



# how to

## READ A PAPER

the basics of evidence-based medicine

FOURTH EDITION

— **isha Greenhalgh**

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# How to Read a Paper

The basics of  
evidence-based medicine

FOURTH EDITION

**Trisha Greenhalgh**

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## **Foreword to the First Edition by Professor Sir David Weatherall**

Not surprisingly, the wide publicity given to what is now called “evidence-based medicine” has been greeted with mixed reactions by those who are involved in the provision of patient care. The bulk of the medical profession appears to be slightly hurt by the concept, suggesting as it does that until recently all medical practice was what Lewis Thomas has described as a frivolous and irresponsible kind of human experimentation, based on nothing but trial and error, and usually resulting in precisely that sequence. On the other hand, politicians and those who administrate our health services have greeted the notion with enormous glee. They had suspected all along that doctors were totally uncritical and now they had it on paper. Evidence-based medicine came as a gift from the gods because, at least as they perceived it, its implied efficiency must inevitably result in cost saving.

The concept of controlled clinical trials and evidence-based medicine is not new however. It is recorded that Frederick II, Emperor of the Romans and King of Sicily and Jerusalem, who lived from 1192 to 1250 AD, and who was interested in the effects of exercise on digestion, took two knights and gave them identical meals. One was then sent out hunting and the other ordered to bed. At the end of several hours he killed both and examined the contents of their alimentary canals; digestion had proceeded further in the stomach of the sleeping knight. In the 17th century Jan Baptista van Helmont, a physician and philosopher, became sceptical of the practice of blood-letting. Hence he proposed what was almost certainly the first clinical trial involving large numbers, randomisation and statistical analysis. This involved taking 200 to 500 poor people, dividing them into two groups by casting lots, and protecting one from phlebotomy while allowing the other to be treated with as much blood-letting as his colleagues thought appropriate. The number of funerals in each group would be used to assess the efficacy of blood-letting. History does not record why this splendid experiment was never carried out.

If modern scientific medicine can be said to have had a beginning it was in Paris in the mid-19th century and where it had its roots in the work and teachings of Pierre Charles Alexandre Louis. Louis introduced statistical analysis to the evaluation of medical treatment and, incidentally, showed that blood-letting was a valueless form of treatment, though this did not change the habits of the physicians of the time, or for many years to come. Despite this pioneering work few clinicians on either side of the Atlantic urged that trials of clinical outcome should be adopted, although the principles of numerically-based experimental design were enunciated in the 1920s by the geneticist Ronald Fisher. The field only started to make a major impact on clinical practice after the Second World War following the seminal work of Sir Austin Bradford Hill and the British epidemiologists who followed him, notably Richard Doll and Archie Cochrane.

But although the idea of evidence-based medicine is not new, modern disciples like David Sackett and his colleagues are doing a great service to clinical practice, not just by popularising the idea but by bringing home to clinicians the notion that it is not a dry academic subject but more a way of thinking that should permeate every aspect of medical practice. While much of it is based on mega-trials and meta-analyses it should also be used to influence almost everything that a doctor does. After all, the medical profession has been brain-washed for years by examiners in medical schools and Royal Colleges to believe that there is only one way of examining a patient. Our bedside rituals could do with as much critical evaluation as our operations and drug regimes; the same goes for almost every aspect of doctoring.

As clinical practice becomes busier, and time for reading and reflection becomes even more precious, the ability effectively to peruse the medical literature and, in the future, to become familiar with a knowledge of best practice from modern communication systems, will be essential skills for doctors. In this lively book Trisha Greenhalgh provides an excellent approach to how to make best use of medical literature and the benefits of evidence-based medicine. It should have equal appeal for first year medical students and grey-haired consultants, and deserves to be read widely.

With increasing years the privilege of being invited to write a foreword to a book by one's ex-students becomes less of a rarity. Trisha Greenhalgh was the kind of medical student who never let her teachers get away with a loose thought and this inquiring attitude seems to have flowered over the years; this is a splendid and timely book and I wish it all the success it deserves. After all, the concept of evidence-based medicine is nothing more than the state of mind that every clinical teacher hopes to develop in their

students; Dr Greenhalgh's sceptical but constructive approach to medical literature suggests that such a happy outcome is possible at least once in the lifetime of a professor of medicine.

