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Review Article

Writing a Systematic Review: The AI way

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A B S T R A C T

Systematic reviews are essential for evidence-based practice but are often labor-intensive and time-consuming. With the rise of artificial intelligence (AI), researchers now have access to tools that can streamline and support each phase of the review process. This guide explores how AI can be effectively integrated into writing a systematic review, from literature search and study selection to data extraction and manuscript drafting. Tools such as Rayyan, ASReview, Elicit, and ChatGPT are examined for their roles in enhancing efficiency, reducing bias, and maintaining methodological rigor. While AI cannot replace human judgment, it offers valuable support in accelerating workflows and improving the overall quality of systematic reviews. This practical approach provides researchers with insights into adopting AI responsibly and effectively in the evolving landscape of academic publishing.

Keywords: Systematic Review, Artificial Intelligence, Literature Screening, Evidence Synthesis, Ai Tools, Research Methodology

Introduction

Systematic reviews are Cornerstone of evidence-based research by providing for informed decision-making in various fields, including healthcare, education, and social sciences. By providing a comprehensive synthesis of existing literature, systematic reviews help researchers and practitioners address specific research questions with a high degree of rigor and reliability. The process of developing a high-quality systematic review is not only intricate but also demands a meticulous and methodical approach to ensure that the findings are valid and applicable.

To embark on the journey of creating a systematic review, researchers must adhere to established guidelines, such as those set forth by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) or the Cochrane Handbook for Systematic Reviews of Interventions[1]. These guidelines offer a structured framework that outlines the necessary steps and considerations, ensuring that the review is both comprehensive and transparent. Compliance with these standards not only enhances the credibility of the review but also facilitates its replication by other researchers.

Once the studies are identified, the next phase involves screening and selecting articles based on the inclusion and exclusion criteria. This step often requires multiple reviewers to minimize bias and ensure that the selection process is rigorous. After selecting the studies, researchers extract relevant data, which may include study characteristics, outcomes, and methodological quality. This data extraction process is critical, as it forms the basis for the subsequent analysis and synthesis of findings. The synthesis of data can take various forms, including qualitative synthesis, quantitative meta-analysis, or a combination of both.

Researchers must carefully consider the appropriateness of each method based on the nature of the data and the research question. Additionally, the use of statistical software and tools can enhance the efficiency and accuracy of the analysis, allowing for a more robust interpretation of the results. In recent years, the integration of artificial intelligence (AI) tools into the systematic review process

has gained traction. AI can assist in various stages, from literature search and screening to data extraction and analysis. For instance, machine learning algorithms can help identify relevant studies more quickly and accurately than traditional methods.[2]

Step 1: Define a Clear Research Question

To enhance the clarity and specificity of the research question, employing the PICO framework is highly beneficial. The PICO framework stands for Population, Intervention, Comparison, and Outcome, and it provides a structured approach to formulating research questions in health and clinical research.

- **Population:** This component defines the specific group of individuals or subjects that the research will focus on. It is essential to clearly specify the characteristics of the population, such as age, gender, health status, or any other relevant demographic factors. By doing so, researchers can ensure that the findings are applicable to the intended group and can address the specific health issues or conditions affecting that population.
- **Intervention:** The intervention refers to the treatment, procedure, or exposure that is being investigated. This could include a specific medication, therapy, lifestyle change, or any other type of intervention aimed at improving health outcomes. Clearly defining the intervention allows researchers to assess its effectiveness and understand how it may influence the population in question.
- **Comparison:** The comparison component involves identifying a control group or an alternative intervention against which the primary intervention will be evaluated. This could be a placebo, standard treatment, or no treatment at all. Including a comparison group is crucial for determining the relative effectiveness of the intervention and for drawing meaningful conclusions about its impact.
- **Outcome:** Finally, the outcome refers to the specific results or effects that the researchers aim to measure. This could include various health outcomes, such as symptom improvement, quality of life, or adverse effects. Clearly defining the outcomes helps ensure that the review addresses the most relevant and important effects of the intervention, allowing for a comprehensive evaluation of its efficacy.

