

MASTERPASS

RCGP AKT: Research, Epidemiology and Statistics

Julian Hick and Ralph Emmerson

Foreword by Professor Mike Pringle

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RCGP AKT: Research, Epidemiology and Statistics

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Foreword by Professor Mike Pringle

To be a generalist is to accept a profound challenge. Our patients look to us to be clinically expert in everything and anything; to treat them in the round as people with specific needs and expectations; to know when to ask for help and advice; to be their confidential adviser; and to behave ethically at all times.

The more a doctor specialises, the more they know about a narrow field. As general practitioners we need to know enough about every area of medicine and much of anthropology, psychology and the other social sciences. To deliver safe care we must be good diagnosticians and careful prescribers, while tolerating a level of uncertainty. And to continually improve we need to reflect on our care, learning as we go and continually striving to maintain our standards.

This is no small ask!

Although we work in teams, our consultations are often one-to-one, private interactions that need to be conducted with humanity and skill. This makes us vulnerable to hubris and short cuts; to falling into bad habits and even burn-out. A good new doctor needs to adopt techniques to guard against these risks.

One way to ensure that we embark on our general practice careers with the right attributes is through vocational training and the MRCP examination. It is only a start, a launch pad, but it is an essential demonstration that we have the knowledge, clinical and social skills, and attitudes, suitable for a career in primary care.

The MRCP has been meticulously designed to ensure that candidates are objectively assessed in these attributes for general practice. A key component of the MRCP is the Applied Knowledge Test (AKT) that is the focus of this book.

Passing the AKT is, of course, part of the rite of passage into general practice, but it should be seen more as a way for a doctor to demonstrate that they have acquired the knowledge, and other skills, to be a safe and effective general practitioner.

Throughout your career, you will be reading research papers and applying new evidence to your practice. You will be puzzling over the ethics of sharing clinical information with managers and researchers. You will be looking at

your clinical practice to see how it can be improved. For these tasks you need appropriate knowledge, the skills to apply it and the will to do so.

This book, written with verve and clarity, is therefore both a primer for the AKT and a guide to good practice. It will travel with you through your first decades in general practice as an aide-mémoire and a source of wisdom. It contains truths that will be your talismans and guides. I hope you enjoy it as much as I have.

Professor Mike Pringle
President
Royal College of General Practitioners
June 2014

About the authors

Dr Julian Hick

Julian came to medicine after spending several years working as an academic in the social sciences and humanities. He taught on several postgraduate and undergraduate courses but spent most time teaching research methods. During this time he also undertook research using both qualitative and quantitative methods, including research into gender, equality and socio-economic deprivation. He is now a general practitioner living and working in Derbyshire after completing the MRCGP in 2012. Additionally, he works in the Academic Unit of Primary Medical Care at the University of Sheffield. His academic interests include inequalities in health and healthcare, translating research into practice and, of course, teaching evidence-based medicine and statistics.

Dr Ralph Emmerson

Ralph is a Programme Director for the Chesterfield GP Training Programme and a full-time practising GP in Matlock, Derbyshire. He has held many educator roles over the years, from teaching undergraduates to experienced GPs. It was whilst Julian Hick was a trainee on the Chesterfield Training Programme, that a need for a better AKT statistics book was identified. Their collaboration has resulted in this book.

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JH acknowledges the support and suggestions he has received from his colleagues at the Academic Unit of Primary Medical Care at the University of Sheffield.

While others have helped and made suggestions, any errors remain ours alone.

List of abbreviations

ACE-I	ACE inhibitor
AKT	Applied Knowledge Test
AR	absolute risk
ARI	absolute risk increase
ARR	absolute risk reduction
BNF	<i>British National Formulary</i>
CER	control event rate
CKD	chronic kidney disease
COC	combined oral contraceptive
DALY	disability-adjusted life year
DENs	doctor's educational needs
DVT	deep vein thrombosis
EER	experimental event rate
FN	false negative
FP	false positive
GI	gastrointestinal
GP	general practitioner
HR	hazard ratio
LR	likelihood ratio
MCQ	multiple-choice question
MHRA	Medicines and Healthcare Products Regulatory Agency
MMR	measles, mumps and rubella vaccination
MRCGP	Membership of the Royal College of General Practitioners
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NIHR	National Institute for Health Research
NNH	number needed to harm
NNT	number needed to treat
NPV	negative predictive value
NSAID	non-steroidal anti-inflammatory drug
OR	odds ratio

