DEKA protocols for meta-analyses: Strengthening study transparency through a modified PRISMA approach

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ABSTRACT

Meta-analysis has emerged as an increasingly vital method for synthesizing scientific evidence in support of data-driven decision-making. To maximize its contribution, meta-analysis manuscripts must be written in a systematic and informative manner. This article aims to provide a conceptual and technical guide on how to write a meta-analysis article that adheres to international scientific standards. In reporting meta-analyses, the title serves as a critical entry point for both readers and reviewers; therefore, it should clearly reflect the population, intervention, and outcome of interest, and include the phrase "a systematic review and meta-analysis" to facilitate indexing. An effective abstract should be concise and well-structured, encompassing the background, objective, methods, main findings, and conclusion, while maintaining clarity and self-sufficiency. The selection of keywords is equally important, as it significantly enhances article visibility in scientific databases; thus, the use of Medical Subject Headings (MeSH) is strongly encouraged. The introduction should present a logical framework that outlines the broader research issue and the specific covariates under analysis, along with clearly formulated objectives and hypotheses. The methods section must transparently describe the literature search strategy, inclusion and exclusion criteria, study quality appraisal, and statistical approaches, all aligned with PRISMA guidelines. Results should be reported systematically, with attention to heterogeneity, publication bias, and consistency of effects. The discussion should synthesize findings in relation to existing literature and theory, address study limitations, and identify directions for future research. The conclusion should highlight the clinical or scientific relevance of the main findings and outline opportunities for future exploration. When written in accordance with proper structure and scholarly principles, a meta-analysis article can achieve strong academic value and broad contributions to science and clinical practice.

KEYWORDS: Meta-analysis; systematic reviews; evidence-based practice; scientific writing; publishing standards.

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INTRODUCTION

Since the evolution of evidence-based medicine, the rising complexity of information and the rampant explosion in scientific literature have led to issues of monumental scale in locating high-quality, pertinent information.[1] Thousands of health-related articles are released every year in multiple international journals, which create an ever-bulky burden of literature that it is difficult for even clinicians, academics, and policymakers to remain aware of.[2] This context emphasizes the imperative for scientific synthesis methods that not only combine findings from primary research but also evaluate the quality and coherence of the evidence in a systematic way. Meta-analysis, followed by a systematic review and performed according to a rigidly defined protocol, is one of the methodological approaches that prominently appears in the solution of this problem. It involves a sequence of intricate procedures—like selection of studies, data abstraction, and analysis of statistics—all of which must be reported

systematically and openly.[3] The reporting burden is further compounded by the fact that the quality of a meta-analysis article is highly contingent on technical factors such as title formulation, abstract structure, and keyword consistency, which in turn affect visibility and indexing in scientific databases such as PubMed, Scopus, and Web of Science.[4]

Meta-analysis is a statistical method to combine results of individual studies in order to come to a more generalizable and reliable estimate of effect. Beyond augmenting statistical power and precision, the approach provides for investigation of heterogeneity, identification of study variation, and search for potential causal connections through subgroup analyses or meta-regression.[5] The success of a meta-analysis does depend heavily on reporting quality, however. Many articles that have been labeled as meta-analyses fail to conform to accepted reporting standards such as PRISMA, fail to use Medical Subject Headings (MeSH) for keywords, or lack a structured and informative abstract. These omissions not only undermine the scientific credibility of these studies but also render them less findable and readable by readers seeking high-quality evidence.[6] The misalignment of structure between scientific needs and writing recognizes a great gap in knowledge in contemporary meta-analysis publication practice.

Therefore, this article aims to provide both a conceptual and technical guide on how to write a meta-analysis manuscript that is systematic, informative, and aligned with international scientific standards. Our primary focus is to detail the key components of writing, including title formulation, abstract development, keyword selection, introduction framing, reporting of methods and results, as well as the construction of a structured discussion and conclusion. We hypothesize that by following proper and standardized writing principles, researchers can not only improve the quality and visibility of their work but also make meaningful contributions to evidence-based clinical practice, health policy-making, and future research directions.

