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Chapter 1

General introduction

"These cabbage pills are just the ticket. I'm pretty sure I read that in The Lancet. Or was it Cosmopolitan?"

Learning objectives

- Understanding what health science literacy is and how these competences will be developed in this book.
- Appreciating the process and the objective of evidence based medicine in clinical practice.
- Getting familiar with the flow of the book and the online learning platform.

1.1 Introduction

Are you sometimes clueless about how to find the best answer to a clinical question? Do you find yourself unable to perform a quick and efficient search in scientific databases? Do you experience problems in selecting the most appropriate search terms (keywords) when looking for scientific papers? Are you looking for help to perform systematic literature searches? Are you considering developing a research protocol to answer clinical questions?

If you can answer "yes", at least once, to any of the questions above, this book is suited to you. By reading this book you will master the competences of searching the scientific literature, both for clinical and scientific purposes. This book will help to create a scientific searching attitude and critical attitude towards reporting from today's tremendous amount of original scientific literature. It will be a guide through the various steps of searching the scientific literature and will enable you to report from the scientific literature by means of a Critical Appraised Topic (CAT) or Systematic Review. All these competences can be defined as **health science literacy.** This step-by-step guide aims to support you along the way of acquiring health science literacy as a professional. It explains the background to these methodologies, what is involved, and how to get started, keep going, and finish! The competences towards searching scientific literature will also enable the reader to use this information for the purpose of preparing a protocol for original research.

Additional to the content of this textbook, an online education platform Sofia is available. This platform is used to provide examples, additional information, important links and also contains test modules. These modules are constructed to provide the reader blended learning with additional feedback. Throughout this textbook referral to Sofia will be done by this symbol in the margin. If you see this symbol in the textbook, additional information or testing is provided on Sofia.

1.2 Health Science literacy

Health literacy is often referred to as "the degree to which individuals (lay people) have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions" [1]. More recent definitions focus on specific skills needed to navigate the health care system and the importance of clear communication between health care providers and their patients. Both health care providers and patients play important roles in health literacy. The number of different definitions of health literacy demonstrate that the field is evolving [2].

Science literacy is referred to as the knowledge and understanding of science-related concepts and processes required for personal discourse and decision making [3].

Health science literacy, as in the title of this book, focusses on the literacy of clinicians as well as academics (students included) in health sciences. Health science literacy is not simply the ability to read. It requires a complex group of competences like reading, listening, analytical thinking, and decision-making skills, and the ability to apply these competences to health situations.

The present textbook indeed starts from the basics of translating a clinical problem into a searchable question, with the aim of developing the competencies to conduct **evidence based practice** (EBP) in all-day clinical practice up to organizing and participating in journal clubs (e.g. by means of a CAT) as a clinician or policy maker to increase EBP in health care settings. Additionally, the book is a step-by-step guide for supporting students and researchers in their process of conducting a **systematic review and reporting from original research.**

1.3 Evidence based Practice (EBP)

1.3.1 Why EBP?

Observations showed that per patient five questions are asked by clinicians. Of them 52% could be answered immediately by the medical reports and 25% by consulting health science databases, e.g. Medline [4]. More important is the finding that searching and finding information has a real impact on the clinical decision itself. It seems that half of the information obtained from a specific search confirmed the medical decision, and half led to a new or improved therapeutic or diagnostic decision [5,6].

It is important that clinicians and managers can justify their treatment decisions with scientifically sound findings, rather than taking decisions based on:

- tradition... (We do it as usual);
- an anecdote... (Ten years ago we had a similar case ...);
- one article... (According to that author, you must do that...);
- the opinion of an expert... (In my experience in these patients ...);
- financial considerations...

Ideally, clinical decisions should be **evidence based**. This means based on a thorough search for, critical appraisal of, and finally the implementation of the best available evidence!

1.3.2 Defining EBP

Evidence based medicine (EBM) is the process of systematically reviewing, appraising and using clinical research findings to aid the delivery of optimum clinical care to patients [7]. The process of EBM should lead to evidence based practice (EBP): the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient. It means "integrating individual clinical expertise with the best available external clinical evidence from systematic research and taking patients' preferences into account" [8].

What sort of evidence are we looking for? Current best evidence. Not perfect evidence – simply, the best there is. But not old or out-of-date evidence; we need to find modern, up-to-date current evidence. How is this to be done? In a conscientious, explicit and judicious way. Again, the words are important.

- Conscientious – being careful, and thorough, in what you do;
- Explicit – being "up-front", open, clear and transparent;
- Judicious – using good judgement and common sense.

If you are going to practice in this way, you must be able to find evidence from scientific studies that is relevant to your patients. You then must understand those studies and be able to appraise them (not all studies will be relevant to your patient and even if they are, they may not be good studies). And finally, you must apply those results when making decisions about your patient. This means being able to integrate the evidence with your patients' personal needs, their values and beliefs and their wishes.

A complete definition would then be: "Evidence based practice is the conscientious, explicit and judicious use of current best evidence in helping individual patients make decisions about their care in the light of their personal values and beliefs" (Figure 1.1) [8].