D. J. Weatherall  
Oxford, September 1996

## **Preface to the First Edition: do you need to read this book?**

This book is intended for anyone, whether medically qualified or not, who wishes to find their way into the medical literature, assess the scientific validity and practical relevance of the articles they find, and, where appropriate, put the results into practice. These skills constitute the basics of evidence-based medicine.

I hope this book will help you to read and interpret medical papers better. I hope, in addition, to convey a further message, which is this. Many of the descriptions given by cynics of what evidence-based medicine is (the glorification of things that can be measured without regard for the usefulness or accuracy of what is measured, the uncritical acceptance of published numerical data, the preparation of all-encompassing guidelines by self-appointed “experts” who are out of touch with real medicine, the debasement of clinical freedom through the imposition of rigid and dogmatic clinical protocols, and the over-reliance on simplistic, inappropriate, and often incorrect economic analyses) are actually criticisms of what the evidence-based medicine movement is fighting *against*, rather than of what it represents.

Do not, however, think of me as an evangelist for the gospel according to evidence-based medicine. I believe that the science of finding, evaluating and implementing the results of medical research can, and often does, make patient care more objective, more logical, and more cost-effective. If I didn't believe that, I wouldn't spend so much of my time teaching it and trying, as a general practitioner, to practise it. Nevertheless, I believe that when applied in a vacuum (that is, in the absence of common sense and without regard to the individual circumstances and priorities of the person being offered treatment or to the complex nature of clinical practice and policymaking), ‘evidence-based’ decision-making is a reductionist process with a real potential for harm.

Finally, you should note that I am neither an epidemiologist nor a statistician, but a person who reads papers and who has developed a pragmatic (and at times unconventional) system for testing their merits. If you wish

to pursue the epidemiological or statistical themes covered in this book, I would encourage you to move on to a more definitive text, references for which you will find at the end of each chapter.

Trisha Greenhalgh  
November 1996



## Preface to the Fourth Edition

When I wrote this book in 1996, evidence-based medicine was a bit of an unknown quantity. A handful of academics (including me) were already enthusiastic and had begun running ‘training the trainers’ courses to disseminate what we saw as a highly logical and systematic approach to clinical practice. Others – certainly the majority of clinicians – were convinced that this was a passing fad that was of limited importance and would never catch on. I wrote *How to Read a Paper* for two reasons. First, students on my own courses were asking for a simple introduction to the principles presented in what was then known as “Dave Sackett’s big red book” (Sackett DL, Haynes RB, Guyatt GH, Tugwell P. *Clinical Epidemiology – a basic science for clinical medicine*. London, Little, Brown & Co., 1991) – an outstanding and inspirational volume that was already in its fourth reprint, but which some novices apparently found a hard read. Second, it was clear to me that many of the critics of evidence-based medicine didn’t really understand what they were dismissing – and that until they did, serious debate on the political, ideological and pedagogical place of evidence-based medicine as a discipline could not begin.

I am of course delighted that *How to Read a Paper* has become a standard reader in many medical and nursing schools, and that it has so far been translated into French, German, Italian, Spanish, Portuguese, Chinese, Polish, Japanese, Czech and Russian. I am also delighted that what was so recently a fringe subject in academia has been well and truly mainstreamed in clinical service. In the UK, for example, it is now a contractual requirement for all doctors, nurses and pharmacists to practise (and for managers to manage) according to best research evidence.

In the 14 years since the first edition of this book was published, evidence-based medicine has waxed and waned in popularity. Some 700 textbooks and 25,000 journal articles now offer different angles on the ‘basics of EBM’ covered briefly in the chapters that follow. An increasing number of these sources point out genuine limitations of evidence-based medicine in certain contexts. Others look at evidence-based medicine as a social

movement – a ‘bandwagon’ that took off at a particular time (the 1990s) and place (north America) and spread dramatically quickly with all sorts of knock-on effects for particular interest groups.

