

introduction to meta analysis borenstein

Introduction to Meta-Analysis: A Comprehensive Guide to Borenstein's Methodology

Meta-analysis, the powerful statistical technique for combining results from multiple independent studies, has revolutionized research across numerous fields. Understanding this methodology is crucial for anyone involved in research synthesis, evidence-based practice, or critical appraisal of scientific literature. This comprehensive guide delves into the foundational principles of meta-analysis as presented by Michael Borenstein and his colleagues, providing a practical introduction suitable for both beginners and those seeking to solidify their understanding. We will explore the key concepts, practical applications, and potential pitfalls, equipping you with the knowledge to critically evaluate and potentially conduct your own meta-analyses.

What is Meta-Analysis and Why Use Borenstein's Approach?

Meta-analysis goes beyond simply summarizing individual study findings; it statistically pools data from multiple studies to estimate an overall effect size. This allows for a more precise and powerful conclusion than any single study could offer, addressing limitations like small sample sizes or conflicting results. Michael Borenstein, along with Larry Hedges, Julian Higgins, and Hannah Rothstein, are renowned for their influential work in making meta-analysis accessible and rigorous. Their book, *Introduction to Meta-Analysis*, serves as a cornerstone text, offering a practical and comprehensive guide to the methodology. Borenstein's approach emphasizes transparency, methodological rigor, and the importance of addressing potential sources of heterogeneity (variation in results across studies).

Understanding Key Concepts in Borenstein's Meta-Analysis Framework

Before diving into the specifics of Borenstein's methods, grasping several core concepts is essential:

1. **Effect Size:** This is a standardized measure of the magnitude of the effect observed in each individual study. Common effect sizes include Cohen's d (for comparing means), odds ratios (for binary outcomes), and correlation coefficients (for associations). Borenstein's approach emphasizes choosing the appropriate effect size measure based on the type of data being analyzed.
1. **Heterogeneity:** This refers to the variability in effect sizes across the included studies. High heterogeneity indicates that the studies are not all measuring the same underlying effect, potentially due to differences in study populations, interventions, or measurement methods. Borenstein's framework provides tools to assess and address heterogeneity, including exploring potential sources and using appropriate statistical models.

1. **Weighting Studies:** Individual studies are not equally weighted in a meta-analysis. Studies with larger sample sizes and more precise estimates generally receive higher weights, reflecting their greater contribution to the overall estimate. Borenstein details several weighting schemes, including inverse-variance weighting, which is commonly used.
1. **Fixed-effects vs. Random-effects Models:** Two primary models are used in meta-analysis: fixed-effects and random-effects. A fixed-effects model assumes that all studies are estimating the same underlying effect, while a random-effects model accounts for both within-study and between-study variability. Borenstein explains when each model is appropriate and how to interpret their results.
1. **Publication Bias:** This is a systematic error where studies with statistically significant results are more likely to be published than those with non-significant results. Publication bias can inflate the overall effect size in a meta-analysis. Borenstein highlights various methods to detect and address publication bias, such as funnel plots and statistical tests.

A Detailed Look at the Structure of Introduction to Meta-Analysis by Borenstein et al.

The book *Introduction to Meta-Analysis* by Borenstein, Hedges, Higgins, and Rothstein is structured to provide a comprehensive understanding of the subject, progressing from fundamental concepts to advanced techniques. Here's a breakdown:

Outline:

Introduction: Sets the stage, defining meta-analysis, its purpose, and its place within research synthesis.

Chapter 1-3: Foundational Concepts: Covers effect sizes, data extraction, and handling missing data. Explains different types of effect sizes and their appropriate use.

Chapter 4-6: Methods of Meta-Analysis: Detailed explanation of fixed-effect and random-effects models, along with weighting schemes. Introduces different statistical methods for handling heterogeneity.

Chapter 7-9: Addressing Heterogeneity and Publication Bias: Discusses various approaches to assess and mitigate the impact of heterogeneity and publication bias. Explores potential sources of variation and strategies for subgroup analysis.

Chapter 10-12: Advanced Topics: Deals with more complex scenarios, including meta-regression, network meta-analysis, and the use of meta-analysis software.

Conclusion: Summarizes key concepts and offers guidance on the proper interpretation and limitations of meta-analysis.

