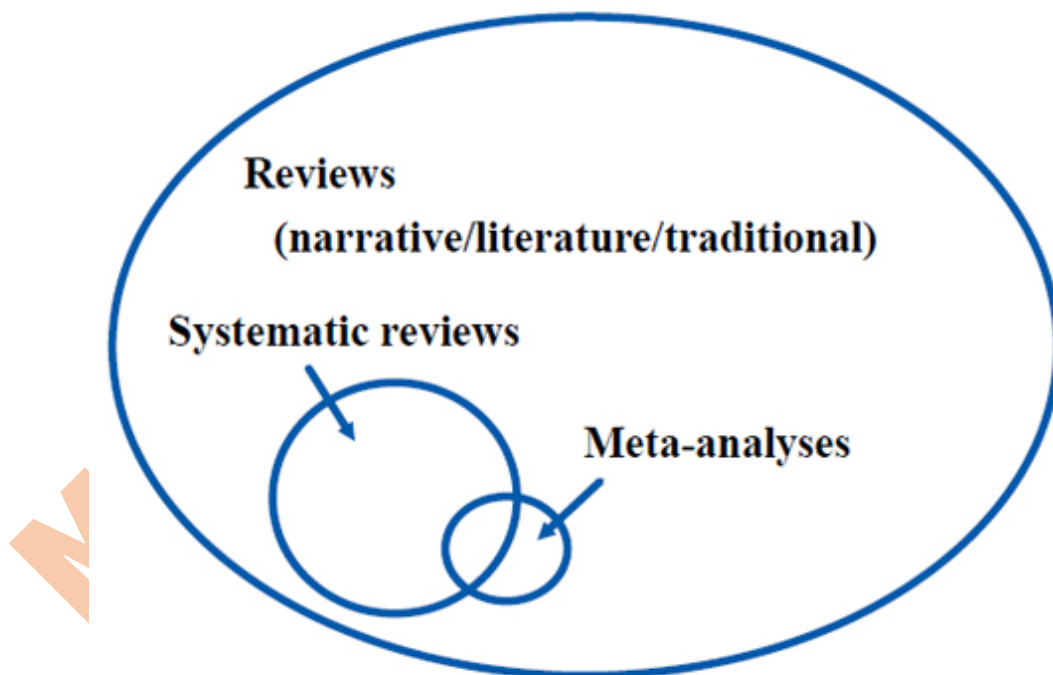
Figure 1. Types of reviews.

Importance and purpose of conducting systematic reviews

The advantages of systematic reviews are numerous. They begin by providing a thorough and lucid summary of the evidence that is currently available on a particular subject. Additionally, SRs aid in locating research holes in our current comprehension of a field. They can draw attention to methodological issues in research studies that can be used to enhance upcoming work in the field. Finally, they can be used to determine which questions have clear answers from the evidence at hand and don't require further investigation.

For new authors in particular, conducting systematic reviews will prove to be a worthwhile endeavour. Authors develop new research ideas, deepen their understanding of the subject matter, and develop critical synthesis skills.

Key differences between systematic reviews and other types of reviews

Research Question: Systematic reviews typically address focused research questions that aim to synthesize and summarize the available evidence on a specific topic. Other types of reviews may have broader or more general research questions.

Comprehensive Search: Systematic reviews require a comprehensive and systematic search of multiple databases and sources to identify all relevant studies. Other types of reviews may have more limited search strategies or rely on a smaller set of sources.

Inclusion Criteria: Systematic reviews have predefined inclusion and exclusion criteria to select studies that meet specific criteria (e.g., study design, population, interventions). Other types of reviews may have less strict or explicit criteria for study selection.

Critical Appraisal: Systematic reviews involve a critical appraisal of the quality and risk of bias in the included studies. This evaluation helps to assess the reliability and validity of the evidence. Other types of reviews may not include a formal quality assessment of the included studies.

Data Synthesis: Systematic reviews use specific methods, such as meta-analysis or qualitative synthesis, to analyze and combine data from multiple studies. Other types of reviews may provide a narrative summary without formal data synthesis.

Transparency and Reproducibility: Systematic reviews adhere to transparent and reproducible methodologies, often guided by
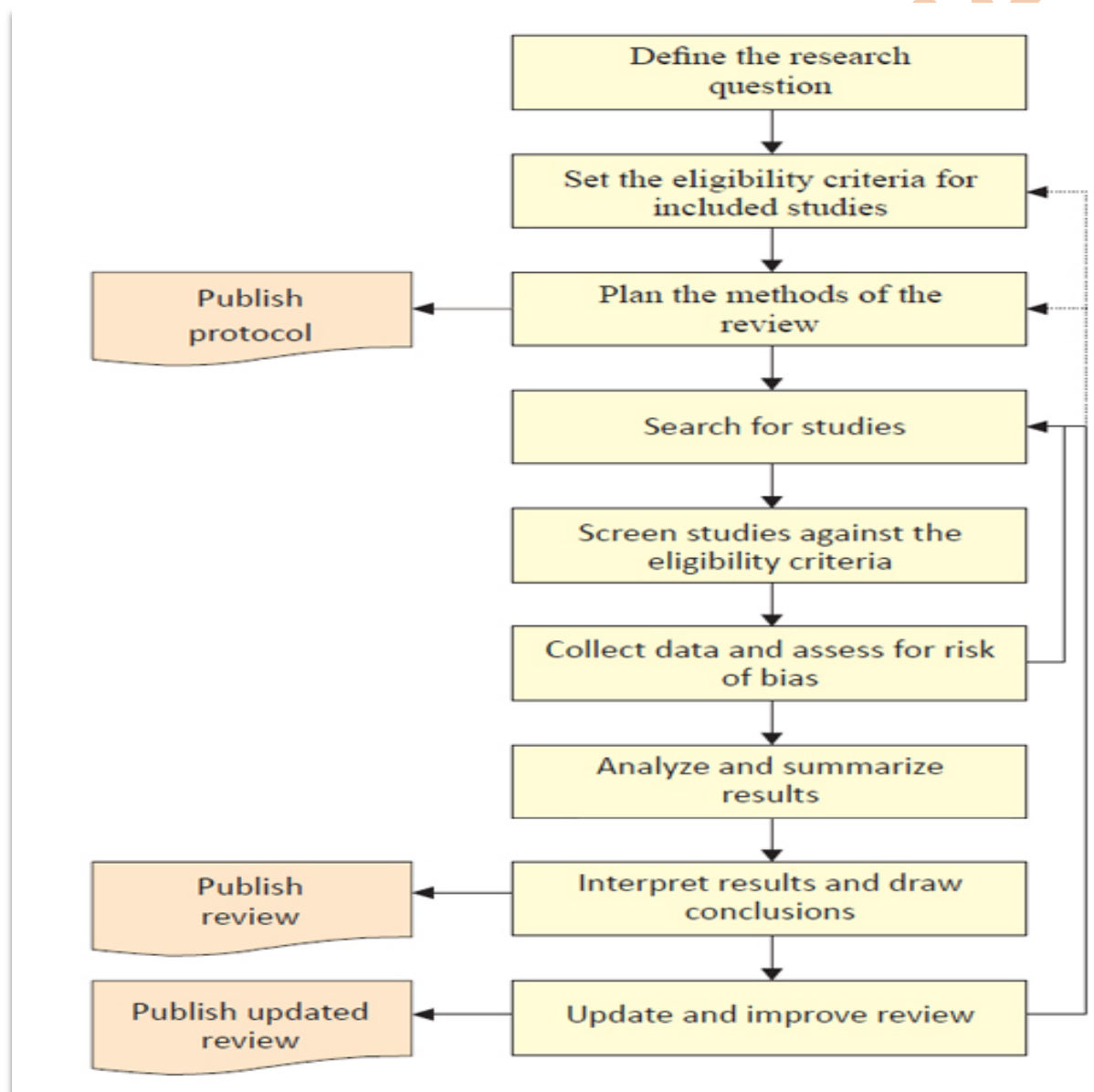
established protocols. This ensures transparency in study selection, data extraction, and analysis. Other types of reviews may have less standardized processes and may not provide detailed methodological information.

Reporting Guidelines: Systematic reviews often follow specific reporting guidelines, such as the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, to ensure the clear and transparent reporting of the review process and findings. Other types of reviews may not have specific reporting guidelines.

Scope and Depth: Systematic reviews aim to provide a comprehensive and unbiased synthesis of the available evidence on a specific research question. Other types of reviews may have a narrower scope, focus on specific aspects or perspectives, or provide more opinion-based interpretations.

It's important to note that the specific characteristics and differences can vary depending on the field of study and the guidelines or conventions followed within that discipline.

Stages of Systematic Review

Define the research question

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Set the eligibility criteria for included studies

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Plan the methods of the review → Publish protocol

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Search for studies

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Screen studies against the eligibility criteria

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Collect data and assess for risk of bias

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Analyze and summarize results

↓

Interpret results and draw conclusions → Publish review

↓

Update and improve review → Publish updated review

Formulating the Research Question and Protocol

Defining the research question and objectives

The first steps in conducting a systematic review are to define the research question and develop a protocol. Your systematic review's success is dependent on a clear and focused question, so take the time to get it right.

