

is meta analysis quantitative

Is Meta-Analysis Quantitative? Unpacking the Methodology and Its Applications

Introduction:

Are you grappling with the nuances of research methodologies? Confused about whether meta-analysis is a quantitative approach or something else entirely? This comprehensive guide delves into the heart of meta-analysis, clarifying its quantitative nature, exploring its applications, and highlighting its crucial role in evidence-based decision-making. We'll move beyond simple definitions to uncover the intricate workings of this powerful research technique, equipping you with the knowledge to understand and critically evaluate meta-analyses you encounter in your field. By the end of this post, you'll not only understand that meta-analysis is quantitative but also grasp its underlying statistical principles and practical applications across diverse disciplines.

What is Meta-Analysis? A Quantitative Approach to Research Synthesis

Meta-analysis, at its core, is a quantitative research method used to systematically synthesize the results of multiple independent studies addressing a specific research question. Unlike narrative reviews which offer a more subjective overview, meta-analysis employs statistical techniques to combine data from these studies, providing a more precise and robust estimate of the overall effect size. This means it doesn't just summarize findings; it statistically combines them to arrive at a single, more powerful conclusion. This quantitative approach allows for a higher level of confidence in the conclusions drawn, compared to relying on individual studies that may have limitations in sample size or statistical power.

Key Characteristics of Meta-Analysis as a Quantitative Method:

Statistical Pooling: The fundamental characteristic distinguishing meta-analysis is its use of statistical methods to pool data from multiple studies. This involves calculating effect sizes (e.g., odds ratios, risk ratios, mean differences) for each individual study and then combining these effect sizes using weighted averages. The weighting often considers factors like sample size and study quality.

Objectivity and Transparency: Unlike narrative reviews, meta-analysis strives for objectivity. The methods used to identify, select, and analyze studies are clearly documented, allowing for replication and scrutiny. This transparency enhances the credibility and reliability of the findings.

Increased Statistical Power: By combining data from multiple studies, meta-analysis increases the overall statistical power compared to individual studies. This allows for the detection of smaller, but still meaningful, effects that might be missed in individual studies due to limited sample sizes.

Identification of Heterogeneity: Meta-analysis not only pools data but also assesses the consistency (or heterogeneity) of findings across studies. Significant heterogeneity indicates substantial variability in the effects observed across the included studies, requiring further investigation to understand the reasons for this variability (e.g., differences in study populations, interventions, or methodologies).

Addressing Publication Bias: Meta-analysis can, through specific statistical techniques, attempt to identify and address publication bias, a potential systematic error where studies with positive or statistically significant results are more likely to be published than those with negative or non-significant results. This bias can skew the overall findings if not accounted for.

Types of Data Used in Meta-Analysis:

Meta-analysis can accommodate various types of data, depending on the research question and the nature of the included studies. Common data types include:

Dichotomous data: Data representing the presence or absence of an outcome (e.g., success or failure, presence or absence of a disease). Odds ratios and risk ratios are commonly used effect sizes.

Continuous data: Data measured on a continuous scale (e.g., blood pressure, weight, test scores). Mean differences or standardized mean differences are commonly used effect sizes.

Counts data: Data representing the number of events occurring within a specific time period or group (e.g., number of infections, number of deaths). Rate ratios or incidence rate ratios are often used.

Steps Involved in Conducting a Meta-Analysis:

A well-conducted meta-analysis follows a rigorous process that involves several key steps:

1. **Formulating a Research Question:** Clearly defining the research question is crucial to guide the entire process.
1. **Developing an Inclusion/Exclusion Criteria:** Establishing precise criteria for selecting studies ensures that only relevant studies are included in the analysis.
1. **Searching for Relevant Studies:** A comprehensive search of relevant databases and other sources is essential to identify all eligible studies.

1. Data Extraction: Extracting relevant data from the selected studies, including effect sizes and other relevant information, is a critical step.
1. Assessing Risk of Bias: Evaluating the methodological quality of the included studies helps to assess the potential for bias in the results.
1. Statistical Analysis: Performing statistical analysis to pool the data and estimate the overall effect size, assess heterogeneity, and explore potential sources of variability.
1. Interpretation and Reporting: Interpreting the results in the context of the research question and reporting the findings clearly and transparently.