PPV	positive predictive value
PSA	prostate-specific antigen
PUN	patient's unmet need
QALY	quality-adjusted life year
RCGP	Royal College of General Practitioners
RCT	randomised controlled trial
RR	relative risk
RRI	relative risk increase
RRR	relative risk reduction
SEM	standard error of the mean
TN	true negative
TP	true positive

Introduction

EVIDENCE-BASED MEDICINE AND EVIDENCE-BASED PRACTICE

Doctors have a lot of responsibilities to their patients: a responsibility to make sure that they treat each patient with appropriate care and attention; a responsibility to make sure that they apply the best knowledge to their clinical practice; a responsibility to make sure that they are competent in their actions; a responsibility to avoid conflicts of interest that could adversely affect their patients. With this background it can be seen that using the best available evidence of what works is vital to good medical care.

Undergraduate medical courses normally include some lectures, workshops and discussions of evidence-based medicine. Moving from this knowledge acquisition to being a practitioner of evidence-based medicine can be tough. During those years of trying to assimilate a huge amount of information on basic sciences and clinical practice, critical appraisal and evidence-based medicine may take a back seat. It is often easier to learn from your senior colleagues, lecturers and peers than it is to evaluate the evidence yourself. The assumption is that many of these people know more than you and have greater experience. However, if you can maintain your critical appraisal skills and evidence-based practice it is likely that the care you give your patients will be improved.

Evidence-based medicine, as a movement or paradigm, has been around for some decades now, but initially it didn't have a big impact on the way doctors and other healthcare professionals practised. The origins of evidence-based practice as we understand it today can be traced back to pioneers such as Archie Cochrane and his realisation that clinicians needed much better information about what worked and what did not when treating their patients.*

It was in 1991 that the term 'evidence-based medicine' was probably first used, when Gordon Guyatt at McMaster University published an editorial in

* See Cochrane A, *Effectiveness and Efficiency: random reflections on health services*. London: Nuffield Provincial Hospitals Trust; 1972.

the *ACP Journal Club* titled 'Evidence-Based Medicine'.^{*} He had earlier coined the term 'scientific medicine', but that had caused a furore and he had to change the term. His idea was that critical appraisal techniques should be used to improve the teaching of medical students and therefore also clinical care. Critical appraisal techniques were discussed in a series of articles in the *Canadian Medical Association Journal* in 1981, written by staff from McMaster University who had been teaching students based on patient problems, epidemiology and statistics. These were the building blocks on which Guyatt created evidence-based medicine teaching programmes at McMaster University in the 1990s.

Evidence-based medicine was formed against the backdrop of clinicians largely following the teaching of their seniors and respected experts or authorities, rather than any certain evidence. The costs of medical treatments were also increasing, as they continue to do, and using limited resources effectively was becoming more important. The pioneers of evidence-based medicine wanted to make sure that clinicians had access to good-quality evidence that could inform their clinical practice. Answering basic questions such as whether a treatment was more likely to harm or to help patients was seen to be necessary to improve clinical treatment and the cost-effectiveness of treatment.

When medicine is based on expert opinion it is very hard for junior clinicians to challenge their seniors. Where there is no evidence for treatments it falls to 'experts' to make decisions around which treatments to offer to patients. Evidence-based medicine aimed to turn this around so that decisions were based on evidence and therefore anyone could challenge accepted practice if he or she had good supporting evidence.

However, having good-quality evidence is only one part of evidence-based practice. It is also important that the preferences and needs of individual patients are taken into account when weighing up the evidence and deciding what treatment to undertake. This is why the term 'evidence-based practice' has become more commonplace, reflecting the fact that medicine is practised in alliance with patients and should not be something that is imposed on patients. As general practitioners (GPs) it is fundamental that we work in partnership with our patients in order to gain the most appropriate outcomes for them. We need to know the advantages and disadvantages of the treatments we offer to our patients so that we can share decision-making with them. This is, of course, in addition to our clinical experiences – we have to engage our clinical acumen as well as being aware of the best evidence.