	PICO	PICOS	SPIDER
Patient/service user	Population	Population	Sample
Health care services	Intervention	Intervention	Phenomenon of Interest
Named types of qualitative data collection and analysis	Comparison	Comparison	Design
Experiences, perceptions	Outcome	Outcome	Evaluation
Qualitative or qualitative method	not applicable	Study type	Research type

Question Type	Patient, Population, Problem	Intervention or exposure	Comparison or control	Outcome measures
Therapy (Treatment)	Patient's disease or disease condition	A therapeutic measure such as surgical inventions, medications or change in lifestyle	Standard care or a placebo	Pain, mortality rate, disability
Prevention	Risk factors for patient's and common health conditions	Preventive measures including medications or change in lifestyle	Preventative measures or NA	Disease incidence, the mortality rate
Diagnosis	Specific disease or disease condition	Surgical procedures or a diagnostic test	The current standard test for that disease or disease condition	Sensitivity and specificity measures of the test utility
The prognosis (Forecast)	Time and severity of major prognostic factor of clinical issues	Watchful waiting	NA	Rate of disease progression, survival rate, the mortality rate
Aetiology (Causation)	Patient's risk factors, general health conditions or current health disorders	The intervention or an exposure of interest which includes an indication of strength, dose of risk factor and the duration of exposure	NA	Rate of disease progression, survival rate, the mortality rate

Obtained from: https://canberra.libguides.com/systematic/question

Examples of few bad (left-hand side column) and few good (right-hand side) research questions

Bad examples of research question	Good examples of research question
Very narrow: What is the protein-energy malnutrition in schoolchildren in Delhi?	Less narrow: How does the education level of the parents impact protein-energy malnutrition in schoolchildren of Delhi?
This is too narrow because it can be answered with a simple statistic. Questions that can be answered with a "yes" or a "no" should also typically be avoided	This question is more specific will lead to more meaningful research and the results would provide the opportunity for an argument to be formed
Unfocussed: What are the effects of protein-energy malnutrition in schoolchildren in New Delhi?	More focused: How does protein-energy malnutrition among children affect academic performance in elementary schoolchildren in Delhi?
This question is so broad that research methodology would be very difficult and the question is too broad to be discussed in a typical research paper	This question has a very clear focus for which data can be collected, analyzed, and discussed
Very objective: How much time do young children in Delhi spend doing physical activity per day?	More subjective: What is the relationship between physical activity levels and childhood obesity?
This question may allow the researcher to collect data but does not lend itself to collecting data that can be used to create a valid argument because the data is just factual information	This is a more subjective question that may lead to the formation of an argument based on the results and analysis of the data. It is interesting and relevant too
Too simple: How are school systems in various schools of Delhi addressing childhood behavioral problems?	More complex: What are the effects of intervention programs in the elementary schools on the rate of childhood psychological health among 6th- 9th-grade students?
This information can be obtained without the need to collect unique data. The question could be answered with a simple online search and does not provide an opportunity for analysis	This question is more complex and requires both investigation and evaluation which will lead the research to form an argument that may be discussed. It is interesting and relevant

Developing the review protocol

A review protocol serves as a roadmap for the entire review process, outlining the research question, study selection criteria, search strategy, data extraction methods, and analysis plan.

Review protocol can be achieved by the following **main** steps:

Define the Research Question: Clearly articulate the research question or objective of your systematic review. Ensure that it is specific, focused, and answerable through a comprehensive review of the available evidence.
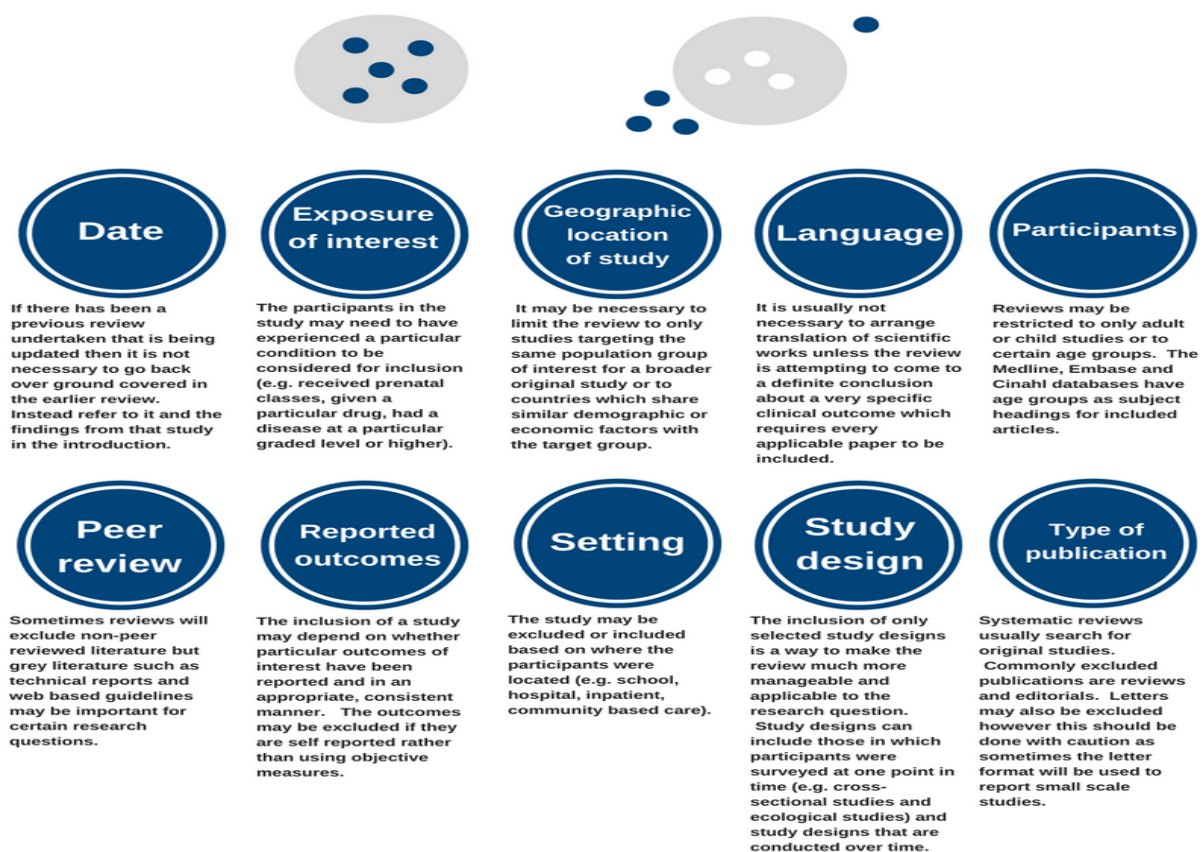
Determine Inclusion and Exclusion Criteria: Establish criteria for study selection based on the population, intervention/exposure, comparator, outcomes (PICO), and study design. Clearly define the types of studies and data sources that will be included or excluded from the review.

Develop Search Strategy: Design a comprehensive and reproducible search strategy to identify relevant studies. Determine the databases, search terms, and filters that will be used. Consider consulting with a librarian or information specialist for assistance.

Inclusion and exclusion criteria for study selection

Inclusion and exclusion criteria set the boundaries for the systematic review. They are determined after setting the research question usually before the search is conducted, however scoping searches may need to be undertaken to determine appropriate criteria. Many different factors can be used as inclusion or exclusion criteria. Information about the inclusion and exclusion criteria is usually recorded as a paragraph or table within the methods section of the systematic review.   It may also be necessary to give the definitions, and source of the definition, used for particular concepts in the research question (e.g. adolescence, depression).

Common Inclusion/Exclusion Criteria

Date

If there has been a previous review undertaken that is being updated then it is not necessary to go back over ground covered in the earlier review. Instead refer to it and the findings from that study in the introduction.

Exposure of interest

The participants in the study may need to have experienced a particular condition to be considered for inclusion (e.g. received prenatal classes, given a particular drug, had a disease at a particular graded level or higher).

Geographic location of study

It may be necessary to limit the review to only studies targeting the same population group of interest for a broader original study or to countries which share similar demographic or economic factors with the target group.

Language

It is usually not necessary to arrange translation of scientific works unless the review is attempting to come to a definite conclusion about a very specific clinical outcome which requires every applicable paper to be included.

Participants

Reviews may be restricted to only adult or child studies or to certain age groups. The Medline, Embase and Cinahl databases have age groups as subject headings for included articles.

Peer review

Sometimes reviews will exclude non-peer reviewed literature but grey literature such as technical reports and web based guidelines may be important for certain research questions.

Reported outcomes

The inclusion of a study may depend on whether particular outcomes of interest have been reported and in an appropriate, consistent manner.   The outcomes may be excluded if they are self reported rather than using objective measures.

Setting

The study may be excluded or included based on where the participants were located (e.g. school, hospital, inpatient, community based care).

Study design

The inclusion of only selected study designs is a way to make the review much more manageable and applicable to the research question.   Study designs can include those in which participants were surveyed at one point in time (e.g. cross-sectional studies and ecological studies) and study designs that are conducted over time.

Type of publication

Systematic reviews usually search for original studies.   Commonly excluded publications are reviews and editorials. Letters may also be excluded however this should be done with caution as sometimes the letter format will be used to report small scale studies.

- Other inclusion/exclusion criteria can include the sample size, method of sampling or availability of a relevant comparison group in the study. Where a single study is reported across

multiple papers the findings from the papers may be merged or only the latest data may be included.

- For a systematic review, you would typically consider primary research papers that address a well-defined research question, meet predefined eligibility criteria, and use a specific methodology to minimize bias and ensure reproducibility. Some types of papers that you may consider for inclusion in a systematic review are:

1. Randomized controlled trials (RCTs): RCTs are considered the gold standard for evaluating the efficacy of an intervention or treatment. They involve random allocation of participants to a treatment or control group and use a standardized protocol to measure outcomes.

2. Observational studies: Observational studies, such as cohort studies, case-control studies, and cross-sectional studies, can provide valuable information on the natural history of a disease, risk factors, and associations between variables.

3. Quasi-experimental studies: Quasi-experimental studies, such as non-randomized controlled trials, can provide information on the effectiveness of an intervention in real-world settings, where randomization may not be feasible or ethical.

4. Diagnostic accuracy studies: Diagnostic accuracy studies evaluate the accuracy of a diagnostic test or tool in detecting a specific condition or disease. They typically report measures such as sensitivity, specificity, and predictive values.

5. Economic evaluations: Economic evaluations assess the cost-effectiveness or cost-benefit of an intervention or treatment. They can provide valuable information for decision-making in healthcare.