Formulating a precise title: Aligning with research objectives
Crafting the title of a meta-analysis article requires precision and careful consideration to ensure that it accurately reflects the full scope of the study while remaining concise. The title serves as the initial point of entry for both readers and reviewers to understand the central focus of the research. Therefore, it must include key elements of the study such as the target population, the intervention or exposure being analyzed, relevant comparisons (if applicable), and the main outcomes of interest.[7] In the context of meta-analyses, it is strongly recommended to include the phrase "a systematic review and meta-analysis" at the end of the title. This not only clarifies the nature of the study but also facilitates indexing in major scientific databases such as PubMed and Scopus.[8]

In addition to conveying the primary content, the title should be concise, simple, and not overly technically framed to avoid using jargon that could confuse readers from different backgrounds. The use of unusual acronyms or highly technical language without defining them should be avoided because these would make reading challenging.[7] Authors are encouraged to use concise and unambiguous language expressing the key issue being addressed without sensational or exaggerative claims. An effective title must simultaneously demand the reader's attention and mirror the scope and analytical concentration of the research accurately.[8] In some cases, inserting explicit methodological language (e.g., dose–response meta-analysis, network meta-

analysis) can enhance the informativeness of the title—if adding it will not render it less clear or longer.[7]

Crafting a concise and informative abstract

Writing an abstract for a meta-analysis study requires a well-organized structure and content that is both concise and informative. Typically, the abstract begins with a brief background consisting of one to two sentences that highlight the main issue or the urgency of the topic under investigation. This background should establish the scientific or clinical context of the problem and justify the need for a systematic review and meta-analysis.[8] Following this, the study objective should be clearly stated in a single sentence, directly outlining what the study aims to achieve. This sentence should be precise and focused, reflecting the core research question without unnecessary elaboration.[9]

The methods section of the abstract is then summarized in one to three sentences, describing the study design, the databases used in the literature search, the time frame of the search, and the statistical approach applied. The results section follows, presented in three to four sentences that include the total number of studies and participants analyzed, the main findings of the pooled analysis, and any outcomes from subgroup analyses if applicable. This section should be conveyed quantitatively by briefly reporting the effect size estimates, confidence intervals, and p-values. Finally, the conclusion should be written in one to two sentences that emphasize the main findings and their significance within the context of research or clinical practice. A well-written abstract should stand on its own, offering a complete summary of the article's content and attracting readers without requiring reference to the main text.[8]

Choosing the right keywords for maximum visibility

The selection of keywords in a meta-analysis study plays a critical role in enhancing the visibility and indexing of the article across major scientific databases. Keywords serve as a bridge between the content of the article and electronic search systems; thus, the careful selection of appropriate terms can help readers and researchers locate the article more efficiently.[10] Authors are therefore advised not only to choose terms that are commonly used in clinical or scientific practice but also to ensure that the selected terms align with the Medical Subject Headings (MeSH) standard. MeSH is a controlled vocabulary maintained by the U.S. National Library of Medicine and serves as an international reference for indexing biomedical publications in databases such as PubMed.[11]

To align keywords with the MeSH database, authors are encouraged to consult the official MeSH website (https://www.ncbi.nlm.nih.gov/mesh) and identify the most accurate terms that reflect the main topics of the article. For instance, if the study examines the association between diabetes mellitus and cardiovascular disease risk, the keywords should reflect official MeSH terms such as "Diabetes Mellitus" and "Cardiovascular Diseases," rather than more generic expressions like "blood sugar" or "heart disease," which may not correspond to standardized classifications. The recommended number of keywords typically ranges from three to six, arranged alphabetically, and should represent essential elements such as the population, intervention, outcome, and methodology. The use of precise, standardized keywords not only improves the article's discoverability but also reflects the professionalism and scientific rigor of the writing.[12]