AI Tool: Elicit/Scispace[3-4]

Elicit is an AI-powered research assistant that aids in formulating research questions by suggesting relevant components based on existing literature.

- **Pros:** Assists in refining research questions by providing data-driven suggestions, potentially uncovering overlooked aspects.
- **Cons:** May offer suggestions that are too broad or not entirely aligned with the researcher's intent, necessitating manual adjustments by the researcher

Step 2: Develop and Register a Protocol

A protocol outlines the review's methodology, including inclusion and exclusion criteria, data extraction processes, and analysis plans. Registering the protocol on platforms such as PROSPERO[5] (International Prospective Register of Systematic Reviews), which is an international database of prospectively registered systematic reviews, enhances the transparency of the research process. This registration serves multiple purposes: it allows other researchers and stakeholders to be aware of ongoing reviews, helps to prevent duplication of efforts by informing the community about similar studies in progress, and provides a public record of the planned methodology. By promoting transparency, registration also fosters trust in the research findings, as it demonstrates a commitment to adhering to the pre-established methods and reducing the risk of bias that can arise from post-hoc changes to the study design.

AI Tool: Covidence[6]

Covidence is a web-based tool designed to streamline the development and management of systematic review protocols.

- **Pros:** Facilitates structured protocol development with user-friendly interfaces and templates, promoting consistency.
- **Cons:** Limited customization options may not accommodate unique or complex methodologies.

Step 3: Conduct a Comprehensive Literature Search

Performing an exhaustive literature search across multiple databases (e.g., PubMed, Scopus, Cochrane Library) is vital. The use of Boolean operators—such as AND, OR, and NOT—in conjunction with Medical Subject Headings (MeSH) terms significantly enhances the precision and relevance of the search results. Boolean operators allow researchers to combine or exclude specific keywords, thereby refining their search queries to yield more targeted results. For instance, using the operator AND can help narrow down results to include only those articles that address multiple aspects of a research question, while OR can broaden the search to include synonyms or related terms, ensuring a more comprehensive collection of literature. Medical Subject Headings (MeSH) terms, which are a standardized set of vocabulary used by the National Library of Medicine, further improve the search process by providing a consistent way to index and retrieve articles based on specific medical concepts. By incorporating MeSH terms into their search strategy, researchers can enhance the accuracy of their results, as these terms are specifically designed to capture

the nuances of medical terminology and ensure that relevant studies are not overlooked.

AI Tool: Research Rabbit[7]

Research Rabbit is an AI-driven tool that identifies relevant literature and suggests additional sources based on initial inputs.

- **Pros:** Efficiently uncovers pertinent articles and related research, expanding the scope of the literature search.
- **Cons:** May overlook grey literature or studies not indexed in mainstream databases.

Step 4: Screen and Select Studies

Screening involves evaluating titles, abstracts, and full texts against predefined criteria, typically performed by multiple reviewers to mitigate bias.

AI Tool: Rayyan[8]

Rayyan is an AI-powered platform that facilitates collaborative screening of studies in systematic reviews.

- **Pros:** Supports blinded screening, highlights discrepancies between reviewers, and accelerates the selection process.
- **Cons:** Ambiguous cases may still require manual resolution, and initial setup can be time-consuming.

Step 5: Extract and Manage Data

Systematically extracting data from selected studies is crucial for subsequent analysis. Utilizing standardized forms ensures consistency.

AI Tool: EPPI-Reviewer[9]

EPPI-Reviewer is a web-based application that supports data extraction and management for systematic reviews.

- **Pros:** Enables comprehensive data extraction with integrated analysis tools, supporting both quantitative and qualitative synthesis.
- **Cons:** May have a steep learning curve for new users and requires a subscription.

Step 6: Assess Study Quality and Risk of Bias

Evaluating the quality of included studies and assessing potential biases is essential to ensure the reliability of the review's findings. Traditional tools like the Cochrane Risk-of-Bias Tool for Randomized Trials (RoB 2)[10] are widely used for this purpose. However, integrating artificial intelligence (AI) tools can enhance the efficiency and consistency of this assessment.