Commonly asked questions while formulating a search strategy:

What Is the Minimum Number of Studies to Include in a Systematic Review?

There is no minimum number of studies to include in a systematic review. The number of studies you include in a systematic review largely depends on your research topic, as well as the amount of supportive evidence available. A systematic review may be valid even if it contains no studies, as it indicates the field's lack of research and knowledge gaps.

Can Other Systematic Reviews Be Included as Data?

Since systematic reviews are considered secondary studies, including them as data is a grey area. However, there's a consensus that they should be noted in order to express that there have been reviews done on the topic.

Searching and Identifying Relevant Studies

Selecting appropriate databases and other sources

There are a number of databases that can be searched for literature, but the identification of relevant sources is dependent on the clinical or research question (different databases have different focuses, from more biology to more social science oriented) and the type of evidence that is sought (i.e. some databases report only randomised controlled trials).

- *Electronic databases*
1. MEDLINE/PubMed: www.ncbi.nlm.nih.gov/pubmed
2. Embase: www.embase.com
3. PsycINFO: www.apa.org/psycinfo
4. Cochrane Central Register of Controlled Trials (CENTRAL): www.cochranelibrary.com
5. Cumulative Index of Nursing and Allied Health Literature (CINAHL): www.cinahl.com
6. British Nursing Index: www.bniplus.co.uk
7. Allied and Complementary Medicine Database: https://www.ebsco.com/products/research-databases/amed-the-allied-and-complementary-medicine-database

- Searching electronic databases
  It is very important to identify search terms. Here comes something called MeSH.
- Records in PubMed have been assigned subject headings, a controlled vocabulary called Medical Subject Headings or MeSH for short. These are used to index citations allowing you to retrieve all records on a particular subject regardless of the terminology used by the author. For example, a search for the subject heading **Myocardial Infarction** will retrieve records that include terms such as heart attack, acute myocardial injury and

myocardial infarction including any variant spellings and plurals. Narrower, more specific MeSH terms will also be searched for such as **ST Elevation Myocardial Infarction**.

- A simple PubMed search automatically searches for MeSH terms. However, you can also carry out your own searches using the MeSH database if you wish.
- [MeSH database](#) MeSH (Medical Subject Headings) is the NLM controlled vocabulary thesaurus used for indexing citations in MEDLINE and PubMed. When searching PubMed, and limiting the search to MeSH, only MEDLINE citations will be retrieved. **Use MeSH to Build a Better PubMed Query:** https://youtu.be/uyF8uQY9wys

Commonly asked questions while formulating a search strategy:

Which databases should I search for my systematic review?
The choice of databases depends on the subject area and scope of your review. Commonly recommended databases include PubMed/MEDLINE, Embase, Scopus, Web of Science, CINAHL, PsycINFO, and Cochrane Library.

How do I determine if a database is relevant to my review?
Beginners may struggle with determining the relevance of a database to their review. Consider the subject coverage, indexing, and depth of content related to your research question. Look for databases that specialize in the field or discipline relevant to your topic. Explore the database's search features and tools to assess their suitability for your review.

Should I include non-English databases in my search?
If your research question includes non-English studies or if you want to minimize language bias, it is advisable to include relevant non-English databases. However, language restrictions should be considered based on available resources and the review's scope.

Are there specific databases for gray literature?

Beginners may be unaware of databases that specialize in gray literature. Databases such as OpenGrey, ProQuest Dissertations and Theses, ClinicalTrials.gov, grey literature databases specific to their field, and conference proceedings databases. It is important to note the importance of searching gray literature sources to capture unpublished or difficult-to-access studies.

How do I search beyond databases?

Beginners may not be aware of searching beyond traditional databases. Explain the importance of manual searching, which involves hand searching key journals, contacting experts, searching conference proceedings, and scanning reference lists of relevant articles. Encourage the use of citation tracking to identify studies that have cited relevant articles.

How can I manage the large number of search results?

Beginners often struggle with managing a large number of search results. You can use reference management software (e.g., EndNote, Zotero) to organize and de-duplicate search results. It is quite important to systematically screen titles and abstracts, and using screening tools or software to streamline the process. It is very important to be consistent and transparent while doing the documentation of the screening process.

How do I know if I've searched enough databases?

The goal is to conduct a comprehensive search rather than exhaustively searching every possible database. By searching the major relevant databases and other sources, using a systematic approach, and consulting with experts, they can achieve a robust literature search.

Can I rely solely on one database for my search?
Beginners may inquire about relying solely on one database for their search. It is important to understand the importance of searching multiple databases to minimize the risk of missing relevant studies. Different databases may have variations in indexing, coverage, and access to specific journals or publications.

How do I keep track of the databases I've searched?
Beginners may struggle with keeping track of the databases they have searched. Maintain a search record or log that documents the databases searched, search terms used, and date of search. This record will serve as a reference for reporting the search process in the systematic review manuscript.

How often should I repeat the search during the review process?
Beginners may wonder how frequently they should repeat the search during the review process. It is advisable to conduct an updated search close to the completion of the review to capture any newly published studies. The timing of the updated search may depend on the review's duration and the currency of the field.

Techniques for effective study screening and selection

- Screening is the process of identifying studies from the literature search for inclusion in the review.

- PRISMA (Preferred Reporting Items for Systematic reviews and Meta-Analyses) is fast becoming a standard for reporting of systematic reviews and meta-analyses, but is also used with other review types.

- It includes a procedural checklist, and a flow diagram to illustrate the screening process.
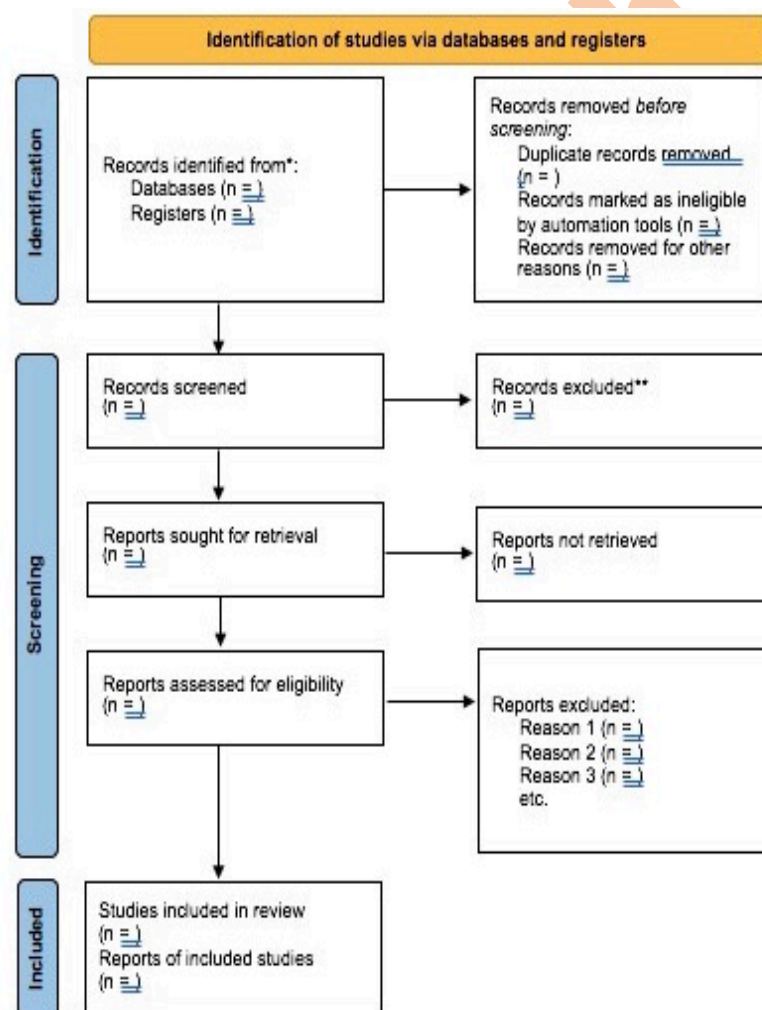
PRISMA CHART

Tools to manage the screening process

- Consider using one of the tools below to manage the screening process.
- EndNote (Deakin supported)
  Export searches to an EndNote library. Create groups to screen citations against inclusion and exclusion criteria, then populate the PRISMA flow diagram.
- Covidence (Deakin supported)
  Cochrane-recommended web-based software that streamlines the production of systematic reviews. Allows importing of citations, management of screening by multiple reviewers, data extraction and data export. Deakin has a license for Covidence and for more information go to the Covidence page.
- Rayyan (free)
  Web based collaborative application facilitates team screening, including the upload of citations and recording of the decisions behind the screening process. A mobile app allows you to screening articles any place. Read the Rayyan for Systematic Reviews guide for further advice on this tool.
  When exporting from EndNote, choose the RIS format to import into Rayyan. More instructions are in this EndNote guide.
  Check out this tutorial: https://youtu.be/1YWABilWWIg

Understanding the Screening Process:

- Your review protocol developed at the beginning of your review will have outlined inclusion and exclusion criteria. These will form the basis of the screening process.
- Begin by screening titles and abstracts to remove obviously irrelevant material. At this stage you may not need to provide justification for your exclusions.
- You will then need to examine the full text of an article for more detailed screening against your eligibility criteria. At this stage you must provide reasons why you exclude documents.

Consider:

- appropriate study population (age, geography, illness)
- appropriate intervention/method/measurements
- comparable environment/ population
- language - can the article be sourced/translated in the language required?

When reviewing the full text of the article, consider:

- appropriate method/measurement
- appropriate sample size
- duplication of data (avoid counting the same data twice)
- access to data not included in the article if required

A team of at least two or three reviewers is important for the screening process to reduce the risk of selection errors and selection bias.