Writing an effective introduction: framing the context, rationale, and objectives

In the first paragraph of the introduction, the author should begin by presenting a broad issue that encompasses the general covariate—a wide-ranging factor that underpins the background of the problem. The opening sentence should highlight the primary challenge or clinical urgency associated with this covariate, followed by a second sentence that includes prevalence, incidence, or mortality data to emphasize the magnitude of the issue. The third sentence should bridge the general covariate with a specific covariate—for instance, by explaining that general variable X is influenced by factors A, B, C, and D, with D being the specific covariate that will be examined in greater depth. The fourth sentence should reinforce this relationship using empirical data, biological theory, or relevant pathophysiological mechanisms. The closing sentence should underscore the importance of the specific covariate in the context of the general covariate, while smoothly transitioning into the next paragraph.

The second paragraph should focus entirely on the specific covariate. The first sentence should define or provide a general overview of the specific covariate. The second sentence should elaborate on the potential mechanisms by which this specific covariate may influence the previously described general covariate. The third sentence should present supporting evidence—whether clinical, epidemiological, or experimental—that strengthens the plausibility of the proposed mechanisms. To maintain scientific balance, the fourth sentence should outline conflicting findings or highlight the lack of robust evidence in the literature, thereby emphasizing the existing knowledge gap. The fifth sentence should then summarize the main unresolved issue or key research question, building a strong rationale for why a meta-analysis is warranted.

The third paragraph should outline the objectives and hypotheses of the study. The first sentence should clearly state the primary aim of the meta-analysis, such as assessing the strength of the association between the specific and general covariates, or evaluating the effect of a particular intervention on a defined clinical outcome. The second sentence should articulate the hypothesis being tested, the expected findings, and the potential practical or scientific implications if the study yields the anticipated results—for instance, contributing to clinical guideline development, identifying novel therapeutic targets, or informing directions for future research.

Methodology writing: Explaining how the study was conducted

Writing the Methods section in a meta-analysis should begin with a clear explanation of the study design, the timeframe of the literature search, and a brief overview of the analytical approach used to achieve the study objectives.[13] Within this subheading, authors should explicitly state that the study was conducted as a systematic review and meta-analysis, specify the search period (e.g., "up to December 31, 2024"), and outline the key steps undertaken—from database searching and data extraction to statistical analysis. Authors are required to declare that the study protocol was developed in accordance with the PRISMA guidelines and,[8] where applicable, include the PROSPERO registration number to ensure methodological transparency.[14] This allows readers to clearly understand the scientific framework underpinning the analysis.

The next subheading should focus on eligibility criteria. Authors must comprehensively describe the inclusion criteria, which may include acceptable study designs, study context (e.g., specific clinical populations), availability of sufficient data to calculate cumulative effect estimates, and additional requirements such as Hardy–Weinberg equilibrium for genetic studies.[15] Conversely, exclusion criteria should be

detailed by specifying reasons for rejection, such as irrelevant titles or abstracts, non-original articles (e.g., reviews or commentaries), and studies deemed low quality based on validation tools—such as a Newcastle–Ottawa Scale (NOS) score below the threshold for non-RCTs[16] or a minimal Jadad score for RCTs.[17] A clear explanation of these criteria helps minimize selection bias and enhances the reproducibility of the study.[18]

The following subheading should describe quality assessment procedures and the search strategy. Authors should identify the tools used—for instance, the Newcastle–Ottawa Scale for observational studies[16] and the modified Jadad scale[17] for randomized trials—and explain which aspects were assessed (e.g., participant selection, group comparability, outcome reporting), including the minimum and maximum possible scores and their interpretation (low, moderate, or high quality).[16,17] The authors must also state who conducted the quality assessments and how discrepancies were resolved, typically through discussion with a senior researcher. The literature search strategy should be described by specifying the databases used, the cut-off date, language restrictions, the search syntax combining core terms and synonyms using Boolean operators, and additional methods such as reference list screening of relevant articles.[19]