Detailed Explanation of the Outline Points:

1. Introduction: This section establishes the importance of meta-analysis in evidence-based decision-making. It differentiates meta-analysis from narrative reviews, highlighting the advantages of a quantitative approach to synthesizing research findings.
1. Foundational Concepts (Chapters 1-3): This critical section lays the groundwork for understanding the core components of a meta-analysis. It details the calculation and interpretation of various effect sizes, depending on the type of data (e.g., continuous, binary, or count data). It emphasizes the importance of meticulous data extraction from individual studies and provides strategies for handling missing data.
1. Methods of Meta-Analysis (Chapters 4-6): This section dives into the core statistical methods used in meta-analysis. It explains the difference between fixed-effect and random-effects models, emphasizing their underlying assumptions and implications. It guides the reader through the process of calculating weighted averages of effect sizes and interpreting the results, emphasizing the role of confidence intervals.
1. Addressing Heterogeneity and Publication Bias (Chapters 7-9): This crucial part addresses the challenges posed by heterogeneity and publication bias. It presents statistical tests for assessing heterogeneity and explores various methods for exploring and explaining the sources of variability across studies. It discusses different approaches to detecting and adjusting for publication bias, recognizing the limitations of each method.
1. Advanced Topics (Chapters 10-12): These chapters cover more advanced meta-analytic techniques. Meta-regression allows exploring the relationship between study characteristics and effect sizes. Network meta-analysis compares multiple interventions simultaneously. The use of specialized software is also explained.
1. Conclusion: The conclusion reinforces the importance of careful planning, rigorous execution, and transparent reporting in meta-analysis. It emphasizes the limitations of meta-analysis, such as the reliance on the quality of the included studies and the potential for bias.

Frequently Asked Questions (FAQs)

1. What software is recommended for conducting a meta-analysis according to Borenstein's methods? Several software packages are suitable, including RevMan, Stata, R (with specialized packages), and Comprehensive Meta-Analysis. Borenstein's book often refers to Comprehensive Meta-Analysis.
1. How do I choose between a fixed-effects and a random-effects model? The choice depends on whether you believe the studies are estimating the same true effect (fixed-effects) or if there's variability in true effects across studies (random-effects). Random-effects models are generally preferred due to their greater realism.
1. What is the significance of the I^2 statistic in meta-analysis? The I^2 statistic quantifies the percentage of total variation in effect sizes attributable to heterogeneity rather than sampling error. High I^2 suggests substantial heterogeneity.
1. How do I handle missing data in a meta-analysis? Strategies include imputation methods (replacing missing values with estimates) or excluding studies with substantial missing data, but this should be justified and transparently reported.
1. What are funnel plots used for? Funnel plots are visual tools used to assess publication bias. Asymmetrical funnel plots suggest potential bias.
1. What is sensitivity analysis in the context of meta-analysis? Sensitivity analysis involves assessing how the results of a meta-analysis change when altering key assumptions or parameters.
1. How do I interpret the confidence interval around the pooled effect size? The confidence interval provides a range of plausible values for the true effect size. A wider interval indicates greater uncertainty.

1. Can I perform a meta-analysis on a small number of studies? While ideally, more studies are better, meta-analysis can still be valuable with a small number of studies, but the results should be interpreted cautiously.

1. What is the importance of forest plots in reporting a meta-analysis? Forest plots graphically display the individual study effect sizes and the overall pooled effect size, providing a clear visual representation of the meta-analysis results.

Related Articles:

1. Understanding Effect Sizes in Meta-Analysis: A detailed exploration of different effect size measures and their appropriate application.

1. Fixed-Effects vs. Random-Effects Models: A Practical Guide: A comparison of the two primary models used in meta-analysis and when to use each.

1. Assessing and Addressing Heterogeneity in Meta-Analysis: Strategies for identifying, quantifying, and exploring the sources of heterogeneity in meta-analysis.

1. Detecting and Addressing Publication Bias in Meta-Analysis: Methods for detecting publication bias and strategies for mitigating its impact.

1. Meta-Regression: Exploring Sources of Variation in Effect Sizes: A guide to meta-regression, a technique for exploring relationships between study characteristics and effect sizes.