Applications of Meta-Analysis:

Meta-analysis has wide-ranging applications across various disciplines, including:

Medicine and Healthcare: Evaluating the effectiveness of medical interventions, assessing the risk factors for diseases, and understanding treatment outcomes.

Education: Investigating the effectiveness of educational interventions, assessing the impact of different teaching methods, and studying student learning outcomes.

Psychology: Examining the effectiveness of psychological interventions, investigating the determinants of behavior, and studying the relationship between psychological variables.

Environmental Science: Assessing the impact of environmental factors on human health, investigating the effectiveness of environmental policies, and studying the effects of pollution.

Sample Meta-Analysis Outline:

Title: The Effectiveness of Cognitive Behavioral Therapy for Generalized Anxiety Disorder: A Meta-Analysis

Introduction: Background on Generalized Anxiety Disorder (GAD), previous research on CBT effectiveness, and the rationale for a meta-analysis.

Methods: Search strategy, inclusion/exclusion criteria, data extraction methods, assessment of risk of bias, statistical methods used.

Results: Summary of included studies, forest plot showing effect sizes, assessment of

heterogeneity, investigation of publication bias, subgroup analyses (if any).

Discussion: Interpretation of the findings, limitations of the study, implications for clinical practice, future research directions.

Conclusion: Summary of the key findings and their implications.

Detailed Explanation of the Outline:

Each section of the outline would contain detailed information related to its heading. For instance:

Introduction: This section would provide a thorough review of the existing literature on GAD and CBT, highlighting the inconsistencies or gaps in the existing evidence that necessitate a meta-analytic approach. It would articulate the specific research question being addressed and the overall objectives of the meta-analysis.

Methods: This is a crucial section where the methodology is clearly described. It would detail the databases searched, search terms used, inclusion/exclusion criteria (e.g., study design, population characteristics, intervention type), data extraction procedures (specifying exactly what data points were collected from each study), methods for assessing risk of bias (e.g., using standardized tools like the Cochrane risk of bias tool), and the statistical methods employed for pooling the data and assessing heterogeneity (e.g., random-effects model, I^2 statistic).

Results: This section would present the key findings of the meta-analysis. It would typically include a summary of the characteristics of the included studies (number of studies, sample sizes, study quality), a forest plot visually representing the effect sizes of individual studies and the pooled effect size, the results of heterogeneity tests (e.g., I^2 statistic), and results regarding the assessment of publication bias (e.g., funnel plot analysis). Subgroup analyses, if conducted, would also be reported here to examine if the effect of CBT varies based on factors such as patient characteristics or treatment parameters.

Discussion: This section would interpret the results within the context of existing literature. It would discuss the limitations of the meta-analysis (e.g., limitations of included studies, potential biases not fully addressed, heterogeneity of results), the implications of the findings for clinical practice and future research, and potential explanations for any observed heterogeneity or unexpected findings.

Conclusion: This section would concisely summarize the key findings and their implications. It would reiterate the main conclusions drawn from the meta-analysis and emphasize the significance of the results for informing clinical practice or future research efforts.

FAQs:

1. Is a meta-analysis always quantitative? Yes, by definition, a meta-analysis is always a quantitative method that involves statistical analysis of pooled data.

1. What are the limitations of meta-analysis? Limitations include reliance on the quality of included studies, potential for publication bias, and difficulties in handling heterogeneity.

1. Can meta-analysis be used with qualitative studies? No, traditional meta-analysis focuses on quantitative data. However, methods like meta-ethnography exist for synthesizing qualitative research.

1. How is heterogeneity assessed in meta-analysis? Heterogeneity is assessed using statistical tests (e.g., Cochran's Q test, I^2 statistic) that measure the variability of effect sizes across studies.

1. What is publication bias, and how is it addressed? Publication bias is the tendency to publish studies with positive results. Funnel plot analysis and statistical techniques like trim-and-fill can help assess and address it.

1. What software is used for meta-analysis? Several software packages, including RevMan, CMA, and STATA, are commonly used.