Reviewer teams should:

- have a good knowledge of the topic for fast and accurate screening
- prepare for screening by doing a pilot screen to establish themes or possible difficulties
- work independently during the screening process to avoid influencing other's decisions

The review paper should detail how many reviewers screened and the process used for resolving any disagreement.

Assessing Study Quality and Risk of Bias

Understanding quality assessment and risk of bias

Quality assessment and risk of bias assessment are essential components of a systematic review. These assessments help evaluate the methodological rigor and reliability of individual studies included in the review. Here's an overview of understanding quality assessment and risk of bias:

Quality Assessment:

Quality assessment involves evaluating the overall quality and validity of individual studies. It aims to determine if the included studies have been conducted in a way that minimizes bias and provides reliable evidence. Commonly used tools for quality assessment include the Newcastle-Ottawa Scale (NOS) for observational studies and the Cochrane Risk of Bias Tool for randomized controlled trials (RCTs).

During quality assessment, reviewers typically evaluate various aspects of a study, such as study design, sample size, data collection methods, statistical analysis, and reporting of results. The assessment can help identify potential limitations or biases that may affect the validity of the study's findings.

Risk of Bias Assessment:

Risk of bias assessment specifically focuses on the potential biases that can influence the internal validity of a study. Biases can arise from various sources, such as study design, conduct, or reporting. The Cochrane Risk of Bias Tool is commonly used to assess the risk of bias in RCTs, covering domains like random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other sources of bias.

During the risk of bias assessment, reviewers assign a judgment (low, high, or unclear) to each domain based on the information provided in the study. The assessment helps determine the overall risk of bias for each study, highlighting potential methodological flaws that may impact the reliability and validity of the results.

Interpreting Quality Assessment and Risk of Bias:
Quality assessment and risk of bias assessment should be conducted by at least two independent reviewers. Discrepancies between reviewers should be resolved through discussion or consultation with a third reviewer if needed.

The results of quality assessment and risk of bias assessment are typically summarized and reported in the systematic review. This information provides readers with insights into the strengths and weaknesses of the included studies and allows them to judge the overall confidence in the review's findings.

It's important to note that quality assessment and risk of bias assessment should not be used to exclude studies from the review solely based on their quality or bias levels. Rather, these assessments provide transparency and help readers interpret the limitations and potential impact of bias on the results. It is crucial to consider the overall body of evidence when drawing conclusions from a systematic review.

By conducting thorough quality assessment and risk of bias assessment, reviewers can provide a robust evaluation of the included studies and enhance the credibility and reliability of the systematic review's findings.

Selecting appropriate tools for quality appraisal

When conducting a systematic review, selecting appropriate tools for quality appraisal depends on the type of study design included in the review. Different tools are available for assessing the quality of various study designs.

Some commonly used tools for quality appraisal:

Newcastle-Ottawa Scale (NOS): The NOS is widely used for assessing the quality of observational studies, including cohort studies, case-control studies, and cross-sectional studies. It evaluates studies based on selection of study groups, comparability of groups, and ascertainment of the exposure or outcome of interest.

Cochrane Risk of Bias Tool: The Cochrane Risk of Bias Tool is specifically designed for assessing the risk of bias in randomized controlled trials (RCTs). It evaluates the quality of studies based on domains such as random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, and other potential sources of bias.

Joanna Briggs Institute (JBI) Critical Appraisal Tools: The JBI provides a range of critical appraisal tools for various study designs, including systematic reviews, RCTs, cohort studies, case series, and qualitative studies. These tools help assess the methodological quality and risk of bias specific to each study design.

Methodological Index for Non-Randomized Studies (MINORS): The MINORS tool is designed for assessing the quality of non-randomized studies, such as non-randomized controlled trials, cohort studies, and case-control studies. It evaluates items related to the study's aim, patient selection, comparability of groups, outcomes, and statistical analysis.

Quality Assessment of Diagnostic Accuracy Studies (QUADAS-2): The QUADAS-2 tool is used to assess the risk of bias and applicability of diagnostic accuracy studies. It evaluates domains such as patient selection, index test, reference standard, flow and timing, and concerns regarding applicability.

AGREE II (Appraisal of Guidelines for Research and Evaluation): The AGREE II tool is designed for assessing the quality and rigor of clinical practice guidelines. It evaluates items related to the guideline's scope and purpose, stakeholder involvement, rigor of development, clarity of presentation, applicability, and editorial independence.
It's important to select the appropriate tool(s) based on the study designs included in your systematic review. Familiarize yourself with the specific instructions and scoring criteria provided by each tool. Ensure that the chosen tool aligns with your research question and review objectives.

Additionally, consider consulting established guidelines and resources specific to your field or topic, as they may provide discipline-specific tools or recommendations for quality appraisal.

Remember that the purpose of quality appraisal is to assess the methodological quality and risk of bias of individual studies, providing transparency and informing the interpretation of the systematic review's findings.

Conducting critical appraisal of included studies

Critical appraisal involves checking the quality, reliability and relevance of the studies in the review in relation to the review question. It appraises each study in terms of the following aspects:.
- Is the study relevant to the research question?
- Is the study valid? E.g. Were the study methods applied appropriately?
- Were appropriate methods used in relation to the review question?

In addition, the studies are collectively appraised in terms of how they support the review findings and evidence claims of the review. For example, if the research evidence comprises of studies that have wide variation of findings, this reduces the strength of the evidence claims. There are many standardised tools available for critical appraisal depending on the study design and the type of review. The approach to critical appraisal and the appraisal decisions for each study should be reported.

Appraisal Resources:

Checklists
- [Critical Appraisal Skills Programme (CASP)](#)
- [A Measurement Tool to Assess Systematic Reviews (AMSTAR)](#)

Tools and resources
- The [Quality Assessment and Risk of Bias Tool Repository](#) - lists appraisal tools which can then be filtered by study type to see which are suitable for the studies to be assessed. There are also notes about the tool in some cases.
- [McMaster University critical review forms](#) - includes both qualitative and quantitative study designs
- [Joanna Briggs Institute](#) - a number of downloadable checklists for a range of study types.
- [The Systematic Review Toolbox](#) - a searchable catalogue of tools for use when conducting advanced reviews process.

- [The University of South Australia](#) - has a range of appraisal tools, listed by type of study.
- [Evidence Analysis Manual](#), in particular the [Quality Criteria Checklist](#) from the Academy of Nutrition and Dietetics.

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- [Evidence Analysis Manual](#), in particular the [Quality Criteria Checklist](#) from the Academy of Nutrition and Dietetics.

Data Extraction and Synthesis

Methods for extracting data from selected studies

Data extraction is the process of a systematic review that occurs between identifying eligible studies and analysing the data, whether it can be a qualitative synthesis or a quantitative synthesis involving the pooling of data in a meta-analysis. The aims of data extraction are to obtain information about the included studies in terms of the characteristics of each study and its population and, for quantitative synthesis, to collect the necessary data to carry out meta-analysis. In systematic reviews, information about the included studies will also be required to conduct risk of bias assessments.

Following good practice when extracting data will help make the process efficient and reduce the risk of errors and bias. Failure to follow good practice risks basing the analysis on poor quality data, and therefore providing poor quality inputs, which will result in poor quality outputs, with unreliable conclusions and invalid study findings. In computer science, this is known as 'garbage in, garbage out' or 'rubbish in, rubbish out'. Furthermore, providing insufficient information about the included studies for readers to be able to assess the generalisability of the findings from a systematic review will undermine the value of the pooled analysis. Such failures will cause your systematic review and meta-analysis to be less useful than it ought to be.

While there is no one-size-fits-all set of formal guidelines for data extraction in systematic reviews, there are several widely recognized resources that provide guidance on this process.

Here are some formal guidelines and resources that can be helpful in developing your data extraction process:

Cochrane Handbook for Systematic Reviews of Interventions: The Cochrane Collaboration is a well-known organization that provides comprehensive guidance on conducting systematic reviews. The Cochrane Handbook for Systematic Reviews of Interventions offers detailed information on data extraction methods and provides examples of data extraction forms.

PRISMA Statement: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement is a widely accepted guideline for reporting systematic reviews. While it does not provide explicit instructions on data extraction, it emphasizes the importance of transparently reporting the data extraction process, including details on what data were collected and how they were synthesized.

Joanna Briggs Institute (JBI) Manual for Evidence Synthesis: The JBI is a well-known organization that focuses on evidence-based healthcare practice. Their Manual for Evidence Synthesis provides guidance on various aspects of systematic reviews, including data extraction. It offers recommendations on designing data extraction forms, managing data, and ensuring consistency.

Institute of Medicine (IOM) Standards for Systematic Reviews: The IOM has developed standards for conducting systematic reviews to inform policy decisions. While these standards are not specific to data extraction, they highlight the importance of transparency and rigorous methodology in the review process, which includes data extraction.

When developing your data extraction process, it is recommended to review these guidelines and adapt them to your specific research question and review objectives. Additionally, consult any specific guidelines provided by the journal or organization for which you are conducting the systematic review, as they may have additional requirements or recommendations.

Remember that data extraction is a critical step that requires attention to detail and consistency. It is important to clearly document the data extraction process, including any decisions or judgments made during the extraction, to ensure transparency and reproducibility of the review.

In this step of the systematic review, you will develop your evidence tables, which give detailed information for each study (perhaps using a PICO framework as a guide), and summary tables, which give a high-level overview of the findings of your review. You can create evidence and summary tables to describe study characteristics, results, or both. These tables will help you determine which studies, if any, are eligible for quantitative synthesis.

What should you extract?

Table 7.3.a: Checklist of items to consider in data collection or data extraction
Items without parentheses should normally be collected in all reviews; items in square brackets may be relevant to some reviews and not others.

Source
- Study ID (created by review author).
- Report ID (created by review author).
- Review author ID (created by review author).
- Citation and contact details.

Eligibility
- Confirm eligibility for review.
- Reason for exclusion.