Evidence-based medicine is not without its critics, and there are problems in translating critical appraisal to clinical practice. Some of these criticisms are considered in [Chapter 8](#). In brief, the limits of evidence-based medicine are

^{*} Guyatt GH. Evidence-based medicine. *ACP J Club*. 1991; 114: A–16.

felt where it is not possible to have good-quality evidence for particular patient groups, such as elderly people with several co-morbidities and who are already on a raft of medications. There is a paucity of research based on these patients due to the limitations of research methods such as randomised controlled trials and the difficulties in translating their outcomes to the individual patient in front of us. It takes a considerable amount of time (and money) to conduct a good randomised controlled trial and therefore the results may not be known for many months, or even years. Of even more importance is that the results of good trials are often not applied in clinical settings for many years. We still have some way to go before evidence-based medicine or evidence-based practice is able to deliver all the possible benefits that it could do.

Evidence-based medicine provides a firm foundation for our clinical practice and we need to engage with evidence in order to keep our practice up to date, safe and effective. It is to be hoped this book can help you to engage effectively with your patients based on evidence of what works.

ABOUT THIS BOOK

This book is primarily for GP trainees contemplating the Applied Knowledge Test (AKT). We hope that it will also be helpful to others who are interested in developing their knowledge and practice of evidence-based medicine. It is also about how to apply research findings to general practice. Everything in the book is directly related to the Royal College of General Practitioners (RCGP) curriculum. The curriculum is based on all the knowledge that a competent GP could be expected to have in order to practise safely and effectively.

The main aim of this book remains to help GP trainees pass the AKT, but as such it has some limitations. It does not aim to be a comprehensive introduction to evidence-based medicine or a guide for researchers. At times we have deliberately skimmed the surface, knowing we are avoiding particular debates or controversies, in order to keep the focus on the level of understanding that a candidate for the AKT needs to have.

You need to pass the AKT. It is one of the hurdles you need to get over before becoming fully qualified as a GP. The exam covers clinical medicine, administrative issues and, the part this book is concerned with, critical appraisal and evidence-based practice. The 10% of marks that are in the critical appraisal and evidence-based practice section could be the difference between failing and passing. This book aims to help you understand critical appraisal and evidence-based practice. Having this understanding should help you pick up marks on the AKT – the answers to the critical appraisal and evidence-based medicine questions are often relatively easy to work out if you have the right knowledge. There are many questions for you to practise, so that you can be sure you have

assimilated the appropriate knowledge. Preparing effectively for the AKT will increase your chances of passing. This book aims to cover the topics in the critical appraisal and evidence-based medicine section of the RCGP *The Applied Knowledge Test Content Guide*, which is available on the RCGP website (www.rcgp.org.uk) and is something that you should certainly read. This book is one part of your preparation process.

It is also our hope that this book will provide you with the tools for critical appraisal and evidence-based practice that will underpin your clinical practice after you have become a fully qualified GP. Evidence-based medicine is extremely important for making sure that our patients receive the best, most appropriate and least harmful treatments. Therefore, being able to understand and evaluate the medical literature is essential. This is normally taught at medical undergraduate level but it can be neglected once the pressures of learning clinical medicine and performing the daily tasks of a junior doctor become more important. We hope in this book that we show how critical appraisal and evidence-based medicine are essential for good medical practice throughout your career. We do recognise that there are limits to evidence-based medicine and these are discussed throughout the text (in particular, see [Chapter 8](#)).

[Chapter 1](#) is a brief introduction to the AKT, including how to prepare for the AKT. Much of this chapter applies to the whole AKT, not just the 10% on critical appraisal and evidence-based medicine. Questions are found throughout the subsequent chapters, including the final chapter entirely consisting of practice questions. The book will make sense to read from start to finish and you can do the practice questions as you go; the answers to most of the questions in each chapter are to be found in the text of that chapter. Alternatively, you could focus on the questions in the final chapter and if struggling to answer them correctly you can then turn back to the appropriate section of the book to revise that topic.