1. Conducting a Meta-Analysis using R: A tutorial on performing meta-analysis using the statistical software R.

1. Interpreting Confidence Intervals in Meta-Analysis: A clear explanation of how to interpret

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new and expanded content on avoiding common mistakes in meta-analysis, understanding heterogeneity in effects, publication bias, and more. Several brand-new chapters provide a systematic how to approach to performing and reporting a meta-analysis from start to finish. Written by four of the world's foremost authorities on all aspects of meta-analysis, the new edition: Outlines the role of meta-analysis in the research process Shows how to compute effects sizes and treatment effects Explains the fixed-effect and random-effects models for synthesizing data Demonstrates how to assess and interpret variation in effect size across studies Explains how to avoid common mistakes in meta-analysis Discusses controversies in meta-analysis Includes access to a companion website containing videos, spreadsheets, data files, free software for prediction intervals, and step-by-step instructions for performing analyses using Comprehensive Meta-Analysis (CMA) Download videos, class materials, and worked examples at www.Introduction-to-Meta-Analysis.com This book offers the reader a unified framework for thinking about meta-analysis, and then discusses all elements of the analysis within that framework. The authors address a series of common mistakes and explain how to avoid them. As the editor-in-chief of the American Psychologist and former editor of Psychological Bulletin, I can say without hesitation that the quality of manuscript submissions reporting meta-analyses would be vastly better if researchers read this book. —Harris Cooper, Hugo L. Blomquist Distinguished Professor Emeritus of Psychology and Neuroscience, Editor-in-chief of the American Psychologist, former editor of Psychological Bulletin A superb combination of lucid prose and informative graphics, the authors provide a refreshing departure from cookbook approaches with their clear explanations of the what and why of meta-analysis. The book is ideal as a course textbook or for self-study. My students raved about the clarity of the explanations and examples. —David Rindskopf, Distinguished Professor of Educational Psychology, City University of New York, Graduate School and University Center, & Editor of the Journal of Educational and Behavioral Statistics The approach taken by Introduction to Meta-analysis is intended to be primarily conceptual, and it is amazingly successful at achieving that goal. The reader can comfortably skip the formulas and still understand their application and underlying motivation. For the more statistically sophisticated reader, the relevant formulas and worked examples provide a superb practical guide to performing a meta-analysis. The book provides an eclectic mix of examples from education, social science, biomedical studies, and even ecology. For anyone considering leading a course in meta-analysis, or pursuing self-directed study, Introduction to Meta-analysis would be a clear first choice. —Jesse A. Berlin, ScD

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This text provides a concise and clearly presented discussion of all the elements in a meta-analysis. It is illustrated with worked examples throughout, with visual explanations, using screenshots from Excel spreadsheets and computer programs such as Comprehensive Meta-Analysis (CMA) or Strata.

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Psychology, City University of New York, Graduate School and University Center, & Editor of the Journal of Educational and Behavioral Statistics. The approach taken by Introduction to Meta-analysis is intended to be primarily conceptual, and it is amazingly successful at achieving that goal. The reader can comfortably skip the formulas and still understand their application and underlying motivation. For the more statistically sophisticated reader, the relevant formulas and worked examples provide a superb practical guide to performing a meta-analysis. The book provides an eclectic mix of examples from education, social science, biomedical studies, and even ecology. For anyone considering leading a course in meta-analysis, or pursuing self-directed study, Introduction to Meta-analysis would be a clear first choice. Jesse A. Berlin, ScD Introduction to Meta-Analysis is an excellent resource for novices and experts alike. The book provides a clear and comprehensive presentation of all basic and most advanced approaches to meta-analysis. This book will be referenced for decades. Michael A. McDaniel, Professor of Human Resources and Organizational Behavior, Virginia Commonwealth University

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introduction to meta analysis borenstein: 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

introduction to meta analysis borenstein: Handbook of Meta-analysis in Ecology and Evolution Julia Koricheva, Jessica Gurevitch, Kerrie Mengersen, 2013-04-21 Meta-analysis is a powerful statistical methodology for synthesizing research evidence across independent studies. This is the first comprehensive handbook of meta-analysis written specifically for ecologists and evolutionary biologists, and it provides an invaluable introduction for beginners as well as an up-to-date guide for experienced meta-analysts. The chapters, written by renowned experts, walk readers through every step of meta-analysis, from problem formulation to the presentation of the results. The handbook identifies both the advantages of using meta-analysis for research synthesis and the potential pitfalls and limitations of meta-analysis (including when it should not be used). Different approaches to carrying out a meta-analysis are described, and include moment and least-square, maximum likelihood, and Bayesian approaches, all illustrated using worked examples based on real biological datasets. This one-of-a-kind resource is uniquely tailored to the biological sciences, and will provide an invaluable text for practitioners from graduate students and senior scientists to policymakers in conservation and environmental management. Walks you through every step of carrying out a meta-analysis in ecology and evolutionary biology, from problem formulation to result presentation Brings together experts from a broad range of fields Shows how to avoid, minimize, or resolve pitfalls such as missing data, publication bias, varying data quality, nonindependence of observations, and phylogenetic dependencies among species Helps you choose the right software Draws on numerous examples based on real biological datasets

