Meta-analysis in Medical Research

The handbook for the understanding and practice of meta-analysis

Gioacchino Leandro

Gastroenterologist, Biostatistician Castellana Grotte, Italy

FOREWORD BY

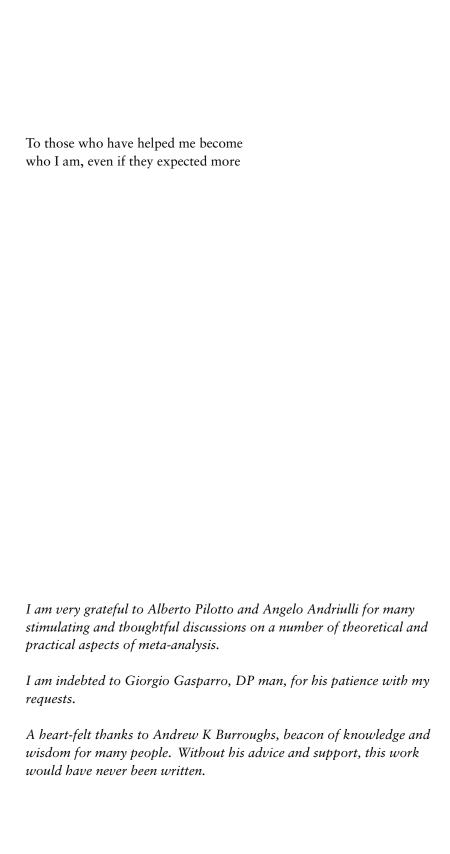
Giuseppe Gallus

Head of the Institute of Medical Statistics University of Milan, Italy



Meta-analysis in Medical Research

The handbook for the understanding and practice of meta-analysis



Meta-analysis in Medical Research

The handbook for the understanding and practice of meta-analysis

Gioacchino Leandro

Gastroenterologist, Biostatistician Castellana Grotte, Italy

FOREWORD BY

Giuseppe Gallus

Head of the Institute of Medical Statistics University of Milan, Italy



© 2005 Gioacchino Leandro

Published by Blackwell Publishing Ltd.

BMJ Books is an imprint of the BMJ Publishing Group Limited, used under licence

Blackwell Publishing, Inc., 350 Main Street, Malden, Massachusetts 02148-5020, USA Blackwell Publishing Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK Blackwell Publishing Asia Pty Ltd, 550 Swanston Street, Carlton, Victoria 3053, Australia

The right of the Author to be identified as the Author of this Work has been asserted in accordance with the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by the UK Copyright, Designs and Patents Act 1988, without the prior permission of the publisher.

First published 2005

Library of Congress Cataloging-in-Publication Data

Leandro, Gioacchino.

Meta-analysis in medical research: the handbook for the understanding and practice of meta-analysis / Gioacchino Leandro.

p. ; cm

Includes bibliographical references and index.

ISBN 1-4051-2733-3 (alk. paper)

1. Meta-analysis. 2. Medicine-Research-Evaluation.

[DNLM: 1. Biomedical Research-methods. 2. Meta-analysis. 3. Bias (Epidemiology)

4. Publication Bias. WA 950 L437m 2004] I. Title.

R853.M48L43 2004 610'.72–dc22

2004017776

ISBN 1-4051-2733-3

A catalogue record for this title is available from the British Library

Set in 10/13.5 Sabon by TechBooks, India

Printed and bound in India by Replika Press Pvt. Ltd.

Commissioning Editor: Alison Brown Editorial Assistant: Claire Bonnett Development Editor: Fiona Pattison Production Controller: Kate Charman

For further information on Blackwell Publishing, visit our website:

http://www.blackwellpublishing.com

The publisher's policy is to use permanent paper from mills that operate a sustainable forestry policy, and which has been manufactured from pulp processed using acid-free and elementary chlorine-free practices. Furthermore, the publisher ensures that the text paper and cover board used have met acceptable environment accrediation standards.

Contents

Foreword	ix
Preface	xi
Introduction	1
A brief history	4
Aims	5
How to Plan a Meta-Analysis	7
Defining the outcomes	8
Choosing the characteristics of the trials that one	
wants to select	8
The 'grey literature'	9
Finding and evaluating the articles	10
Statistical procedures	13
Interpretation of results	14
Bias in Meta-Analytical Research	15
Sampling bias	16
Selection bias	18
Within study bias	19
Other biases	19
Appendix	20
Statistical Procedures	23
Fixed effects models	24
Random effects models	29

viii Contents

Working Procedures	33
Accuracy of the data	34
Evaluation of the numeric output for each trial	35
Evaluation of the pooled effect	38
Additional considerations on heterogeneity	39
Quantifying heterogeneity: the I ² index	42
Tests for publication bias	42
Number needed to treat (NNT)	43
Graphical representation	44
How to Read, Evaluate and Present a Meta-Analysis	57
How to read and evaluate a meta-analysis	58
How to present a meta-analysis	59
Examples	61
How to Use the Program	63
General information	64
Installation of the program	64
Structure of the program	65
Use of the program	69
Getting started	70
References	87
Glossary	89
Index	93

Foreword

In their current medical practice, physicians need to be updated with the results of the most important clinical studies. In addition, they are often asked to be part of trials and to evaluate the results of new diagnostic tools and experimental data. A good knowledge of principles and the methodology of statistics is therefore mandatory for all physicians.

Although there has been an increasing interest in evidence-based practice of medicine in the past few years, the data interpretation is still performed badly and statistics are often misused. Among the principal reasons for this is the lack of knowledge concerning the use of mathematical and statistical tools, and a consequent tendency to avoid them if possible. Thus, those physicians who are more familiar with this type of statistics, and who know what is required in good medical practice and how to communicate with their colleagues, are of great help.

This guide to meta-analysis, together with the included statistical software, is the work of a clinician and it deals with the difficulties mentioned above.

The reader is introduced to the principal aspects of meta-analysis using a simple terminology, which does not imply a superficial approach. The most common errors encountered in the practical application of statistical procedures are discussed. The program is designed for easy use, which will help clinicians to utilize meta-analysis. The handbook contains a short section dedicated to the statistical procedures applied. A basic knowledge of statistical methods is an essential starting point, but this manual can also be of great interest and provide useful information for those who have greater experience and are consolidating their statistical knowledge. It is therefore logical that the author's choice has been to concentrate on practical guidelines rather than describing statistical methods.