Methods
- Study design.
- Total study duration.
- Sequence generation*.
- Allocation sequence concealment*.
- Blinding*.
- Other concerns about bias*.

Participants
- Total number.
- Setting.
- Diagnostic criteria.
- Age.
- Sex.
- Country.
- [Co-morbidity].
- [Socio-demographics].
- [Ethnicity].
- [Date of study].

Interventions
- Total number of intervention groups.

For each intervention and comparison group of interest:
- Specific intervention.
- Intervention details (sufficient for replication, if feasible).
- [Integrity of intervention].

Outcomes
- Outcomes and time points (i) collected; (ii) reported*.

For each outcome of interest:
- Outcome definition (with diagnostic criteria if relevant).
- Unit of measurement (if relevant).
- For scales: upper and lower limits, and whether high or low score is good.

Results
- Number of participants allocated to each intervention group.

For each outcome of interest:
- Sample size.
- Missing participants*.
- Summary data for each intervention group (e.g. 2×2 table for dichotomous data; means and SDs for continuous data).
- [Estimate of effect with confidence interval; P value].
- [Subgroup analyses].

Miscellaneous
- Funding source.
- Key conclusions of the study authors.
- Miscellaneous comments from the study authors.
- References to other relevant studies.
- Correspondence required.
- Miscellaneous comments by the review authors.

Approaches to data synthesis

Your collected data must be combined into a coherent whole and accompanied by an analysis that conveys a deeper understanding of the body of evidence. All reviews should include a qualitative synthesis, and may or may not include a quantitative synthesis (also known as a meta-analysis).

A qualitative synthesis is a narrative, textual approach to summarizing, analyzing, and assessing the body of evidence included in your review. It is a necessary part of all systematic reviews, even those with a focus on quantitative data.

Use the qualitative synthesis to:
- Provide a general summary of the characteristics and findings of the included studies.
- Analyze the relationships between studies, exploring patterns and investigating heterogeneity.
- Discuss the applicability of the body of evidence to the review's question within the PICO structure.
- Explain the meta-analysis (if one is conducted) and interpret and analyze the robustness of its results.
- Critique the strengths and weaknesses of the body of evidence as a whole, including a cumulative assessment of the risk of bias across studies.
- Discuss any gaps in the evidence, such as patient populations that have been inadequately studied or for whom results differ.
- Compare the review's findings with current conventional wisdom when appropriate.

Resources and Tools for Systematic Reviews

When embarking on a systematic review, beginners can benefit from using various resources and tools to facilitate the process.

Some helpful resources and tools for beginners conducting systematic reviews:

Cochrane Handbook for Systematic Reviews of Interventions: The Cochrane Handbook is a comprehensive guide to conducting systematic reviews in the field of healthcare. It provides detailed instructions on each step of the review process, including formulating research questions, searching for studies, data extraction, and meta-analysis. The handbook is freely available online and offers valuable insights for beginners.

PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses): PRISMA is a widely recognized reporting guideline for systematic reviews. It provides a checklist of items that should be included in a systematic review report to enhance transparency and completeness. Beginners can refer to the PRISMA checklist to ensure they have covered all essential components in their review.

Covidence: Covidence is a web-based software platform designed specifically for systematic reviews. It streamlines the review process by facilitating study selection, data extraction, and collaboration among review team members. Beginners can use Covidence to manage and organize their systematic review workflow efficiently.

Rayyan: Rayyan is a free web-based tool for screening and managing studies during the study selection process. It enables reviewers to import search results, collaborate with team members, and efficiently screen studies based on inclusion and exclusion criteria. Rayyan simplifies the screening process, particularly for reviews with a large number of articles.

EndNote or Zotero or Mendeley: Reference management tools like EndNote and Zotero help with organizing and formatting references in a systematic review. These tools allow users to import, store, and

cite references from various sources, making it easier to manage the large number of citations in a systematic review.

PubMed and other bibliographic databases: PubMed is a widely used bibliographic database for biomedical literature. Beginners can utilize PubMed and other relevant databases (such as Embase, Scopus, or Web of Science) to conduct systematic literature searches. Familiarity with database search techniques, including the use of keywords, MeSH terms, and search filters, is essential for efficiently retrieving relevant studies.

Reference textbooks and online tutorials: There are several textbooks and online tutorials available that provide guidance on systematic review methodology. Some recommended resources include "Systematic Reviews in Health Care: Meta-Analysis in Context" by Higgins and Green, "Systematic Reviews and Meta-Analysis: A Step-by-Step Guide" by Petticrew and Roberts, and online tutorials provided by organizations like Cochrane.

These resources and tools can help beginners navigate the systematic review process effectively and ensure adherence to best practices. It is essential to familiarize yourself with these resources, adapt them to your specific research question, and seek guidance from experienced reviewers or mentors when needed.

SECTION II: WRITING THE SYSTEMATIC REVIEW PAPER

Introduction to Systematic Review Writing

Importance of well-written systematic review papers

Well-written systematic review papers play a crucial role in advancing scientific knowledge and informing evidence-based practice.

Key reasons why well-written systematic reviews are important:

Summarizing and Synthesizing Existing Evidence: Systematic reviews provide a comprehensive and unbiased summary of the existing evidence on a specific research question. By synthesizing data from multiple studies, systematic reviews offer a broader and more reliable perspective on the topic compared to individual studies. They help to identify patterns, trends, and inconsistencies in the available evidence.

Identifying Gaps in Knowledge: Systematic reviews can highlight gaps in the current research literature. By systematically reviewing the existing studies, researchers may identify areas where there is a lack of evidence or conflicting findings. This can guide future research efforts by identifying research questions or topics that require further investigation.

Informing Evidence-Based Decision Making: Well-conducted systematic reviews provide a solid foundation for evidence-based decision making in various fields, including healthcare, public policy, and education. They help policymakers, healthcare practitioners, and other stakeholders make informed decisions based on the best available evidence. Systematic reviews often serve as a key source of evidence for clinical practice guidelines and policy development.

Enhancing Transparency and Reproducibility: Well-written systematic reviews follow a rigorous and transparent methodology, including predefined protocols, systematic search strategies, and explicit criteria for study selection and data extraction. This transparency allows other researchers to reproduce the review process and validate the findings. Transparent reporting also facilitates critical

appraisal and helps identify potential biases or limitations in the review.

Providing a Resource for Researchers and Practitioners: Systematic reviews serve as valuable resources for researchers and practitioners seeking an overview of the current state of knowledge on a specific topic. They provide a consolidated source of information, saving time and effort in searching and evaluating individual studies. Researchers can use systematic reviews as a basis for further research or to identify research gaps, while practitioners can use them to inform their clinical decision making and practice.

Overall, well-written systematic review papers contribute to the advancement of knowledge, guide evidence-based practice, and provide a reliable and accessible resource for researchers, practitioners, and decision-makers.

Key components of a systematic review paper

A systematic review paper typically consists of several key components that provide a comprehensive and structured presentation of the review findings. Here are the key components of a systematic review paper:

Title: The title should clearly and concisely reflect the focus of the systematic review.

Abstract: The abstract provides a brief summary of the review, including the research question, methods, key findings, and implications. It should be structured and highlight the main aspects of the review.

Introduction: The introduction sets the context and rationale for the systematic review. It includes background information on the topic, the research question or objective, and the significance of the review.

Methods: The methods section outlines the systematic review methodology in detail. It includes information on the search strategy, study selection criteria, data extraction process, assessment of study quality or risk of bias, and any statistical methods employed.

Results: The results section presents the findings of the systematic review. It includes a summary of the characteristics of the included studies, the main outcomes or results extracted from the studies, and any additional analyses or subgroup analyses conducted.

Discussion: The discussion section interprets the findings in the context of the research question and existing literature. It discusses the strengths and limitations of the review, explores possible explanations for the findings, and highlights implications for practice, policy, or future research.

Conclusion: The conclusion section provides a concise summary of the main findings and their implications. It should directly address the research question or objective and highlight the overall contributions of the systematic review.

References: The reference section lists all the cited sources following a specific citation style (e.g., APA, MLA). It should include complete

and accurate bibliographic information for each reference cited in the text.

It is important to note that the structure and format of a systematic review paper may vary slightly depending on the journal or publication guidelines. Therefore, it is essential to check the specific guidelines of the target journal when preparing a systematic review for submission.

PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	

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Writing the ABSTRACT

The abstract should summarize the key methods, results and conclusions of the review and should not contain any information that is not in the review. Links to other parts of the review (such as references, studies, tables and figures) may not be included in the abstract. A hypothetical example of an abstract is included in the box at the end of this topic.

Abstracts should be targeted primarily at healthcare decision makers (clinicians, informed consumers and policy makers) rather than just to researchers. Terminology should be reasonably comprehensible to a general rather than a specialist healthcare audience. Abbreviations should be avoided, except where they are widely understood (for example, HIV). Where essential, other abbreviations should be spelt out (with the abbreviations in brackets) on first use. Names of drugs and interventions that can be understood internationally should be used wherever possible. Trade names should not be used.

The content under each heading in the abstract should be as follows:

Background: This should be one or two sentences to explain the context or elaborate on the purpose and rationale of the review. If this version of the review is an update of an earlier one, it is helpful to include a sentence such as "This is an update of a Cochrane review first published in YEAR, and previously updated in YEAR".

Objectives: This should be a precise statement of the primary objective of the review, ideally in a single sentence, matching the Objectives in the main text of the review. Where possible the style should be of the form "To assess the effects of [intervention or comparison] for [health problem] for/in [types of people, disease or problem and setting if specified]".