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decide to publish a study based on the results of the study, rather than on the basis of its theoretical or methodological quality. It can arise from selective publication of favorable results, or of statistically significant results. This threatens the validity of conclusions drawn from reviews of published scientific research. Meta-analysis is now used in numerous scientific disciplines, summarizing quantitative evidence from multiple studies. If the literature being synthesised has been affected by publication bias, this in turn biases the meta-analytic results, potentially producing overstated conclusions. *Publication Bias in Meta-Analysis* examines the different types of publication bias, and presents the methods for estimating and reducing publication bias, or eliminating it altogether. Written by leading experts, adopting a practical and multidisciplinary approach. Provides comprehensive coverage of the topic including: Different types of publication bias, Mechanisms that may induce them, Empirical evidence for their existence, Statistical methods to address them, Ways in which they can be avoided. Features worked examples and common data sets throughout. Explains and compares all available software used for analysing and reducing publication bias. Accompanied by a website featuring software, data sets and further material. *Publication Bias in Meta-Analysis* adopts an inter-disciplinary approach and will make an excellent reference volume for any researchers and graduate students who conduct systematic reviews or meta-analyses. University and medical libraries, as well as pharmaceutical companies and government regulatory agencies, will also find this invaluable.

introduction to meta analysis borenstein: *Applied Meta-Analysis for Social Science Research* Noel A. Card, 2015-10-06 Offering pragmatic guidance for planning and conducting a meta-analytic review, this book is written in an engaging, nontechnical style that makes it ideal for graduate course use or self-study. The author shows how to identify questions that can be answered using meta-analysis, retrieve both published and unpublished studies, create a coding manual, use traditional and unique effect size indices, and write a meta-analytic review. An ongoing example illustrates meta-analytic 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. ÿ

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comprehensive assessment of existing research.

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introduction to meta analysis borenstein: Statistical Methods for Meta-Analysis Larry V. Hedges, Ingram Olkin, 2014-06-28 The main purpose of this book is to address the statistical issues for integrating independent studies. There exist a number of papers and books that discuss the mechanics of collecting, coding, and preparing data for a meta-analysis, and we do not deal with these. Because this book concerns methodology, the content necessarily is statistical, and at times mathematical. In order to make the material accessible to a wider audience, we have not provided proofs in the text. Where proofs are given, they are placed as commentary at the end of a chapter. These can be omitted at the discretion of the reader. Throughout the book we describe computational procedures whenever required. Many computations can be completed on a hand calculator, whereas some require the use of a standard statistical package such as SAS, SPSS, or BMD. Readers with experience using a statistical package or who conduct analyses such as multiple regression or analysis of variance should be able to carry out the analyses described with the aid of a statistical package.

introduction to meta analysis borenstein: Statistical Meta-Analysis with Applications Joachim Hartung, Guido Knapp, Bimal K. Sinha, 2011-09-20 An accessible introduction to performing meta-analysis across various areas of research The practice of meta-analysis allows researchers to obtain findings from various studies and compile them to verify and form one overall conclusion. *Statistical Meta-Analysis with Applications* presents the necessary statistical methodologies that allow readers to tackle the four main stages of meta-analysis: problem formulation, data collection, data evaluation, and data analysis and interpretation. Combining the authors' expertise on the topic with a wealth of up-to-date information, this book successfully introduces the essential statistical practices for making thorough and accurate discoveries across a wide array of diverse fields, such as business, public health, biostatistics, and environmental studies. Two main types of statistical analysis serve as the foundation of the methods and techniques: combining tests of effect size and combining estimates of effect size. Additional topics covered include: Meta-analysis regression procedures Multiple-endpoint and multiple-treatment studies The Bayesian approach to meta-analysis Publication bias Vote counting procedures Methods for combining individual tests and combining individual estimates Using meta-analysis to analyze binary and ordinal categorical data Numerous worked-out examples in each chapter provide the reader with a step-by-step understanding of the presented methods. All exercises can be computed using the R and SAS software packages, which are both available via the book's related Web site. Extensive references are also included, outlining additional sources for further study. Requiring only

a working knowledge of statistics, *Statistical Meta-Analysis with Applications* is a valuable supplement for courses in biostatistics, business, public health, and social research at the upper-undergraduate and graduate levels. It is also an excellent reference for applied statisticians working in industry, academia, and government.

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introduction to meta analysis borenstein: *Meta-Analysis with R* Guido Schwarzer, James R. Carpenter, Gerta Rücker, 2015-10-08 This book provides a comprehensive introduction to performing meta-analysis using the statistical software R. It is intended for quantitative researchers and students in the medical and social sciences who wish to learn how to perform meta-analysis with R. As such, the book introduces the key concepts and models used in meta-analysis. It also includes chapters on the following advanced topics: publication bias and small study effects; missing data; multivariate meta-analysis, network meta-analysis; and meta-analysis of diagnostic studies.

introduction to meta analysis borenstein: *Meta-Analysis* Mike W.-L. Cheung, 2015-05-06 Presents a novel approach to conducting meta-analysis using structural equation modeling.