We cover a bit of background in [Chapter 2](#), an introduction to statistics – this chapter discusses probability and statistical significance in particular. Inferential and descriptive statistics are explained, along with the sometimes confusing ideas of the null hypothesis and p-values. There is also a brief discussion on the limits of statistics – some things cannot be understood adequately with statistical analysis, or with statistical analysis alone. We also need to be aware that data may not be as useful as they appear – we cover the ideas of reliability, validity and generalisability in this chapter.

Basic descriptive statistics, correlation, confidence intervals and graphical representations of data are discussed in [Chapter 3](#). This chapter also introduces the idea that there are different types of numerical data, all which need to be understood in order to see which statistical tests can be used to analyse data appropriately.

[Chapter 4](#) turns away from statistics and quantitative methods to discuss qualitative methods. These methods are very helpful in gaining a deeper understanding of individuals or groups of people in terms of their values and experiences. Often qualitative research is viewed as inferior to quantitative research; it actually aims to find out something different from, but often equally as important as, that which can be studied with quantitative methods. More powerfully qualitative and quantitative methods can be used together to gain deeper understanding of a research topic.

[Chapters 5](#) and [6](#) look at quantitative research methods and epidemiology, respectively. These two chapters introduce a lot of formulas and show relatively simple applications of these formulas so that you can get used to applying them. [Chapter 5](#) discusses common research methods and research outcomes, including the hierarchical pyramid of study designs. [Chapter 6](#) covers some of the useful tests that are used in epidemiological studies and also discusses measures of mortality and economic analyses.

In [Chapter 7](#) we turn to look at how to answer questions relevant to primary care and the practice of research in primary care. Research ethics are also considered in this chapter. In [Chapter 8](#), the final text chapter, we have a brief recap of how to succeed in the AKT and then we take a slightly more critical look at evidence-based medicine and consider how it, and medicine more generally, may change in the future. Finally, as already mentioned, [Chapter 9](#) consists entirely of practice questions.

PASSING THE APPLIED KNOWLEDGE TEST

Reading this book suggests that you want to pass the AKT and have therefore decided to improve your chances by preparing as best you can for the exam. As mentioned earlier, this book can only be one part of your work towards passing the AKT. [Chapter 1](#) gives a lot of pointers to how to prepare for the AKT. We would argue that you should gain much of the knowledge you need to pass your membership examinations through your training rotations, but it is important to be focused on what you need to know to practise as an independent GP throughout all your training.

Starting thinking about what you need as a GP and staying focused on general practice will help make sure that your training rotations prepare you for life after membership examinations. Remember that the work you put in to passing your AKT will also be relevant for the Clinical Skills Assessment, where knowing the evidence will help in scoring marks in the management of your cases. We wish you luck, both in the AKT and in your future career as an independent, knowledgeable, caring and thoughtful GP. Now, let us turn to look in more detail at the AKT exam and how to prepare for it.

The Applied Knowledge Test

The Applied Knowledge Test came into being in August 2007 as one of the three components of the Membership of the Royal College of General Practitioners (MRCGP) mandatory licensing examination. The other two components are the Clinical Skills Assessment and the Workplace Based Assessment. The AKT is a 200-item multiple-choice test that will take you 3 hours to complete, and here is the first statistic: that is *54 seconds* per question! That is the *mean* time you will need to spend on each question. This will increase to a mean of 57 seconds per question, when the AKT duration extends to three hours and ten minutes. Now we are on our way!

Of these 200 multiple-choice items, approximately 80% (160 items) are on clinical medicine; 10% (20 items) are on ethics, legal issues and organisational structure; and the final 10% (20 items) are on critical appraisal and evidence-based clinical practice. It is that final 10% we are interested in here, and we hope that reading this book will maximise your score in this section. Remember, every correct answer gives you 0.5%! Gaining the full 10% on these items will make a big difference to your score and could be the difference between passing and failing.

APPLIED KNOWLEDGE TEST QUESTION FORMATS

Why 200 *items* rather than 200 questions? Well, you may know that there are nine different formats of AKT questions. Let us have a look at the nine formats.

1. **Single best answer.** This is often a scenario-based question where there is only one correct answer. The others, the Royal College of General Practitioners tells us, may be plausible but are not the most likely. You must pick the *most likely* correct answer.
2. **Extended matching questions.** These questions have a list of possible