Search methods: This should list the sources and the dates of the last search, for each source, using the active form 'We searched....' or, if there is only one author, the passive form can be used, for example, 'Database X, Y, Z were searched'. Search terms should not be listed here. If the CRG's Specialized Register was used, this should be listed first in the form 'Cochrane X Group Specialized Register'. The order for listing other databases should be the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE, other databases. The date range of the search for each database should be given. For the Cochrane Central Register of Controlled Trials this should be in the form 'Cochrane Central Register of Controlled Trials (The Cochrane Library 2007, Issue 1)'. For most other databases, such as MEDLINE, it should be in the form 'MEDLINE (January 1966 to December 2006)'. Searching of bibliographies for relevant citations can be covered in a generic phrase 'reference lists of articles'. If there were any constraints based on language or publication status, these should be listed. If individuals or organizations were contacted to locate studies this should be noted and it is preferable to use 'We contacted pharmaceutical companies' rather than a listing of all the pharmaceutical companies contacted. If journals were specifically handsearched for the review, this should be noted but handsearching to help build the Specialized Register of the CRG should not be listed.

Selection criteria: These should be given as '[type of study] of [type of intervention or comparison] in [disease, problem or type of people]'. Outcomes should only be listed here if the review was restricted to specific outcomes.

Data collection and analysis: This should be restricted to how data were extracted and assessed, and not include details of what data were extracted. This section should cover whether data extraction and assessments of risk of bias were done by more than one person. If the authors contacted investigators to obtain missing information, this should be noted here. What steps, if any, were taken to identify adverse effects should be noted.

Main results: This section should begin with the total number of studies and participants included in the review, and brief details pertinent to the interpretation of the results (for example, the risk of bias in the studies overall or a comment on the comparability of the studies, if appropriate). It should address the primary objective and be restricted to the main qualitative and quantitative results (generally including not more than six key results). The outcomes included should be selected on the basis of which are most likely to help someone making a decision about whether or not to use a particular intervention. Adverse effects should be included if these are covered in the review. If necessary, the number of studies and participants contributing to the separate outcomes should be noted, along with concerns over quality of evidence specific to these outcomes. The results should be expressed narratively as well as quantitatively if the numerical results are not clear or intuitive (such as those from a standardized mean differences analysis). The summary statistics in the abstract should be the same as those selected as the defaults for the review, and should be presented in a standard way, such as 'odds ratio 2.31 (95% confidence interval 1.13 to 3.45)'. Ideally, risks of events (percentage) or averages (for continuous data) should be reported for both comparison groups. If overall results are not calculated in the review, a qualitative assessment or a description of the range and pattern of the results can be given. However, 'vote counts' in which the numbers of 'positive' and 'negative' studies are reported should be avoided.

Authors' conclusions: The primary purpose of the review should be to present information, rather than to offer advice or recommendations. The Authors' conclusions should be succinct and drawn directly from the findings of the review so that they directly and obviously reflect the main results. Assumptions should generally not be made about practice circumstances, values, preferences, tradeoffs; and the giving of advice or recommendations should generally be avoided. Any important limitations of data and analyses should be noted.

Important conclusions about the implications for research should be included if these are not obvious.

Hypothetical example of an abstract

(For the review 'A versus B for treating influenza in adults' by Peach A, Apricot D, Plum P.)

Background

A and B both have antiviral properties, but they are not widely used due to incomplete knowledge of their properties and concerns about possible adverse effects. This is an update of a Cochrane review first published in 1999, and previously updated in 2006.

Objectives

To assess the effects of A and B in adults with influenza.

Search methods

We searched the Cochrane Acute Respiratory Infections Group Trials Specialized Register (15 February 2007), the Cochrane Central Register of Controlled Trials (*The Cochrane Library* Issue 1, 2007), MEDLINE (January 1966 to January 2007), EMBASE (January 1985 to December 2006) and reference lists of articles. We also contacted manufacturers and researchers in the field.

Selection criteria

Randomized and quasi-randomized studies comparing A and/or B with placebo, or comparing doses or schedules of A and /or B in adults with influenza.

Data collection

Two authors independently assessed trial quality and extracted data. We contacted study authors for additional information. We collected adverse effects information from the trials.

Main results

Seventeen trials involving 689 people were included. Five trials involving 234 people compared A with placebo. Compared with placebo, A significantly shortened duration of fever by 23% (by 1.00 days, 95% confidence interval 0.73 to 1.29). Six trials involving 256 people compared B with placebo. B significantly shortened duration of fever by 33% compared with placebo (by 1.27 days, 95% confidence interval 0.77 to 1.77). The small amount of information available directly comparing A and B (two trials involving 53 people) did not indicate that the efficacy of the two drugs was different, although the confidence intervals were very wide. Based on four trials of 73 people, central nervous system effects were significantly more common with A than B (relative risk 2.58, 95% confidence interval 1.54 to 4.33).

Authors' conclusions

A and B both appear to be effective in the treatment of influenza. There is insufficient evidence to determine whether one is more effective than the other. Both drugs appear to be relatively well tolerated, although B may be safer.

Writing the Introduction

For anyone who has experience working on any sort of study, be it a review, thesis, or even just an academic paper – writing an introduction shouldn't be a foreign concept. It generally follows the same rules, requiring it to give the readers the context of the study explaining what the review is all about: the topic it tackles, why the study was performed and the goals of its findings.

This is the reader's first exposure to the subject matter and so the introduction should summarise the topic area and say why a systematic review was necessary – for example, was there disagreement in the literature, were there gaps in common knowledge that might actually be filled by a thorough summary of the literature, was the size of the effect of a treatment unclear, or was the treatment being used in situations outside evidence from trials?. The introduction should be normally no longer than a couple of pages (ideally shorter) and the briefer the better. If there have been previous review articles or even systematic reviews, say why another one is necessary.

The introduction should end with a sentence which states clearly the aims of the review; be careful not to duplicate statements made elsewhere.

That said, most systematic reviews are governed by two guidelines that help improve the reporting of the research. These are the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement and the Cochrane handbook. Both have specifications on how to write the report, including the introduction.

PRISMA Statement vs. Cochrane Guidelines
PRISMA requires that a systematic review introduction have two parts: the rationale and the objective. Meanwhile, the Cochrane

guidelines require that it should be split up into four parts, namely the problem description, the intervention being considered, the efficacy of the intervention, and the justification behind the systematic review.

Commonly asked questions while writing this section:

What Is The Right Length Of A Systematic Review Introduction?

There's no hard and fast rule about the length of a systematic review introduction. However, it's best to keep it concise. Limit it to just two to four paragraphs, not exceeding one full page. Don't worry, you'll have the rest of the paper to fill with data!

What To Include In A Systematic Review Introduction?

Whether or not you're following writing guidelines, here are some pieces of information that you should include in your systematic review introduction:

Context

Give background information about the review, including what's already known about the topic and what you're attempting to discover with your findings.

Definitions

This is optional, but if your review is dealing with important terms and concepts that require defining beforehand for better understanding on the readers' part, add them to your introduction.

Rationale

Delve a little into why the study topic is important, and why a systematic review must be done for it. This prompts a discussion about the knowledge gaps, a lack of cohesion in existing studies, and the potential implications of the review.

Research Question

Introduce your topic, specifically the research question that's driving the study. Be sure that it's new, focused, specific, and answerable, and that it ties together with your conclusion later on.

Should I include references in the introduction?

While references are not typically heavily relied upon in the introduction, it is common to cite a few key studies or reviews that support the need for the systematic review or highlight significant findings in the field. However, the main focus should be on presenting the rationale and context rather than providing an extensive literature review.

How do I make the introduction concise yet informative?

Focus on the main points and avoid excessive details or tangential information. Clearly state the research question or objective, highlight the gap in knowledge or problem being addressed, and briefly mention the potential impact or implications of the systematic review.

Can I include my hypothesis or research aims in the introduction?

In a systematic review, it is more common to state the research question or objective rather than specific hypotheses. However, if you have specific research aims or hypotheses, you can briefly mention them as part of the introduction to provide additional clarity.

Should I discuss the methodology in the introduction?

The introduction is not the appropriate section to discuss the methodology in detail. Instead, save the detailed description of the methodology for the methods section of the systematic review paper.

How can I engage the reader in the introduction?

Use clear and concise language to grab the reader's attention and convey the significance of the research question. Present any surprising or compelling statistics, emphasize the potential impact of the review findings, or highlight the relevance of the topic to a specific audience or field.

WRITING METHODS AND STUDY SELECTION

You must structure your methods in a logical order.

Most of the SRs are conducted and reported in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement and the Cochrane Handbook for Interventional Reviews.

1. Criteria for including studies: Describe the studies which you would include, e.g. prospective study in a particular population testing a particular treatment. In this section use subheadings for example who were the patients/subjects/animals; what were the interventions/characteristic sought; what were the outline outcome measures and indicate which were primary or secondary; what were the study characteristics. Here you might mention certain features that the studies had to report such as the sample size, the primary results, whether there was any language restriction or years within in which the studies had to be done and if they had to be published in full or not.

2. Identification of studies: Here you would detail your electronic database search including which databases (Medline, EMBASE, ISI Web of Knowledge, Google Scholar, etc), between which years. Provide a list of search terms in an appendix. You would also detail which journals you hand searched and if you screened review articles and other bibliographies.

3. Study selection: Here you would describe how you handled all the studies that you identified, removing duplicates, screening for relevance on title then abstract then full text article; whether you wrote to the author for copies of their paper or used inter-library loan and then screening of the full papers that got through all of these eligibility checks.

4. Data extraction: Here you would describe what data you extracted from the paper such as description of included

patients/subjects/animals, how many had which outcome, what the summary statistics were as given in the paper, whether you read data off graphs if not provided numerically and what you did if serial results were reported, i.e. which one did you choose.

5. Quality assessment: Quality assessment criteria have been described for most types of literature and many of these are available on the EQUATOR Network (www.equator-network.org/) which you should consult. There are ten point comparisons for various types of data (see end).