Structural equation modeling (SEM) and meta-analysis are two powerful statistical methods in the educational, social, behavioral, and medical sciences. They are often treated as two unrelated topics in the literature. This book presents a unified framework on analyzing meta-analytic data within the SEM framework, and illustrates how to conduct meta-analysis using the metaSEM package in the R statistical environment. *Meta-Analysis: A Structural Equation Modeling Approach* begins by introducing the importance of SEM and meta-analysis in answering research questions. Key ideas in meta-analysis and SEM are briefly reviewed, and various meta-analytic models are then introduced and linked to the SEM framework. Fixed-, random-, and mixed-effects models in univariate and multivariate meta-analyses, three-level meta-analysis, and meta-analytic structural equation modeling, are introduced. Advanced topics, such as using restricted maximum likelihood estimation method and handling missing covariates, are also covered. Readers will learn a single framework to apply both meta-analysis and SEM. Examples in R and in Mplus are included. This book will be a valuable resource for statistical and academic researchers and graduate students carrying out meta-analyses, and will also be useful to researchers and statisticians using SEM in biostatistics. Basic knowledge of either SEM or meta-analysis will be helpful in understanding the materials in this book.

introduction to meta analysis borenstein: The Handbook of Research Synthesis and Meta-Analysis Harris Cooper, Larry V. Hedges, Jeffrey C. Valentine, 2019-06-14 Research synthesis is the practice of systematically distilling and integrating data from many studies in order to draw more reliable conclusions about a given research issue. When the first edition of *The Handbook of Research Synthesis and Meta-Analysis* was published in 1994, it quickly became the definitive reference for conducting meta-analyses in both the social and behavioral sciences. In the third edition, editors Harris Cooper, Larry Hedges, and Jeff Valentine present updated versions of classic chapters and add new sections that evaluate cutting-edge developments in the field. *The Handbook of Research Synthesis and Meta-Analysis* draws upon groundbreaking advances that have transformed research synthesis from a narrative craft into an important scientific process in its own right. The editors and leading scholars guide the reader through every stage of the research synthesis process—problem formulation, literature search and evaluation, statistical integration, and report preparation. The Handbook incorporates state-of-the-art techniques from all quantitative synthesis traditions and distills a vast literature to explain the most effective solutions to the problems of quantitative data integration. Among the statistical issues addressed are the synthesis of non-independent data sets, fixed and random effects methods, the performance of sensitivity analyses and model assessments, the development of machine-based abstract screening, the increased use of meta-regression and the problems of missing data. The Handbook also addresses the non-statistical aspects of research synthesis, including searching the literature and developing schemes for gathering information from study reports. Those engaged in research synthesis will find useful advice on how tables, graphs, and narration can foster communication of the results of research syntheses. The third edition of the Handbook provides comprehensive instruction in the skills necessary to conduct research syntheses and represents the premier text on research synthesis. Praise for the first edition: *The Handbook* is a comprehensive treatment of literature synthesis and provides practical advice for anyone deep in the throes of, just teetering on the brink of, or attempting to decipher a meta-analysis. Given the expanding application and importance of literature synthesis, understanding both its strengths and weaknesses is essential for its practitioners and consumers. This volume is a good beginning for those who wish to gain that understanding. —*Chance* Meta-analysis, as the statistical analysis of a large collection of results from individual studies is called, has now achieved a status of respectability in medicine. This respectability, when combined with the slight hint of mystique that sometimes surrounds meta-analysis, ensures that results of studies that use it are treated with the respect they deserve....*The Handbook of Research Synthesis* is one of the most important publications in this subject both as a definitive reference book and a practical manual.—*British Medical Journal* When the first edition of *The Handbook of Research Synthesis* was published in 1994, it quickly became