1. What is the difference between a systematic review and a meta-analysis? A systematic review is a comprehensive, unbiased summary of existing research. A meta-analysis is a statistical synthesis of data from multiple studies within a systematic review.

1. Can meta-analysis prove causality? No, meta-analysis, like observational studies, cannot definitively prove causality. It can, however, strengthen the evidence for an association.

1. How do I critically appraise a meta-analysis? Assess the research question, methods (search strategy, inclusion/exclusion criteria, risk of bias assessment, statistical methods), results, and conclusions. Check for transparency and potential biases.

Related Articles:

1. Systematic Review Methodology: A step-by-step guide to conducting a systematic review.
2. Understanding Effect Sizes: Explanation of different effect size measures and their interpretation.
3. Assessing Risk of Bias in Studies: Methods for evaluating the methodological quality of research.
4. Heterogeneity in Meta-Analysis: Dealing with inconsistencies in study results.
5. Publication Bias in Research: Identifying and addressing publication bias.
6. Forest Plots in Meta-Analysis: Interpretation and construction of forest plots.
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is meta analysis quantitative: Modern Methods of Clinical Investigation Institute of Medicine, Committee on Technological Innovation in Medicine, 1990-02-01 The very rapid pace of advances in biomedical research promises us a wide range of new drugs, medical devices, and clinical procedures. The extent to which these discoveries will benefit the public, however, depends in large part on the methods we choose for developing and testing them. Modern Methods of Clinical Investigation focuses on strategies for clinical evaluation and their role in uncovering the actual benefits and risks of medical innovation. Essays explore differences in our current systems for evaluating drugs, medical devices, and clinical procedures; health insurance databases as a tool for assessing treatment outcomes; the role of the medical profession, the Food and Drug Administration, and industry in stimulating the use of evaluative methods; and more. This book will be of special interest to policymakers, regulators, executives in the medical industry, clinical researchers, and physicians.

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is meta analysis quantitative: Cochrane Handbook for Systematic Reviews of

Interventions Julian P. T. Higgins, Sally Green, 2008-11-24 Healthcare providers, consumers, researchers and policy makers are inundated with unmanageable amounts of information, including evidence from healthcare research. It has become impossible for all to have the time and resources to find, appraise and interpret this evidence and incorporate it into healthcare decisions. Cochrane Reviews respond to this challenge by identifying, appraising and synthesizing research-based evidence and presenting it in a standardized format, published in The Cochrane Library (www.thecochranelibrary.com). The Cochrane Handbook for Systematic Reviews of Interventions contains methodological guidance for the preparation and maintenance of Cochrane intervention reviews. Written in a clear and accessible format, it is the essential manual for all those preparing, maintaining and reading Cochrane reviews. Many of the principles and methods described here are appropriate for systematic reviews applied to other types of research and to systematic reviews of interventions undertaken by others. It is hoped therefore that this book will be invaluable to all those who want to understand the role of systematic reviews, critically appraise published reviews or perform reviews themselves.

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is meta analysis quantitative: Meta-Study of Qualitative Health Research Barbara L. Paterson, 2001-06 This title provides step-by-step directions for how to conduct a meta-study, as well as recommendations for tools and standards for the application of this approach.

is meta analysis quantitative: Advances in Meta-Analysis Terri Pigott, 2012-01-31 The subject of the book is advanced statistical analyses for quantitative research synthesis (meta-analysis), and selected practical issues relating to research synthesis that are not covered in detail in the many existing introductory books on research synthesis (or meta-analysis). Complex statistical issues are arising more frequently as the primary research that is summarized in quantitative syntheses itself becomes more complex, and as researchers who are conducting meta-analyses become more ambitious in the questions they wish to address. Also as researchers have gained more experience in conducting research syntheses, several key issues have persisted and now appear fundamental to the enterprise of summarizing research. Specifically the book describes multivariate analyses for several indices commonly used in meta-analysis (e.g., correlations, effect sizes, proportions and/or odds ratios), will outline how to do power analysis for meta-analysis (again for each of the different kinds of study outcome indices), and examines issues around research quality and research design and their roles in synthesis. For each of the statistical topics we will examine the different possible statistical models (i.e., fixed, random, and mixed models) that could be adopted by a researcher. In dealing with the issues of study quality and research design it covers a number of specific topics that are of broad concern to research synthesists. In many fields a current issue is how to make sense of results when studies using several different designs appear in a research literature (e.g., Morris & Deshon, 1997, 2002). In education and other social sciences a critical aspect of this issue is how one might incorporate qualitative (e.g., case study) research within a synthesis. In medicine, related issues concern

whether and how to summarize observational studies, and whether they should be combined with randomized controlled trials (or even if they should be combined at all). For each topic, included is a worked example (e.g., for the statistical analyses) and/or a detailed description of a published research synthesis that deals with the practical (non-statistical) issues covered.