6. Data synthesis: Here you should describe how you handled the data. What you do with the data may very much depend on what you have been able to extract from the individual papers *Key point:* This is section where you would have to insert the tables or any other ways you have used to extract the data.
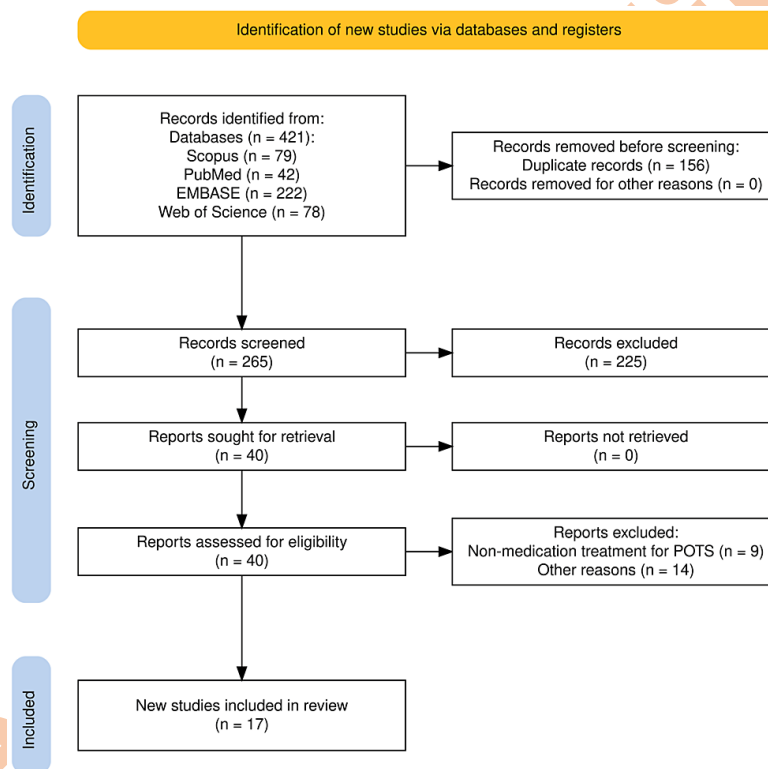
Example of a well writen methodology section:
https://www.sciencedirect.com/science/article/pii/S0735109715071193?via%3Dihub

PRESENTING THE RESULTS

Remember to present the results in a clear and organized manner, using appropriate tables, figures, or visual aids to enhance understanding. It is also crucial to adhere to the specific guidelines and reporting standards of the target journal or publication when presenting the results of your systematic review. This is the section where you talk about the PRISMA chart

Example of a PRISMA chart:

From: https://www.cureus.com/articles/155900-choices-and-challenges-with-drug-therapy-in-postural-orthostatic-tachycardia-syndrome-a-systematic-review#!/

Here is a breakdown of what you should include:

Study Selection: Provide information on the number of records identified through the initial search, the number of records screened, the number of full-text articles assessed for eligibility, and the final number of studies included in the review. You can present this information in a flowchart or a table to illustrate the selection process.

Study Characteristics: Describe the key characteristics of the included studies. This includes information such as study design, sample size, participant demographics, intervention or exposure, outcome measures, and follow-up duration. You can present this information in a table or summarize it in a narrative format.

Quality Assessment: Summarize the results of the quality assessment or risk of bias assessment for each included study. Mention the criteria used for evaluation and provide an overview of the strengths and limitations of the included studies. You can present this information in a table or describe it in a narrative format.

Data Extraction: Present the key data extracted from each study that is relevant to your research question. This may include quantitative data (e.g., mean values, odds ratios, hazard ratios) or qualitative data (e.g., themes, categories, qualitative findings). Summarize the data in a clear and concise manner.

Synthesis of Findings: Depending on the nature of the included studies and the research question, you may conduct a quantitative synthesis (meta-analysis) or a qualitative synthesis (thematic synthesis or narrative synthesis). Present the overall findings derived from the synthesis, including any statistical measures (e.g., effect sizes, confidence intervals) or qualitative themes that emerged. Summarize the synthesized findings in a coherent and informative manner.

Subgroup Analyses or Sensitivity Analyses: If you have conducted any subgroup analyses or sensitivity analyses, report the results in this section. Highlight any variations or differences in the findings based on different subgroups or sensitivity analyses conducted.

Additional Analyses: If you have conducted any additional analyses, such as assessment of publication bias or exploration of heterogeneity, summarize the findings in this section. Discuss the implications of these analyses for the overall review findings.

Strengths and Limitations: Discuss the strengths and limitations of the included studies and the review process. Address potential sources of bias or confounding and provide a balanced evaluation of the evidence. Discuss any limitations of the review itself, such as limitations in the search strategy or potential bias in the selection process.

Interpretation: Interpret the findings in the context of the research question and the existing literature. Discuss the implications of the results, their clinical or practical relevance, and any recommendations for future research or practice. Emphasize the key takeaways and highlight any important or unexpected findings.

Remember to present the results in a logical and organized manner, using headings, subheadings, and appropriate formatting to enhance clarity. Use tables, figures, or visual aids as necessary to present data in a concise and informative way.

Interpreting the Findings and Discussion

As with any other type of paper your discussion needs to follow logical order and start with a simple statement summarising the major finding from your review. For example is the weight of evidence in favour of a treatment having a beneficial effect or not? Do the studies suggest that some particular feature is associated with future risk of a disease? Is one diagnostic test better than another? If you have found that there is simply not enough evidence to arrive a definite conclusion then you should state that.

- The second paragraph should describe limitations of the included studies and of your systematic review and hence the reliability of result – robustness, biases, etc. were there specific problems with the data (amount, populations, etc). Were the individual papers full of biases? Etc.
- The third paragraph should describe the strengths and weaknesses of your review methods. For example, did you miss out non-english publications? Were there only a handful of papers with a small sample size that you were able to include?
- The fourth paragraph should set the results in context of other knowledge on the topic, eg compare your work with previous systematic reviews or current opinions and guidelines

The fifth paragraph should provide conclusions, and then 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 information on which to base clinical practice?

Conclusion and Future Directions

What are the implications of your review and what are the potential future directions for research in this area?

- Manuscripts that do not mention the implications of the study are often desk-rejected by journals. What constitutes the 'implications' of research, and why is it important to include research implications in your manuscript?
- How can the findings of your study help create a better world? What can we infer from your conclusion about the current state of research in your field or the quality of methods you employed? These are all important implications of your study.
- You cannot predict how your study will influence the world or research in the future. You can only make reasonable speculations. In order to ensure that the implications are reasonable, you have to be mindful of the limitations of your study.
- In the research context, only speculations supported by data count as valid implications. If the implications you draw do not logically follow the key findings of your study, they may sound overblown or outright preposterous.
- Suppose your study evaluated the effects of a new drug in the adult population. In that case, you could not honestly speculate on how the drug will impact paediatric care. Thus, the implications you draw from your study cannot exceed its scope.

How to Write Implications/Conclusion

- *This section starts by summarising your work, but this time emphasises your work's significance.*
- *While writing the implications, it is helpful to ask, "who will benefit the most from reading my paper?"—policymakers, physicians, the public, or other researchers. Once you know your target population, explain how your findings can help them.*

- *Think about how the findings in your study are similar or dissimilar to the findings of previous studies. Your study may reaffirm or disprove the results of other studies. This is an important implication.*
- *Suggest future directions for research in the subject area in light of your findings or further research to confirm your findings. These are also crucial implications.*

Editing, Formatting, and References

Here is a checklist for editing, formatting, and referencing a systematic review:

Editing and Formatting:

- Proofread the entire manuscript for spelling, grammar, and punctuation errors.
- Ensure consistency in writing style, tense, and terminology throughout the manuscript.
- Check for clarity and readability of the text, making sure that the content is easy to understand for the intended audience.
- Review the structure and flow of the manuscript, ensuring that sections and subsections are logically organized.
- Trim unnecessary or repetitive information to improve conciseness.
- Format the manuscript according to the guidelines provided by the target journal or publication, including font style, font size, line spacing, margins, and page numbering.
- Use appropriate headings and subheadings to improve the organization and readability of the manuscript.
- Include tables, figures, and other visual aids as necessary to present data in a clear and concise manner.
- Ensure proper alignment and formatting of tables and figures, and provide clear captions and labels.
- Double-check the accuracy of all references, citations, and in-text citations.

References and Citations:

- Follow the specific citation style required by the target journal or publication (e.g., APA, MLA, Harvard).
- Verify the accuracy of all references, including author names, publication titles, journal names, volume numbers, page ranges, and publication years.

- Use a reference management software (e.g., EndNote, Mendeley, Zotero) to organize and format your references automatically.
- Format in-text citations according to the citation style guidelines, ensuring that they are properly formatted and correspond to the complete reference in the reference list.
- Create a comprehensive and accurate reference list that includes all the sources cited in the manuscript.
- Alphabetize the references in the reference list based on the last name of the first author or according to the guidelines of the citation style.
- Verify that all in-text citations have corresponding references in the reference list, and vice versa.
- Ensure that all references are cited in the text and that there are no missing citations or references.
- Check for consistency in citation formatting, such as the use of italics, capitalization, and punctuation.
- Cross-check the formatting of references and citations against the specific guidelines of the chosen citation style.
- By following this checklist, you can ensure that your systematic review manuscript is well-edited, properly formatted, and appropriately referenced. Remember to consult the specific guidelines provided by the target journal or publication for any additional requirements or recommendations.

Avoiding Plagiarism in SYSTEMATIC REVIEWS

Plagiarism is a serious academic misconduct that involves using someone else's work, ideas, or words without proper attribution. To avoid plagiarism and ensure ethical writing, here's a checklist you can follow:

Understand what constitutes plagiarism: Familiarize yourself with the different forms of plagiarism, including direct copying, paraphrasing without proper citation, and presenting someone else's ideas as your own.

Use proper citations: Whenever you use someone else's ideas, data, or words, make sure to provide proper citations. Follow the appropriate citation style recommended by your institution or the journal you are submitting to (e.g., APA, MLA, Chicago).