The final subheading should cover the data extraction process, covariate definitions, and statistical analysis. Authors must outline the types of information extracted—such as first author, year of publication, country, study design, participant characteristics, sample sizes of cases and controls, and other relevant variables—and define the procedure for resolving discrepancies between extractors, typically through discussion with a senior investigator. Each covariate analyzed should be clearly defined, the method of measurement described, its meaning interpreted, and, if applicable, subgroup analysis plans elaborated.[20] Finally, the statistical analysis should be described in detail, including data presentation format, tests for publication bias (e.g., Egger's test, funnel plot), heterogeneity assessment using I^2 statistics and p-values with justification for choosing a random-effects or fixed-effects model, and primary effect measures—such as the Z-test, Mantel–Haenszel method for dichotomous data, or inverse variance method for continuous outcomes—along with the software used (e.g., Review Manager, Stata, or R).[21] This approach ensures the analysis is conducted rigorously, transparently, and can be reliably replicated by other researchers.

Reporting research results: Clarity, accuracy, and structure
The article selection process must be conducted systematically in accordance with PRISMA guidelines.[8] Reporting should begin with the initial results of database searches, which yield a number of records that are then screened based on titles and abstracts. The report must also specify the number of duplicate articles and those irrelevant to the research topic, which are excluded at the early screening stage. Next, it should include the results of full-text assessments conducted to determine compliance with the predefined inclusion and exclusion criteria. Studies that fail to meet the criteria—such as those lacking sufficient data or employing inappropriate study designs—must be clearly reported as excluded. The final number of studies deemed eligible and included in the quantitative synthesis should be reported in detail through a PRISMA flow diagram, which visually illustrates the entire selection process from identification to final inclusion.[22]

The characteristics at baseline of included studies should be presented in a table with study design, country of origin, case and control group sample sizes, and the used

assessment tool. The report should also present the important findings of the meta-analysis, based on the overall number of participants in case and control groups across all included studies. The estimates of combined effects should be reported in terms of odds ratio or mean difference, along with accompanying 95% confidence intervals and p-values. Their implications would then be interpreted in terms of between-group comparison to determine both statistical significance and potential clinical significance.[22]

The report must also present the result of subgroup analyses conducted to examine consistency of effects between specific categories, e.g., geographic region, special groups, or intervention type. The number of studies and participants in each subgroup must be reported, together with subgroup-specific estimates and p-values. Interpretation should consider whether statistically or clinically significant differences exist among subgroups. If the differences are large, then they should be reported in greater detail to take into account potential causes of between-study heterogeneity.[8]

The report must also present an overview of the evaluation of heterogeneity between studies using the Chi-square (Q) test and the I^2 statistic. The I^2 must be presented to determine the degree of heterogeneity, with those above 50% typically reflecting substantial heterogeneity. Based on these results, the proper model to analyze needs to be selected—fixed-effects when heterogeneity is low or random-effects when heterogeneity is high. Potential publication bias needs to be explained using Egger's test and visualization by funnel plot. p-value in Egger's test and the symmetry or asymmetry of the funnel plot needs to be checked for identifying any hint of publication bias. When suspected bias, the report should also include extra or sensitivity analyses performed to determine the stability of the results.[8,22]

Structuring the discussion: strengths, limitations, and future directions
The opening paragraph of the Discussion should present a synthetic interpretation of the study's main findings without repeating statistical data already detailed in the Results section. Authors should focus on the conceptual significance and contribution of the findings in advancing understanding of the research issue.[23] The findings must be contextualized through critical comparisons with prior empirical studies, highlighting both concordant and discordant evidence. Differences or consistencies in results should be explained by identifying possible direct causes (e.g., variations in methodology, population, or measurement tools) and indirect factors (e.g., social, environmental, or cultural influences). This paragraph should conclude with a provisional summary that positions the meta-analysis findings within the existing body of literature.[24]

