

Home

Contents

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Records

[Title Page\(s\)](#) [Key Passage\(s\)](#) [Context](#)

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[Pettiti DB \(1994\)](#). Meta-analysis, decision analysis, and cost-effectiveness analysis: Methods for quantitative synthesis in medicine. New York: Oxford University Press.

[Title pages](#)

Meta-Analysis Decision Analysis and Cost-Effectiveness Analysis

Methods for Quantitative
Synthesis in Medicine

DIANA B. PETITTI

Key passages

Meta-analysis, decision analysis, and cost-effectiveness analysis are conceptually related quantitative methods for combining information to arrive at a summary conclusion. Development of each of the three methods grew out of the need to resolve uncertainty: for meta-analysis, uncertainty about the medical literature; for decision analysis, uncertainty about management of clinical problems; and for cost-effectiveness analysis, uncertainty about how best to allocate resources. All play a large and increasingly important role in formulation of policy recommendations in medicine. Their use in summarizing information from the burgeoning,

often contradictory literature of medicine has become widespread.

I decided to write a book describing how to do these three kinds of research in the winter of 1990. At that time, I was working with a number of students and fellows who wanted experience doing research but who had no time to carry out meaningful studies that involved collecting data from human subjects. I had previously identified several important questions that I thought might be addressed with meta-analysis, decision analysis, or cost-effectiveness analysis, and I recruited students to work on these projects with me over the spring and summer.

I soon discovered that the seductive simplicity of the results of published studies that used the three methods belied enormous complexity in their proper conduct. It became apparent in working with students that successful use of any of the methods required a great deal of knowledge about research study design, practical skills in data collection, a firm understanding of statistics, and an ability to critically evaluate and recognize the limitations inherent in each method. Much to my dismay, no generalized discussion of any of the three methods written at a level appropriate for students or fellows was available. What had been written tended to focus on the quantitative aspects of each method to the exclusion of discussion of the practical aspects of information retrieval and interpretation.

More important, there had never been an attempt to unify the three topics, although their conceptual similarity as methods that "synthesize" information quantitatively seems obvious. The three methods are considered together in this book in the belief that a scientist interested in one is also likely to be eventually interested in all three. In addition, meta-analysis can often enhance estimation of probabilities in a decision analysis, and constructing a decision tree is the first step in a cost-effectiveness analysis.

This book describes how to design, conduct, analyze, and interpret these three types of synthetic studies. The book describes in detail how to collect the data necessary to do the studies. Basic statistical methods for meta-analysis and quantitative methods necessary to do decision analysis are presented. Information on how to measure cost is provided. The book includes many published examples of analyses using the three techniques as well as some unpublished data. Examples of analyses that yield incorrect or problematic conclusions are also given, as there is often more to be learned from failure than from success. The limitations of the methods are described fully, and, I hope, honestly.

The book tries to present sufficient detail on the practical aspects of the application of the methods so that a novice could do a simple analysis knowing nothing more than what is in the book. The book attempts not to repeat advanced material on decision analysis that is covered well in textbooks by Weinstein and Fineberg (*Clinical Decision Analysis*) and Sox et al. (*Medical Decision Making*). Cost-effectiveness analysis is covered at a level suitable for many physicians, but it will not be useful to economists or experts in cost-effectiveness analysis.

The reader who has taken an introductory course in both epidemiology and biostatistics should be prepared to read the basic text. Some of the material on statistical analysis of meta-analytic data may require more advanced preparation. Even the reader with little direct experience in carrying out studies using these methods will profit from reading the discussion of the limitations of the methods. In addition, policymakers without direct research experience will learn how better to utilize data from the three types of studies.

In a perfect world, every important topic in medicine would be studied using a randomized clinical trial; a single definitive study would always be available; when interventions were known to work, they would be available to everyone. The reality of the scientific and fiscal world in which we live is far from this ideal. It is not possible to study all medical treatments in experiments. Single studies are almost never definitive. We cannot afford to pay for everything that might be done for patients. Given these realities, the need for synthesis of information to evaluate

effectiveness and to evaluate costs is irrefutable. My hope is that this book will help foster rational decision making in medicine based on systematic use of the information we already have.

San Francisco
May 1993

D.B.P.