Paraphrase effectively: If you want to include information from a source but rephrase it in your own words, ensure that you still give credit to the original source by providing an in-text citation. Paraphrase accurately and do not simply replace a few words or sentence structures while retaining the original meaning.

Understand common knowledge: Common knowledge refers to information widely known and accepted within a field. You do not need to provide a citation for common knowledge. However, if in doubt, it is better to cite the source to avoid unintentional plagiarism.

Manage reference list properly: Create a comprehensive reference list that includes all the sources you have cited in your work. Ensure that the references are accurate, complete, and formatted correctly according to the appropriate citation style.

Use plagiarism detection tools: Consider using plagiarism detection software or online tools to check your work for unintentional

plagiarism. These tools can help identify instances where your writing closely matches existing sources. Kindly refrain using free online tools available over internet. They are predatory. While working in our projects, we take care of all these checks.

Seek guidance if unsure: If you are uncertain about how to properly cite or attribute a source, seek guidance from your instructor or mentor. They can help and clarify any doubts you may have.

Develop good research and writing practices: Cultivate good habits that promote ethical writing, such as taking detailed notes while conducting research, organizing your sources, and citing them properly from the outset.

Fundamentals of In-Text Citations and References in SYSTEMATIC REVIEWS

Properly citing and attributing sources is crucial to maintain academic integrity and give credit to the original authors in your systematic review paper.

Some guidelines to follow when citing and attributing sources:

1. **In-text citations:** Whenever you use information, ideas, or quotes from a specific source, include an in-text citation within the text of your systematic review. This helps the reader identify the source of the information. The format of the in-text citation depends on the citation style you are using (e.g., APA, MLA, Chicago). Typically, it includes the author's last name and the year of publication.
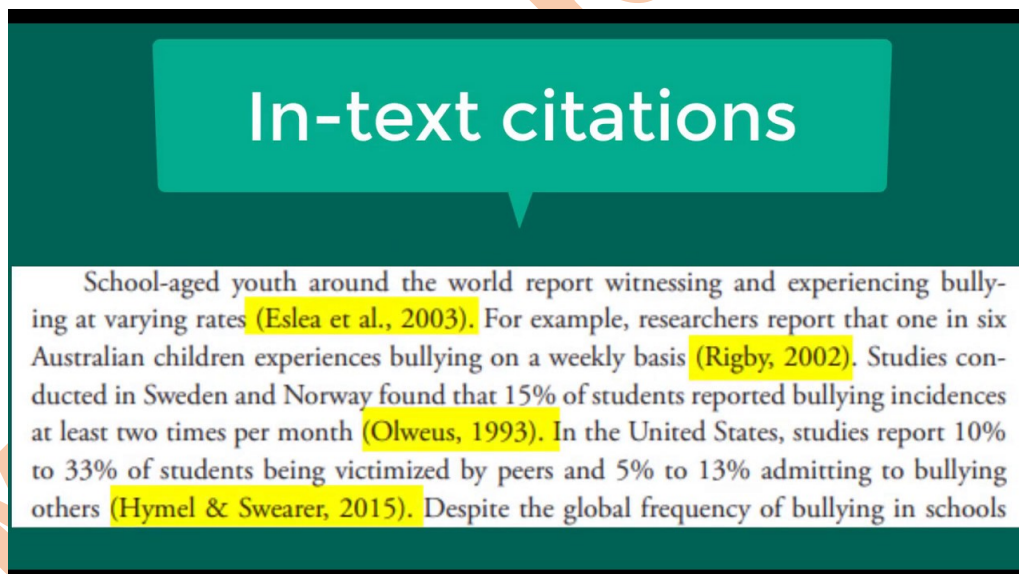
APA style in-text citation.

2. **Reference list:** Include a comprehensive reference list at the end of your systematic review. This section provides detailed information about each source cited in your paper. The format and style of the reference list will depend on the citation style you are following. Include the author(s), title, publication year,

journal or book title, page numbers, and any other required information based on the citation style.

Example (APA style):
Smith, J. (2019). Title of the article. Journal of Medical Sciences, 14(3), 40-55.

Direct quotations: When directly quoting a source, use quotation marks to indicate the exact words of the author. Immediately following the quotation, include an in-text citation to attribute the quote to the original source.
Example:
According to Johnson (2018), "quote goes here" (p. 67).

3. **Paraphrasing:** Paraphrasing involves restating someone else's ideas or information in your own words. Even when you paraphrase, you must provide an in-text citation to attribute the ideas to the original source. It is not sufficient to simply change a few words or sentence structures.

   Example:
   Original source: "Quote goes here" (Smith, 2019, p. 45).
   Paraphrased: According to Smith (2019), the concept is described as [rephrase in your own words] (p. 45).

4. **Multiple authors:** When a source has multiple authors, include all the authors' last names in the in-text citation for the first occurrence. For subsequent citations, use et al. after the first author's last name.
   Example:
   First citation: (Smith, Johnson, & Brown, 2020)
   Subsequent citations: (Smith et al., 2020)

Commonly Asked Questions about Citations:

Q: How do I know which citation style to use?
A: The citation style you use depends on the guidelines provided by your institution or the journal you're submitting to. Check the specific requirements or consult your professor or supervisor for guidance.

Q: What information do I need to include in a citation?
A: A citation typically includes the author(s), title of the work, publication date, journal or book title, and page numbers. The exact format and order of these elements depend on the citation style you are using.

Q: How do I properly format in-text citations?
A: In-text citations usually include the author's last name and the publication year within parentheses. Place the citation immediately after the information you have taken from the source, either as a direct quote or paraphrase.

Q: How do I cite sources with multiple authors?
A: For sources with multiple authors, include all the authors' last names in the first citation. For subsequent citations, use the first author's last name followed by "et al." (Latin for "and others"). "Et al." is used when there are three or more authors for a source. Instead of listing all the authors' names, only the first author's name is mentioned, followed by "et al." to indicate the presence of additional authors.

Q: How do I cite sources with no author?
A: If a source has no author, use the title of the work in place of the author's name. It is advisable to consult the specific citation style guidelines for the correct format.

Q: How do I cite sources that are websites or online articles?

A: When citing websites or online articles, include the author (if available), the title of the web page or article, the website name, the publication date (if available), and the URL or DOI (if applicable). Again, refer to the citation style guide for precise formatting.

Q: How do I avoid accidental plagiarism in my citations and references?
A: To avoid accidental plagiarism, always ensure you properly attribute ideas, quotes, and information to their original sources. Use quotation marks for direct quotes and provide in-text citations and a reference list or bibliography to credit the sources you have used.

Q: What tools can I use to make the citation process easier and more efficient?
A: There are various citation management tools available, such as EndNote, Zotero, and Mendeley, which can help you organize your references and generate citations in different styles automatically.

Practice Exercises and Systematic Review Paper Writing Tips

Here are some practice exercises and tips for writing a systematic review paper:

- Practice extracting data from a few studies and summarizing it in a table or chart.
- Write a mock abstract for a systematic review paper, summarizing the purpose, methods, and findings.
- Write a mock introduction for a systematic review paper, introducing the topic and explaining why the review is important.
- Practice using a citation management tool, such as EndNote or Zotero, to organize and cite your sources.
- Practice writing clear and concise sentences and paragraphs, using plain language and avoiding jargon.

Tips for writing a systematic review paper:

- Plan your review carefully, including your research question, inclusion and exclusion criteria, and search strategy.
- Use a standardized protocol for study selection, data extraction, and quality assessment.
- Analyze your data systematically, using statistical methods if appropriate.
- Present your findings clearly and concisely, using tables, figures, and text as needed.
- Use a clear and consistent writing style, and follow the guidelines for your target journal or publication.

Reading and analysing published systematic reviews mindfully is crucial to understand and critically evaluate the existing evidence. Some tips to help you with this process:

- *Start with the research question:* Before diving into the systematic review, clearly understand the research question or objective. This will help you focus on the specific topic and outcomes being investigated.
- *Assess the study design and methodology:* Pay attention to the methodology used in the systematic review. Look for details on the search strategy, inclusion and exclusion criteria, data extraction, and quality assessment methods. This information will give you insights into how the review was conducted and help you gauge the reliability of the findings.
- *Evaluate the study selection process:* Examine the process used to select studies for inclusion in the review. Look for transparency in reporting, including details on how potential bias was addressed and how conflicts were resolved. This will help you determine if the included studies are relevant and representative.
- *Scrutinize the data extraction and synthesis methods:* Understand how data were extracted from the included studies and how the synthesis was conducted. Look for clear explanations of the statistical methods used, such as meta-analysis, and any assumptions or limitations involved. Assess the appropriateness of the chosen synthesis method for the research question.
- *Consider the quality of included studies:* Evaluate the quality of the included studies. Look for information on how the quality assessment was performed and whether the risk of bias was adequately considered. Assess the overall strength of the evidence based on the quality of the included studies.
- *Examine the results and interpretation:* Pay close attention to the results presented in the systematic review. Look for consistency or inconsistencies across the included studies.

Evaluate the clarity of the presented data and the appropriateness of the statistical analyses. Consider the authors' interpretation of the findings and whether it aligns with the evidence presented.

- *Assess the limitations and implications:* Identify and consider the limitations of the systematic review. Look for discussions on potential biases, heterogeneity, or gaps in the evidence. Evaluate the implications of the findings in the context of clinical practice, policy-making, or further research.
- *Seek additional perspectives:* Consider reading and analyzing systematic reviews from different authors or research groups to gain a broader understanding of the topic. Compare and contrast findings, methodologies, and interpretations to get a comprehensive view.
- *Take notes and critically reflect:* While reading, make notes of important findings, strengths, weaknesses, and areas for further exploration. Reflect on the implications of the review's findings and consider how they contribute to the existing knowledge in the field.