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Introduction

1.1 At Whom is This Book Aimed?

There are countless people working in areas related to health who are, or could be, involved in research. This certainly includes doctors, dentists, nurses, pharmacists, physiotherapists, midwives, and health visitors, but there are many other groups where this is equally true. The types of useful research they could be carrying out range from simple descriptions of the frequency of a particular condition in a specific location or describing local adherence to a health guideline through to more complex work involving comparisons between groups of patients, organizations, or geographical locales, etc. Based on our experience, one hurdle to involvement in carrying out this type of research is a lack of confidence in using statistics. This book is aimed at that group of health workers who are interested in building the evidence base to underpin excellent practice in their area, but who are struggling to design good quality analyses that stand up to scrutiny. It focuses on what you need to know to use statistics correctly to improve the robustness of your project without all of the theory and complex mathematics. It is not intended for anybody who already has significant research experience or for those who aim to become expert statisticians.

Our assumption is that any project our would-be researcher undertakes will be fairly simple. We use the word "simple" advisedly. We do not use it to imply triviality or that such work is necessarily easy. By "simple," we mean the opposite of complex. It can be very tempting to investigate simultaneously six different factors that

A Practical Approach to Using Statistics in Health Research: From Planning to Reporting, First Edition. Adam Mackridge and Philip Rowe.

Companion website: www.wiley.com/go/Mackridge/APracticalApproachtoUsingStatisticsinHealthResearch

might influence a particular clinical outcome or indeed to look at numerous outcomes for a given factor. Such complexity all too often leads to a tangled mass of data that defies clear interpretation. In order to produce clear and robust evidence, it is important to keep it simple and look at questions such as, whether people living in the more deprived part of your local town suffer increased levels of a particular condition, or whether patients counseled by nurses have a better understanding of their medication than those counseled by doctors. By keeping your design simple, as in these latter cases, any positive finding will be easily and unambiguously interpretable and much more likely to help develop best practice. Our motto is "Keep it simple – keep it clear." In line with this philosophy, the statistical methods covered in this book are deliberately limited to those that consider the possibility that a single factor might have some influence upon a single clinical outcome.

1.2 At What Scale of Project is This Book Aimed?

The type of research project for which we envisage this book being useful is quite small: typically involving one or two researchers or something handled by a small team, with you, the reader, as the leader or a prominent member of the project team. Large, complex studies that involve significant funding (e.g. those funded by the UK's National Institute for Health Research) would almost certainly require the services of a specialist statistician, at which point this book becomes more of a guide to help you understand the techniques that may be used and the reasons for this, but it would be unlikely to cover all the statistical aspects of your project.

1.3 Why Might This Book be Useful for You?

The intention is to provide a handbook – something you can pick up, read the bit you need, and put down. You do not need to read it from cover to cover. It provides "how to" advice that covers the complete journey through a research project. How to:

- Work out how much data you need to collect in order to provide a reliable answer to the question you have asked (sample size).

- Identify an appropriate measure of effect size, and use that to determine whether any difference you have detected is large enough to be of practical significance (i.e. is a change in public policy or professional practice required?)
- Identify appropriate statistical methods.
- Apply the relevant statistical methods to your data using statistical software, mainly using SPSS.
- Identify which bits of the software output you need to focus on and how to interpret them.
- Determine whether your data indicates statistical significance (i.e. is there adequate evidence that outcomes really do differ between the groups studied?)
- Determine whether your data indicates practical/clinical significance (i.e. is any difference between study groups big enough to be of practical consequence?)
- Make sure any publications you write contain all the necessary statistical details.

This book is intended to help you **use** statistics in practice-focused research and will not attempt to provide a full theoretical background to statistical methods. For that, you can turn to our sister publication (Rowe, 2015).[1]

1.4 How to Use This Book

Table 1.1 shows the ideal flow of events from first planning stages through to final analysis and reporting of your experimental data. It may not always be possible to adhere to every detail, but this describes an ideal approach, at which to aim.

Everybody should read the first six chapters of this book.
You can than select the appropriate chapter from the remainder of the book, which will talk you through sample size planning, execution of the statistical test, and interpretation and reporting of the results.

Chapter 20 describes Cronbach's alpha. This is not a statistical test as such but is covered in a short chapter due to its widespread use in questionnaire-based research.

[1] Rowe P. Essential statistics for the pharmaceutical sciences, 2nd edn. Chichester: Wiley, 2015.

Table 1.1 The ideal stage-by-stage flow of events for a research program.

Stage	Actions	Chapters to read
1	Identify the research question that is to be answered.	
2	Make an outline plan of an experiment/trial/ survey that will answer the question.	
3	Decide which statistical test you will use.	2, 3, and 4
4	Determine the smallest effect size you want to be able to detect.	
5	Using the results from steps three and four, calculate appropriate sample sizes.	Relevant chapter from 7 to 20
6	Perform the survey/experiment etc.	
7	Describe the data obtained.	Chapter 3 and relevant
8	Carry out the test selected at step three, and draw your conclusions as to statistical and practical/ clinical significance.	chapter from 7 to 20
9	If other interesting features emerged within the results, analyze these, but report them as exploratory (or secondary) analyses and do not place undue reliance on any conclusions.	Relevant chapter from 7 to 20
10	Consider whether you have increased the risk of generating false positive findings by carrying out multiple statistical tests.	5
11	Report your findings.	Relevant chapter from 7 to 20

1.5 Computer Based Statistics Packages

This book and its accompanying videos concentrate mainly on SPSS, as this is probably the most widely used package in health research. If you do not have access to SPSS, the instructions should still be useful; all packages work in essentially similar ways. The choice of statistical routine, the information you have to supply to allow the method to run correctly, and the key pieces of output that you have to identify will not vary from package to package.

On our companion website, we have provided all of our data files in SPSS format, but in case you do not have access to this, we have also

provided the data in Microsoft Excel format. If you do not have access to this program either, you can download a free Excel Viewer program from Microsoft's website that will allow you to view the data sets.

Unfortunately, despite its considerable price, SPSS does not calculate necessary sample sizes. We therefore also refer to G*Power, which will do this job. G*Power is free software that can be downloaded from the internet – we would advise using the Heinrich-Heine-Universität Düsseldorf site.

1.6 Relevant Videos etc.

The practical execution of statistical routines using SPSS is covered in a collection of videos. Individual chapters indicate where you can view these.

The following video, relevant to this chapter, is available at www.wiley.com/go/Mackridge/APracticalApproachtoUsingStatisticsinHealthResearch

Video_1.1_SPSS_Basics: The absolute basics of using SPSS.