Tool: Newcastle–Ottawa Scale (NOS)[11]

The Newcastle–Ottawa Scale[5] is a tool used for assessing the quality of non-randomized studies in systematic reviews and meta analysis.

- **Pros:** Provides a standardized method for quality assessment, enhancing the credibility of the review.
- **Cons:** Primarily designed for observational studies and may not be applicable to other study designs.

AI Tool: RobotReviewer[12]

It is an AI-driven tool designed to automate the risk of bias assessment in randomized controlled trials. It analyzes study texts and provides preliminary evaluations, which can streamline the review process. Studies have demonstrated its effectiveness in automating risk of bias assessments, thereby reducing the workload on researchers.

- **Pros:** Accelerates the risk of bias assessment process and ensures consistency across evaluations.
- **Cons:** May not fully capture context-specific nuances, necessitating manual verification by researchers.

Step 7: Synthesize and Analyze Data

Data synthesis involves combining results from individual studies to draw overarching conclusions. Depending on the data, this can be a qualitative synthesis or a quantitative meta-analysis.

AI Tool: RevMan[13]

RevMan is software developed by the Cochrane Collaboration for preparing and maintaining systematic reviews and meta-analyses.

- **Pros:** Facilitates data synthesis with built-in statistical tools and supports the creation of forest plots and other visualizations.
- **Cons:** Requires statistical expertise to interpret outputs accurately and may not accommodate all types of data.

AI Tool: DistillerSR14

It is an AI-powered systematic review management software that assists in data extraction and synthesis. It offers features like automated data extraction, customizable forms, and real-time collaboration, which enhance the efficiency of the synthesis process.

- **Pros**: Streamlines data extraction and synthesis, reduces manual errors, and supports collaboration among reviewers.
- **Cons:** Requires a subscription, which may be a limitation for some research teams.

Step 8: Write and Structure the Manuscript

Adhering to the IMRAD (Introduction, Methods, Results, and Discussion) format is standard practice. Clear and concise writing enhances the manuscript's readability and impact.

AI Tool: Grammarly15

Grammarly is an AI-driven writing assistant that checks for grammatical errors, enhances clarity, and suggests stylistic improvements.

- **Pros:** Improves language quality, ensures grammatical accuracy, and enhances overall readability.
- **Cons:** May not fully grasp context-specific nuances, leading to inappropriate suggestions.

Step 9: Reference Management and Citation Formatting

Properly managing references and formatting citations according to journal guidelines is crucial for professionalism and adherence to submission requirements.

AI Tool: Zotero/Mendeley16-17

Zotero is a free, open-source reference management tool that helps organize and format citations.

- **Pros:** Simplifies reference management with browser integration and supports various citation styles.
- **Cons:** Occasional compatibility issues with certain word processors and requires manual corrections for complex references.

Step 10: Submit the Review and Respond to Peer Review

Ensuring compliance with journal guidelines during submission and addressing peer review comments constructively are final yet critical steps.

AI Tool: Paperpal18

Paperpal is an AI-driven tool that checks manuscripts for journal compliance and language quality before submission.

- **Pros:** Identifies potential issues related to journal guidelines and suggests improvements, enhancing the likelihood of acceptance.
- **Cons:** May not cover all journal-specific nuances, necessitating manual verification.

AI Tool: PRISMA-DFLLM19

It is an extension of the PRISMA guidelines that incorporates domain-specific fine-tuned large language models to enhance the reporting of systematic literature reviews. It leverages AI to automate aspects of the reporting process, ensuring adherence to guidelines and improving the quality of reporting.

- **Pros:** Enhances the quality and consistency of reporting by automating adherence to established guidelines.
- **Cons:** As a relatively new approach, it may require additional validation and acceptance within the research community.

Conclusion

Writing a systematic review is a rigorous process that benefits from meticulous planning and execution. Integrating AI tools at various stages can enhance efficiency and accuracy, but reliance solely on these tools is insufficient. Human expertise remains indispensable for critical analysis, contextual understanding, and ethical considerations.

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