When preparing this fourth edition, I was advised by my publisher not to change too much, since there is clearly still room on the bookshelves for a no-frills introductory text. Many of the chapters are essentially unchanged apart from adding illustrations and updating the reference lists. Some chapters – notably those on searching, qualitative research, systematic review, and implementing evidence-based practice – have been substantially revised because the fields have moved on significantly since the previous edition. I am particularly indebted to Jeanette Buckingham from the University of Alberta, Canada for writing the lion’s share of Chapter 2 on Searching the Literature. I first met Jeanette on one of the week-long Evidence Based Medicine Workshops in the late 1990s. A librarian by background, she has many years’ experience of teaching EBM to medical students and doctors, and she is one of the first people I go to when I’m foxed with a search query myself. I’ve also added two new chapters – on quality improvement and complex interventions. As ever, I would welcome any feedback that will help make the text more accurate, readable and practical.

Trisha Greenhalgh  
January 2010

## Acknowledgements

I am not by any standards an expert on all of the subjects covered in this book (in particular, I am very bad at sums), and I am grateful to the people listed below for help along the way. I am, however, the final author of every chapter, and responsibility for any inaccuracies is mine alone.

- 1 To Professor Sir Andy Haines and Professor Dave Sackett who introduced me to the subject of evidence-based medicine and encouraged me to write about it.
- 2 To the late Dr Anna Donald, who broadened my outlook through valuable discussions on the implications and uncertainties of this evolving discipline.
- 3 To Jeanette Buckingham of the University of Alberta, Canada, for invaluable input to Chapter 2.
- 4 To various expert advisers and proofreaders who had direct input to this new edition or who advised me on previous editions.
- 5 To the many readers, too numerous to mention individually, who took time to write in and point out both typographical and factual errors in previous editions. As a result of their contributions, I have learnt a great deal (especially about statistics) and the book has been improved in many ways. Some of the earliest critics of *How to Read a Paper* have subsequently worked with me on my teaching courses in evidence-based practice; several have co-authored other papers or book chapters with me, and one or two have become personal friends.
- 6 To various colleagues, named in the different chapters, who gave permission for me to reproduce figures and tables. Box 2 of chapter 11, reproduced from Tony Hope and colleagues' book *Medical Ethics and Law: The Core Curriculum*, is based on data provided by Dr A Briggs and Professor A Gray, Department of Public Health, University of Oxford.

Thanks also to my husband, Dr Fraser Macfarlane, for his unfailing support for my academic work and writing. My sons Rob and Al had not long been born when the first edition of this book was being written. It is a source of great pride to me that they have now read the book, applied its messages in their own developing scientific careers and made suggestions for how to improve it.

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# Chapter 1 **Why read papers at all?**

## **1.1 Does ‘evidence-based medicine’ simply mean ‘reading papers in medical journals’?**

Evidence-based medicine (EBM) is much more than just reading papers. According to the most widely quoted definition, it is ‘the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients.’<sup>1</sup> I find this definition useful up to a point but it misses out what for me is a very important aspect of the subject – the use of mathematics. Even if you know almost nothing about EBM you know it talks a lot about numbers and ratios. Anna Donald and I decided to be up front about this in our own teaching, and proposed this alternative definition:

*‘Evidence-based medicine is the use of mathematical estimates of the risk of benefit and harm, derived from high-quality research on population samples, to inform clinical decision-making in the diagnosis, investigation or management of individual patients.’*

The defining feature of EBM, then, is the use of figures derived from research on *populations* to inform decisions about *individuals*. This, of course, begs the question ‘What is research?’ – for which a reasonably accurate answer might be ‘Focused, systematic enquiry aimed at generating new knowledge’. In later chapters, I will explain how this definition can help you distinguish genuine research (which should inform your practice) from the poor-quality endeavours of well-meaning amateurs (which you should politely ignore).

If you follow an evidence-based approach to clinical decision-making, therefore, all sorts of issues relating to your patients (or, if you work in public health medicine, issues relating to groups of people) will prompt you to ask questions about scientific evidence, seek answers to those questions in a systematic way and alter your practice accordingly.

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