the definitive reference for researchers conducting meta-analyses of existing research in both the social and biological sciences. In this fully revised second edition, editors Harris Cooper, Larry Hedges, and Jeff Valentine present updated versions of the Handbook's classic chapters, as well as entirely new sections reporting on the most recent, cutting-edge developments in the field. Research synthesis is the practice of systematically distilling and integrating data from a variety of sources in order to draw more reliable conclusions about a given question or topic. The Handbook of Research Synthesis and Meta-Analysis draws upon years of groundbreaking advances that have transformed research synthesis from a narrative craft into an important scientific process in its own right. Cooper, Hedges, and Valentine have assembled leading authorities in the field to guide the reader through every stage of the research synthesis process—problem formulation, literature search and evaluation, statistical integration, and report preparation. The Handbook of Research Synthesis and Meta-Analysis incorporates state-of-the-art techniques from all quantitative synthesis traditions. Distilling a vast technical literature and many informal sources, the Handbook provides a portfolio of the most effective solutions to the problems of quantitative data integration. Among the statistical issues addressed by the authors are the synthesis of non-independent data sets, fixed and random effects methods, the performance of sensitivity analyses and model assessments, and the problem of missing data. The Handbook of Research Synthesis and Meta-Analysis also provides a rich treatment of the non-statistical aspects of research synthesis. Topics include searching the literature, and developing schemes for gathering information from study reports. Those engaged in research synthesis will also find useful advice on how tables, graphs, and narration can be used to provide the most meaningful communication of the results of research synthesis. In addition, the editors address the potentials and limitations of research synthesis, and its future directions. The past decade has been a period of enormous growth in the field of research synthesis. The second edition Handbook thoroughly revises original chapters to assure that the volume remains the most authoritative source of information for researchers undertaking meta-analysis today. In response to the increasing use of research synthesis in the formation of public policy, the second edition includes a new chapter on both the strengths and limitations of research synthesis in policy debates

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introduction to meta analysis borenstein: *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.

introduction to meta analysis borenstein: 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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introduction to meta analysis borenstein: The Oxford Handbook of Personnel Assessment and Selection Neal Schmitt, 2013-12-15 Employee selection has long stood at the practical forefront of industrial/organizational psychology. Today's social, business, and economic climates require ongoing adaptations by those who select organizations' personnel, and research on the topic helps gauge the impact of these adaptations and their implications for human performance and potential. The Oxford Handbook of Personnel Assessment and Selection codifies the wealth of new research surrounding employee selection (web-based assessments, social networking, globalization of organizations), situating them alongside more traditional practices to establish the best and most relevant research for both professionals and academics. Comprising chapters from authors in both the private sector and academia, this volume is organized into seven parts: (1) historical and social context of the field of assessment and selection; (2) research strategies; (3) individual difference constructs that underlie effective performance; (4) measures of predictor constructs; (5) employee performance and outcome assessment; (6) societal and organizational constraints on selection practice; and (7) implementation and sustainability of selection systems. While providing a comprehensive review of current research and practice, the purpose of this handbook is to provide an up-to-date profile of each of the areas addressed and highlight current questions that deserve additional attention from researchers and practitioners. This compendium is essential reading for industrial/organizational psychologists and human resource managers.

introduction to meta analysis borenstein: Network Meta-Analysis for Decision-Making Sofia Dias, A. E. Ades, Nicky J. Welton, Jeroen P. Jansen, Alexander J. Sutton, 2018-03-19 A practical guide to network meta-analysis with examples and code In the evaluation of healthcare, rigorous methods of quantitative assessment are necessary to establish which interventions are effective and cost-effective. Often a single study will not provide the answers and it is desirable to synthesise evidence from multiple sources, usually randomised controlled trials. This book takes an approach to evidence synthesis that is specifically intended for decision making when there are two or more treatment alternatives being evaluated, and assumes that the purpose of every synthesis is to answer the question for this pre-identified population of patients, which treatment is 'best'? A comprehensive, coherent framework for network meta-analysis (mixed treatment comparisons) is adopted and estimated using Bayesian Markov Chain Monte Carlo methods implemented in the freely available software WinBUGS. Each chapter contains worked examples, exercises, solutions and code that may be adapted by readers to apply to their own analyses. This book can be used as an introduction to evidence synthesis and network meta-analysis, its key properties and policy implications. Examples and advanced methods are also presented for the more experienced reader.

Methods used throughout this book can be applied consistently: model critique and checking for evidence consistency are emphasised. Methods are based on technical support documents produced for NICE Decision Support Unit, which support the NICE Methods of Technology Appraisal. Code presented is also the basis for the code used by the ISPOR Task Force on Indirect Comparisons. Includes extensive carefully worked examples, with thorough explanations of how to set out data for use in WinBUGS and how to interpret the output. Network Meta-Analysis for Decision Making will be of interest to decision makers, medical statisticians, health economists, and anyone involved in Health Technology Assessment including the pharmaceutical industry.

introduction to meta analysis borenstein: *Meta-regression Analysis in Economics and Business* T. D. Stanley, Hristos Doucouliagos, 2012 Meta-Regression Analysis in Economics and Business is the first text devoted to the meta-regression analysis (MRA) of economics and business research.

introduction to meta analysis borenstein: Research Synthesis and Meta-Analysis Harris Cooper, 2010 Providing researchers with a practical and accessible advice, the Fourth Edition of the lauded Research Synthesis and Meta-Analysis offers thoroughly updated information. Author Harris M. Cooper draws on more than 30 years of experience to show readers how to conduct a comprehensive synthesis of past research.