is meta analysis quantitative: *Doing Meta-Analysis with R* Mathias Harrer, Pim Cuijpers, Toshi A. Furukawa, David D. Ebert, 2021-09-15 *Doing Meta-Analysis with R: A Hands-On Guide* serves as an accessible introduction on how meta-analyses can be conducted in R. Essential steps for meta-analysis are covered, including calculation and pooling of outcome measures, forest plots, heterogeneity diagnostics, subgroup analyses, meta-regression, methods to control for publication bias, risk of bias assessments and plotting tools. Advanced but highly relevant topics such as network meta-analysis, multi-three-level meta-analyses, Bayesian meta-analysis approaches and SEM meta-analysis are also covered. A companion R package, dmetar, is introduced at the beginning of the guide. It contains data sets and several helper functions for the meta and metafor package used in the guide. The programming and statistical background covered in the book are kept at a non-expert level, making the book widely accessible. Features • Contains two introductory chapters on how to set up an R environment and do basic imports/manipulations of meta-analysis data, including exercises • Describes statistical concepts clearly and concisely before applying them in R • Includes step-by-step guidance through the coding required to perform meta-analyses, and a companion R package for the book

is meta analysis quantitative: *Systematic Reviews and Meta-Analysis* Jacqueline Corcoran, Vijayan Pillai, 2008-02-13 When used in tandem, systematic reviews and meta-analysis-- two distinct but highly compatible approaches to research synthesis-- form a powerful, scientific approach to analyzing previous studies. But to see their full potential, a social work researcher must be versed in the foundational processes underlying them. This pocket guide to Systematic Reviews and Meta-Analysis illuminates precisely that practical groundwork. In clear, step-by-step terms, the authors explain how to format topics, locate and screen studies, extract and assess data, pool effect sizes, determine bias, and interpret the results, showing readers how to combine reviewing and meta-analysis correctly and effectively. Each chapter contains vivid social work examples and concludes with a concise summary and notes on further reading, while the book's glossary and handy checklists and sample search and data extraction forms maximize the book's usefulness. Highlighting the concepts necessary to understand, critique, and conduct research synthesis, this brief and highly readable introduction is a terrific resource for students and researchers alike.

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is meta analysis quantitative: Meta-Ethnography George W. Noblit, R. Dwight Hare, 1988-02 How can ethnographic studies be generalized, in contrast to concentrating on the individual case? Noblit and Hare propose a new method for synthesizing from qualitative studies: meta-ethnography. After citing the criteria to be used in comparing qualitative research projects, the authors define the ways these can then be aggregated to create more cogent syntheses of research. Using examples from numerous studies ranging from ethnographic work in educational settings to the Mead-Freeman controversy over Samoan youth, Meta-Ethnography offers useful procedural advice from both comparative and cumulative analyses of qualitative data. This provocative volume will be read with interest by researchers and students in qualitative research methods, ethnography, education, sociology, and anthropology. After defining metaphor and synthesis, these authors provide a step-by-step program that will allow the researcher to show similarity (reciprocal translation), difference (refutation), or similarity at a higher level (lines or argument synthesis) among sample studies....Contain(s) valuable strategies at a seldom-used level of analysis. --Contemporary Sociology The authors made an important contribution by reframing how we think of ethnography comparison in a way that is compatible with the new developments in interpretive ethnography. Meta-Ethnography is well worth consulting for the problem definition it offers. --The Journal of Nervous and Mental Disease This book had to be written and I am pleased it was. Someone needed to break the ice and offer a strategy for summarizing multiple ethnographic studies. Noblit and Hare have done a commendable job of giving the research community one approach for doing so. Further, no one else can now venture into this area of synthesizing qualitative studies without making references to and positioning themselves vis-a-vis this volume. -Educational Studies