The second paragraph should focus on the interpretation of subgroup analysis findings. While numerical results are not repeated, the discussion should explore the scientific implications of effect patterns observed in different subgroups.[24] Authors are expected to compare across categories and offer theoretically or empirically supported arguments to explain potential sources of effect heterogeneity. Both direct causal mechanisms and contextual mediating or moderating factors should be considered. Interpretation should reflect an understanding of the complexity of population responses to the exposure or intervention being analyzed. The paragraph may conclude by emphasizing the need for more stratified approaches in both clinical practice and future research.[23]

The third paragraph must integrate the outcomes of meta-analysis with corresponding theoretical or conceptual models. Authors are encouraged to outline how their findings confirm—or disconfirm—popularly accepted theoretical frameworks, biomedical, behavioral, or social. If findings support established theory, then this should be emphasized as a demonstration of the external validity of said model.[23] Conversely, when results contradict theory, discussion needs to address whether deviation is a function of limitations in the theory or whether it reflects newly developed dynamics not yet addressed within the theory. This paragraph enhances the epistemological contribution of meta-analytic results toward science understanding beyond empirical synthesis.[24]

The fourth paragraph needs to describe practical and clinical implications of the findings. Authors should highlight the relevance of the main findings and subgroup analyses to practice, health policy, and population-level interventions. This section should not include reporting results but explain how the outcomes will improve diagnostic productivity, therapeutic efficacy, or resource allocation in health provision.[23] In addition, authors should state specific clinical or policy questions that can be addressed through the results, and suggest possible avenues for future investigations, such as randomized controlled trials or implementation studies.[24]

The fifth paragraph should critically and logically discuss the study's limitations. Authors should state and characterize probable confounding variables that could not be strictly controlled, and their impact on internal and external validity. Limitations of sample size, primary study design heterogeneity (e.g., observational versus interventional studies), or methodological and population heterogeneity should be declared.[23] Furthermore, the possible danger of publication bias, reporting limitations on the data, and inability to access unpublished studies should be explicitly declared. The paragraph serves to demonstrate scientific openness, but is to claim that—where such limitations are present—the meta-analysis makes an important contribution to the evidence base.[24]

Drawing conclusions: answering objectives and opening new questions
When authors write the Conclusion section of a meta-analysis, they need to provide a substantial summary of the principal findings of the analysis without statistical estimate repetition. The initial sentence should indicate the primary finding in synthetic and narrative form, mentioning the size of the observed intervention effect or association and its clinical or scientific relevance. Then there is some informal comment on the outcome of subgroup analysis to be made—not as a data report but as part of interpretive synthesis—on whether the same effects were observed in all the subpopulations or significant differences were noted. Its style is to indicate emphasis on the homogeneity or heterogeneity of the effects that can affect the generalizability of the findings.[4]

The final part of the Conclusion should include directions and implications for future research. Authors can specify existing knowledge gaps, unresolved limitations, or the need for further validation by prospective studies with higher power designs. Additional research may also include applying effects in special populations, examining causal pathways more comprehensively, or translating findings to implementation studies in real-world settings. Therefore, the Conclusion serves not only to shut out the report, but to offer informative scientific advice to advance the discipline.[8]

CONCLUSION

In conclusion, this comprehensive guide underscores that producing a high-quality meta-analysis article requires consistency across all components—from a precise title, a well-structured abstract, and MeSH-compliant keywords, to an introduction that outlines the context and objectives, transparent PRISMA-based methodology, clear and accurate results, a critical yet balanced discussion, and a concise, forward-looking conclusion. Diligence in specifying the population, intervention, comparison, and outcomes; adherence to rigorous literature search protocols and study quality assessment; as well as the integrity to acknowledge limitations and identify directions for future research may ensure that the article is not only discoverable and comprehensible but also contributes valid and impactful evidence to both clinical practice and health policy.

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