introduction to meta analysis borenstein: Meta-Analysis John Edward Hunter, Frank L. Schmidt, Gregg B. Jackson, 1982-10 There are few areas of modern life that are burdened by as much information and advice, often contradictory, as our diet and health: eat a lot of meat, eat no meat; whole-grains 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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projects requiring simulations in R intended to reinforce material Summaries of major results and general points of discussion at the end of each chapter Open problems in mixed modeling methodology, which can be used as the basis for research or PhD dissertations Ideal for graduate-level courses in mixed statistical modeling, the book is also an excellent reference for professionals in a range of fields, including cancer research, computer science, and engineering.

introduction to meta analysis borenstein: *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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introduction to meta analysis borenstein: Design and Analysis of Ecological Experiments Samuel M. Scheiner, Jessica Gurevitch, 2001-04-26 Ecological research and the way that ecologists use statistics continues to change rapidly. This second edition of the best-selling *Design and Analysis of Ecological Experiments* leads these trends with an update of this now-standard reference book, with a discussion of the latest developments in experimental ecology and statistical practice. The goal of this volume is to encourage the correct use of some of the more well known statistical techniques and to make some of the less well known but potentially very useful techniques available. Chapters from the first edition have been substantially revised and new chapters have been added. Readers are introduced to statistical techniques that may be unfamiliar to many ecologists, including power analysis, logistic regression, randomization tests and empirical Bayesian analysis. In addition, a strong foundation is laid in more established statistical techniques in ecology including exploratory data analysis, spatial statistics, path analysis and meta-analysis. Each technique is presented in the context of resolving an ecological issue. Anyone from graduate students to established research ecologists will find a great deal of new practical and useful information in this current edition.

introduction to meta analysis borenstein: Evidence Synthesis and Meta-analysis for Drug Safety Council for International Organizations of Medical Sciences (CIOMS), Council for International Organizations of Medical Sciences. Working Group X, 2016 At any point in the drug development process, systematic reviews and meta-analysis can provide important information to guide the future path of the development program and any actions that might be needed in the post-marketing setting. This report gives the rationale for why and when a meta-analysis should be considered, all in the context of regulatory decision-making, and the tasks, data collection, and analyses that need to be carried out to inform those decisions. There is increasing demand by decision-makers in health care, the bio-pharmaceutical industry, and society at large to have access to the best available evidence on benefits and risks of medicinal products. The best strategy will take an overview of all the evidence and where it is possible and sensible, combine the evidence and summarize the results. For efficacy, the outcomes generally use the same or very similar predefined events for each of the trials to be included. Most regulatory guidance and many Cochrane Collaboration reviews have usually given more attention to assessment of benefits, while issues around combining evidence on harms have not been as well-covered. However, the (inevitably) unplanned nature of the data on safety makes the process more difficult. Combining evidence on adverse events (AEs), where these were not the focus of the original studies, is more challenging than combining evidence on pre-specified benefits. This focus on AEs represents the main contribution of the current CIOMS X report. The goal of the CIOMS X report is to provide principles on appropriate application of meta-analysis in assessing safety of pharmaceutical products to inform regulatory decision-making. This report is about meta-analysis in this narrow area, but the present report should also provide conceptually helpful points to consider for a wider range of applications, such as vaccines, medical devices, veterinary medicines or even products that are combinations of

medicinal products and medical devices. Although some of the content of this report describes highly technical statistical concepts and methods (in particular Chapter 4), the ambition of the working group has been to make it comprehensible to non-statisticians for its use in clinical epidemiology and regulatory science. To that end, Chapters 3 and 4, which contain the main technical statistical aspects of the appropriate design, analysis and reporting of a meta-analysis of safety data are followed by Chapter 5 with a thought process for evaluating the findings of a meta-analysis and how to communicate these.