is meta analysis quantitative: Finding What Works in Health Care Institute of Medicine, Board on Health Care Services, Committee on Standards for Systematic Reviews of Comparative Effectiveness Research, 2011-07-20 Healthcare decision makers in search of reliable information that compares health interventions increasingly turn to systematic reviews for the best summary of the evidence. Systematic reviews identify, select, assess, and synthesize the findings of similar but separate studies, and can help clarify what is known and not known about the potential benefits and harms of drugs, devices, and other healthcare services. Systematic reviews can be helpful for clinicians who want to integrate research findings into their daily practices, for patients to make well-informed choices about their own care, for professional medical societies and other organizations that develop clinical practice guidelines. Too often systematic reviews are of uncertain or poor quality. There are no universally accepted standards for developing systematic reviews leading to variability in how conflicts of interest and biases are handled, how evidence is appraised, and the overall scientific rigor of the process. In Finding What Works in Health Care the Institute of Medicine (IOM) recommends 21 standards for developing high-quality systematic reviews of comparative effectiveness research. The standards address the entire systematic review process from the initial steps of formulating the topic and building the review team to producing a detailed final report that synthesizes what the evidence shows and where knowledge gaps remain. Finding What Works in Health Care also proposes a framework for improving the quality of the science underpinning systematic reviews. This book will serve as a vital resource for both sponsors and producers of systematic reviews of comparative effectiveness research.

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are healthy, whole-grains are a disaster; eat everything in moderation; eat only certain foods--and on and on. In *One Hundred Million Years of Food* biological anthropologist Stephen Le explains how cuisines of different cultures are a result of centuries of evolution, finely tuned to our biology and surroundings. Today many cultures have strayed from their ancestral diets, relying instead on mass-produced food often made with chemicals that may be contributing to a rise in so-called Western diseases, such as cancer, heart disease, and obesity. Travelling around the world to places as far-flung as Vietnam, Kenya, India, and the US, Stephen Le introduces us to people who are growing, cooking, and eating food using both traditional and modern methods, striving for a sustainable, healthy diet. In clear, compelling arguments based on scientific research, Le contends that our ancestral diets provide the best first line of defense in protecting our health and providing a balanced diet. Fast-food diets, as well as strict regimens like paleo or vegan, in effect hijack our biology and ignore the complex nature of our bodies. In *One Hundred Million Years of Food* Le takes us on a guided tour of evolution, demonstrating how our diets are the result of millions of years of history, and how we can return to a sustainable, healthier way of eating.--Publisher's description.

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is meta analysis quantitative: Presenting Medical Statistics from Proposal to Publication Janet L. Peacock, Sally M. Kerry, Raymond R. Balise, 2017-07-21 As many medical and healthcare researchers have a love-hate relationship with statistics, the second edition of this practical reference book may make all the difference. Using practical examples, mainly from the authors' own research, the book explains how to make sense of statistics, turn statistical computer output into coherent information, and help decide which pieces of information to report and how to present them. The book takes you through all the stages of the research process, from the initial research proposal, through ethical approval and data analysis, to reporting on and publishing the findings. Helpful tips and information boxes, offer clear guidance throughout, including easily followed instructions on how to: -develop a quantitative research proposal for ethical/institutional approval or research funding -write up the statistical aspects of a paper for publication -choose and perform simple and more advanced statistical analyses -describe the statistical methods and present the results of an analysis. This new edition covers a wider range of statistical programs - SAS, STATA, R, and SPSS, and shows the commands needed to obtain the analyses and how to present it, whichever program you are using. Each specific example is annotated to indicate other scenarios that can be analysed using the same methods, allowing you to easily transpose the knowledge gained from the book to your own research. The principles of good presentation are also covered in detail, from translating relevant results into suitable extracts, through to randomised controlled trials, and how to present a meta-analysis. An added ingredient is the inclusion of code and datasets for all analyses shown in the book on our website (<http://medical-statistics.info>). Written by three experienced biostatisticians based in the UK and US, this is a step-by-step guide that will be invaluable to researchers and postgraduate students in medicine, those working in the professions allied to medicine, and statisticians in consultancy roles.