Contents

- 1 Introduction, 3**
 - 1.1 Three Illustrative Problems, 4
 - 1.2 Definitions, 4
 - 1.3 Historical Perspective, 6
 - 1.4 Linkages of the Three Methods, 9
 - 1.5 Organization of the Book, 13
- 2 Overview of the Methods, 15**
 - 2.1 Meta-Analysis, 15
 - 2.2 Decision Analysis, 20
 - 2.3 Cost-Effectiveness Analysis, 31
- 3 Planning the Study, 35**
 - 3.1 Defining the Problem, 35
 - 3.2 Developing a Study Protocol, 36
 - 3.3 Acquiring Resources, 40
 - 3.4 Procuring Administrative Approvals, 40
- 4 Information Retrieval, 43**
 - 4.1 Overall Strategy for Retrieving Information on Published Studies, 43
 - 4.2 Computerized Searches of MEDLINE, 45
 - 4.3 Other Computer-Stored Databases, 49
 - 4.4 Limitations of Computerized Searches of Computer-Stored Databases, 50
 - 4.5 Publication Bias, 55

- 5 Data Collection, 63
 - 5.1 Overall Goals, 63
 - 5.2 Reliability, 64
 - 5.3 Validity, 67
 - 5.4 Bias, 68

- 6 Advanced Issues in Meta-Analysis, 70
 - 6.1 Defining Eligibility Criteria and Determining Eligibility of Individual Studies, 71
 - 6.2 Study Design, 74
 - 6.3 Inclusive Dates of Publication, 75
 - 6.4 English-Language Publications, 76
 - 6.5 Multiple Publications from the Same Study Population, 77
 - 6.6 Restrictions on Sample Size or Length of Follow-Up, 77
 - 6.7 Eligibility Based on Similarity of Treatments (or Exposures) or Outcomes, 79
 - 6.8 Completeness of Information, 80
 - 6.9 Choosing Estimates of Effect Within Eligible Studies, 82
 - 6.10 Incorporating Information on Study Quality, 84

- 7 Statistical Methods in Meta-Analysis, 90
 - 7.1 Model Choice, 91
 - 7.2 Choice of Effect Measure, 96
 - 7.3 Mantel-Haenszel Method, 96
 - 7.4 Peto Method, 100
 - 7.5 General Variance-Based Methods, 102
 - 7.6 General Variance-Based Methods That Use Confidence Intervals, 106
 - 7.7 Statistical Tests of Homogeneity, 110
 - 7.8 DerSimonian and Laird Method, 111

- 8 Other Statistical Issues in Meta-Analysis, 115
 - 8.1 Measures on a Continuous Scale, 115
 - 8.2 Estimating Trend, 123
 - 8.3 Modeling in Meta-Analysis, 125
 - 8.4 Vote Counting and Related Methods, 126
 - 8.5 Statistical Approaches to Publication Bias, 129

- 9 Complex Decision Problems, 131
 - 9.1 More Than One Outcome, 132
 - 9.2 More Than Two Alternative Treatments or Interventions, 135
 - 9.3 Many Intervening Events, 138
 - 9.4 Estimating Life Expectancy, 138
 - 9.5 Markov Models, 142

- 10 Estimating Probabilities, 148
 - 10.1 Overall Goals, 148

- 10.2 Relying on Selected Published Sources of Information on Probabilities, 150
- 10.3 Aggregating Information from Multiple Published Sources, 152
- 10.4 Expert Panels as Sources of Probability Estimates, 153
- 10.5 Personal Experience and “Guessing” to Estimate Probabilities, 153
- 10.6 Accounting for Uncertainty in Probability Estimates, 154
- 11 Utility Analysis, 157**
 - 11.1 The Concept of Utility, 157
 - 11.2 Conceptual Issues in the Measurement of Preferences for Health States, 158
 - 11.3 Developing Measurement Scales in Practice, 161
 - 11.4 Incorporating Measures of Preference for Health States into Decision Analysis, 166
 - 11.5 Limitations of Measures of Preferences for Health States, 168
- 12 Advanced Cost-Effectiveness Analysis, 169**
 - 12.1 Key Concepts, 169
 - 12.2 Costs, 172
 - 12.3 Estimating Costs, 175
 - 12.4 Discounting Costs, 178
 - 12.5 Inflation, 182
 - 12.6 Discounting Benefits, 184
 - 12.7 Time Horizon, 186
- 13 Sensitivity Analysis, 187**
 - 13.1 Goals of Sensitivity Analysis, 187
 - 13.2 One-Way Sensitivity Analysis in Decision Analysis and Cost-Effectiveness Analysis, 188
 - 13.3 Two-Way, Three-Way, and n -Way Sensitivity Analysis, 190
 - 13.4 Application of the Principles of Sensitivity Analysis to Meta-Analysis, 194
- 14 Reporting Results, 197**
 - 14.1 Meta-Analysis, 197
 - 14.2 Decision Analysis, 199
 - 14.3 Cost-Effectiveness Analysis, 200
 - 14.4 Graphical Presentation of the Results of Meta-Analysis, 200
 - 14.5 Graphical Presentation of the Results of Decision Analysis and Cost-Effectiveness Analysis, 209
- 15 Limitations, 212**
 - 15.1 Meta-Analysis, 213
 - 15.2 Decision Analysis, 219
 - 15.3 Cost-Effectiveness Analysis, 220
 - 15.4 Problems with Life Expectancy as an Outcome Measure, 224
 - 15.5 Values and Ethics and the Quality-Adjusted Life Year, 226
 - 15.6 Situations Where the Methods Are Most and Least Useful, 228

References, 229

Subject Index, 239

Index of Examples, 245