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Ding-Geng (Din) Chen, Karl E. Peace, 2021-03-31 Review of the First Edition: The authors strive to reduce theory to a minimum, which makes it a self-learning text that is comprehensible for biologists, physicians, etc. who lack an advanced mathematics background. Unlike in many other textbooks, R is not introduced with meaningless toy examples; instead the reader is taken by the hand and shown around some analyses, graphics, and simulations directly relating to meta-analysis... A useful hands-on guide for practitioners who want to familiarize themselves with the fundamentals of meta-analysis and get started without having to plough through theorems and proofs. —Journal of Applied Statistics Statistical Meta-Analysis with R and Stata, Second Edition provides a thorough presentation of statistical meta-analyses (MA) with step-by-step implementations using R/Stata. The authors develop analysis step by step using appropriate R/Stata functions, which enables readers to gain an understanding of meta-analysis methods and R/Stata implementation so that they can use these two popular software packages to analyze their own meta-data. Each chapter gives examples of real studies compiled from the literature. After presenting the data and necessary background for understanding the applications, various methods for analyzing meta-data are introduced. The authors then develop analysis code using the appropriate R/Stata packages and functions. What's New in the Second Edition: Adds Stata programs along with the R programs for meta-analysis Updates all the statistical meta-analyses with R/Stata programs Covers fixed-effects and random-effects MA, meta-regression, MA with rare-event, and MA-IPD vs MA-SS Adds five new chapters on multivariate MA, publication bias, missing data in MA, MA in evaluating diagnostic accuracy, and network MA Suitable as a graduate-level text for a meta-data analysis course, the book is also a valuable reference for practitioners and biostatisticians (even those with little or no experience in using R or Stata) in public health, medical research, governmental agencies, and the pharmaceutical industry.

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Harris Cooper, Larry V. Hedges, 1993-11-23 "The Handbook is a comprehensive treatment of literature synthesis and provides practical advice for anyone deep in the throes of, just teetering on the brink of, or attempting to decipher a meta-analysis. Given the expanding application and importance of literature synthesis, understanding both its strengths and weaknesses is essential for its practitioners and consumers. This volume is a good beginning for those who wish to gain that understanding." —Chance "Meta-analysis, as the statistical analysis of a large collection of results from individual studies is called, has now achieved a status of respectability in medicine. This respectability, when combined with the slight hint of mystique that sometimes surrounds meta-analysis, ensures that results of studies that use it are treated with the respect they deserve....The Handbook of Research Synthesis is one of the most important publications in this subject both as a definitive reference book and a practical manual."—British Medical Journal The Handbook of Research Synthesis is the definitive reference and how-to manual for behavioral and medical scientists applying the craft of research synthesis. It draws upon twenty years of ground-breaking advances that have transformed the practice of synthesizing research literature from an art into a scientific process in its own right. Editors Harris Cooper and Larry V. Hedges have brought together leading authorities to guide the reader through every stage of the research synthesis process—problem formulation, literature search and evaluation, statistical integration, and report preparation. The Handbook of Research Synthesis incorporates in a single volume state-of-the-art techniques from all quantitative synthesis traditions, including Bayesian inference

and the meta-analytic approaches. Distilling a vast technical literature and many informal sources, the Handbook provides a portfolio of the most effective solutions to problems of quantitative data integration. The Handbook of Research Synthesis also provides a rich treatment of the non-statistical aspects of research synthesis. Topics include searching the literature, managing reference databases and registries, and developing coding schemes. Those engaged in research synthesis will also find useful advice on how tables, graphs, and narration can be deployed to provide the most meaningful communication of the results of research synthesis. The Handbook of Research Synthesis is an illuminating compilation of practical instruction, theory, and problem solving. It provides an accumulation of knowledge about the craft of reviewing a scientific literature that can be found in no other single source. The Handbook offers the reader thorough instruction in the skills necessary to conduct powerful research syntheses meeting the highest standards of objectivity, systematicity, and rigor demanded of scientific enquiry. This definitive work will represent the state of the art in research synthesis for years to come.

introduction to meta analysis borenstein: Ecological Statistics Gordon A. Fox, Simoneta Negrete-Yankelevich, Vinicio J. Sosa, 2015 The application and interpretation of statistics are central to ecological study and practice. Ecologists are now asking more sophisticated questions than in the past. These new questions, together with the continued growth of computing power and the availability of new software, have created a new generation of statistical techniques. These have resulted in major recent developments in both our understanding and practice of ecological statistics. This novel book synthesizes a number of these changes, addressing key approaches and issues that tend to be overlooked in other books such as missing/censored data, correlation structure of data, heterogeneous data, and complex causal relationships. These issues characterize a large proportion of ecological data, but most ecologists' training in traditional statistics simply does not provide them with adequate preparation to handle the associated challenges. Uniquely, Ecological Statistics highlights the underlying links among many statistical approaches that attempt to tackle these issues. In particular, it gives readers an introduction to approaches to inference, likelihoods, generalized linear (mixed) models, spatially or phylogenetically-structured data, and data synthesis, with a strong emphasis on conceptual understanding and subsequent application to data analysis. Written by a team of practicing ecologists, mathematical explanations have been kept to the minimum necessary. This user-friendly textbook will be suitable for graduate students, researchers, and practitioners in the fields of ecology, evolution, environmental studies, and computational biology who are interested in updating their statistical tool kits. A companion web site provides example data sets and commented code in the R language.

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