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Appraising and synthesising data • Making use of reviews/models of research use. Easy to read and logically structured, this book is essential reading for anyone doing systematic reviews. David Gough is Professor of Evidence Informed Policy and Practice and Director of SSRU and its EPPI-Centre and Co-Editor of the journal Evidence & Policy. Sandy Oliver is Professor of Public Policy and Deputy Director of SSRU and its EPPI-Centre. James Thomas is Reader in Social Policy, Assistant Director of SSRU and Associate Director of the EPPI-Centre.

is meta analysis quantitative: Handbook of Ethics in Quantitative Methodology A. T. Panter, Sonya K. Sterba, 2011-03-01 This comprehensive Handbook is the first to provide a practical, interdisciplinary review of ethical issues as they relate to quantitative methodology including how to present evidence for reliability and validity, what comprises an adequate tested population, and what constitutes scientific knowledge for eliminating biases. The book uses an ethical framework that emphasizes the human cost of quantitative decision making to help researchers understand the specific implications of their choices. The order of the Handbook chapters parallels the chronology of the research process: determining the research design and data collection; data analysis; and communicating findings. Each chapter: Explores the ethics of a particular topic Identifies prevailing methodological issues Reviews strategies and approaches for handling such issues and their ethical implications Provides one or more case examples Outlines plausible approaches to the issue including best-practice solutions. Part 1 presents ethical frameworks that cross-cut design, analysis, and modeling in the behavioral sciences. Part 2 focuses on ideas for disseminating ethical training in statistics courses. Part 3 considers the ethical aspects of selecting measurement instruments and sample size planning and explores issues related to high stakes testing, the defensibility of experimental vs. quasi-experimental research designs, and ethics in program evaluation. Decision points that shape a researchers' approach to data analysis are examined in Part 4 - when and why analysts need to account for how the sample was selected, how to evaluate tradeoffs of hypothesis-testing vs. estimation, and how to handle missing data. Ethical issues that arise when using techniques such as factor analysis or multilevel modeling and when making causal inferences are also explored. The book concludes with ethical aspects of reporting meta-analyses, of cross-disciplinary statistical reform, and of the publication process. This Handbook appeals to researchers and practitioners in psychology, human development, family studies, health, education, sociology, social work, political science, and business/marketing. This book is also a valuable supplement for quantitative methods courses required of all graduate students in these fields.

is meta analysis quantitative: How to Perform a Systematic Literature Review Edward Purssell, Niall McCrae, 2020-08-04 The systematic review is a rigorous method of collating and synthesizing evidence from multiple studies, producing a whole greater than the sum of parts. This textbook is an authoritative and accessible guide to an activity that is often found overwhelming. The authors steer readers on a logical, sequential path through the process, taking account of the different needs of researchers, students and practitioners. Practical guidance is provided on the fundamentals of systematic reviewing and also on advanced techniques such as meta-analysis. Examples are given in each chapter, with a succinct glossary to support the text. This up-to-date, accessible textbook will satisfy the needs of students, practitioners and educators in the sphere of healthcare, and contribute to improving the quality of evidence-based practice. The authors will advise some freely available or inexpensive open source/access resources (such as PubMed, R and Zotero) to help students how to perform a systemic review, in particular those with limited resources.

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techniques. In addition to the fundamentals, the book discusses more advanced topics, such as artifact correction, random- and mixed-effects models, structural equation representations, and multivariate procedures. User-friendly features include annotated equations; discussions of alternative approaches; and Practical Matters sections that give advice on topics not often discussed in other books, such as linking meta-analytic results with theory and the utility of meta-analysis software programs. ȳ

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previous knowledge, but takes the reader through the process stage by stage; Drawing on examples from such diverse fields as psychology, criminology, education, transport, social welfare, public health, and housing and urban policy, among others. Including detailed sections on assessing the quality of both quantitative, and qualitative research; searching for evidence in the social sciences; meta-analytic and other methods of evidence synthesis; publication bias; heterogeneity; and approaches to dissemination.

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