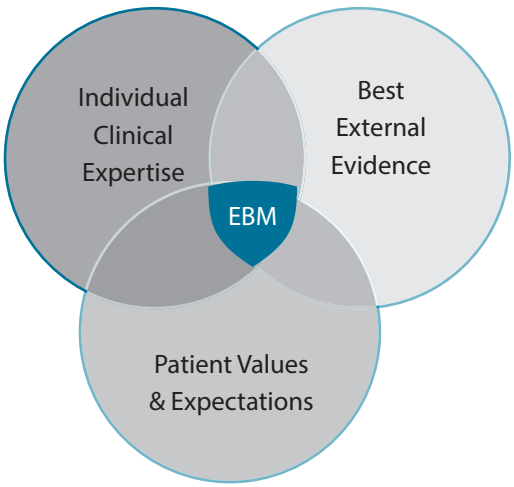

Figure 1.1. Representation of EBM (based on Sacket et al., 1996 [8]).

The definitions refer to the best external evidence based on the results of valid and relevant clinical research. Nonetheless, under similar medical conditions and in the light of the same evidence, clinicians may still take different decisions. Preferences, wishes and expectations of the well-informed patient or his representatives may vary and also the clinical expertise of the clinician may influence the final decision.

The practice of evidence based medicine implies an integration in knowledge from research with the practical experience of the clinician to arrive at the best care and the best prevention.

EBM is a mindset which assumes that the clinical practice should be based as much as possible on scientific findings. It is a way of working in which clinicians should question themselves, if there is evidence to support a decision, and how strong the evidence is.

1.3.3 Process of EBP

In health care it is expected from the clinician that he/she offers solid information about the causes of disease, the diagnosis of the patient, the prognosis of the patient and the anticipated effects of different therapeutic options with respect to the patients' views. This knowledge about the impact of clinical actions is preferably based on findings of clinical research [9].

Therefore, applying EBP in clinical practice requires the use of a five-step method [8,10].

1. Translating the clinical problem into a searchable and answerable question.
2. Efficiently searching for the best evidence.
3. Critically appraising the evidence found, based on methodological quality and applicability in the clinical practice situation.
4. Taking a decision based on the available evidence.
5. Regularly evaluating the quality of this process.

This process requires a number of skills, such as formulating a clear question, developing a search strategy and applying it to retrieve articles, critically reviewing articles and translating the results to clinical practice. All of that must be done in a conscientious, explicit and judicious way or, in other words, in a scientifically integer way. The strategy and competences required for working according to the methodology of EBP (besides the clinical competences) are discussed in this book.

1.3.4 Required competences

1.3.4.1 Formulating the question

How to translate the clinical problem into a searchable and answerable question will be elaborated in Chapter 4.

1.3.4.2 Efficiently searching the evidence

Modern health professionals are overwhelmed with information. Information is not always easy to find for clinicians and they can barely overview the continuous flow of new studies. We are living in the "Information Age", but the information that could support clinical decisions is fragmented. Even with a strict selection of journals and articles, it remains a confusing amount of reading material. Another factor is that there are constant changes in knowledge, whereby the weight of existing evidence can change continuously. Moreover, not all the published research is of the same high scientific quality [9].

Depending on the purpose of your search, you will preferentially access different sources and databases. To help you in that choice, we rely on the 6S pyramid that will be introduced in Chapter 5, Searching databases. The tool highlights sources of pre-appraised research evidence in the top of the pyramid in order to save public health practitioners time critically appraising the literature. Evidence from sources lower in the pyramid must be critically appraised, which is indeed often done by the researchers when synthetizing evidence for research purposes.

Depending on the aim the resource and database to start with will differ. When the aim is to write a systematic review for instance, you will mainly search the primary resources and do the critical appraisal yourself. For clinical purposes, you will first search for pre-appraised guidelines and summaries on top.

The easiest way to access the evidence for clinicians is to search for "clinical guidelines" in existing databases and systems (Chapter 2 and 3). **Guidelines** create a welcome order in this data.

Unfortunately, guidelines do not cover every topic, do not provide sufficiently detailed information to draw a conclusion for a specific clinical question, are not (yet) up-to-date or are of poor quality.

If a proper guideline is not available, clinicians can start looking for an answer by themselves by conducting a literature search. How to do that will be explained in Chapter 4 and 5.

1.3.4.3 Appraising the evidence

When searching the evidence, different results may be generated that should be screened first on applicability and quality before implementation, because not all relevant evidence comes in the same quality and format. According to the principles of EBM, decisions must preferably be based on the best available evidence.

First, the search results must apply to the specific clinical case, and thus search results should be screened on their relevance. This will be explained in Chapter 6.

Second, there is a sort of hierarchy of evidence, based on study design and quality of the study. As already briefly mentioned above, some databases and systems provide already pre-appraised resources, but for other layers of the 6S pyramid appraisal must still be performed. This will be explained in Chapters 6, 7, 8 and 9. Note that we talk about evidence and about proof. Evidence is not strictly the same as proof; evidence is an indication that may be so strong that there is little doubt about the correctness, or so weak that it is hardly convincing. In the first case, evidence comes close to proof. However, for a specific clinical question, there is not always 'strong' evidence. To conduct EBP, clinicians should thus search for the best evidence available (based on applicability and level of evidence). Ultimately, it is the quality of the evidence – a measure of the credibility of the results, that will be decisive for the implementation of the findings in clinical practice.

1.3.4.4 Implementation and evaluation

Unfortunately, most studies do not end up with a summary of practical implementations as "how does this result apply to this problem" and "what is the best option, based on this study, for a specific problem at your clinic?"

Study findings must be made useful for the management of the individual patient. There are many factors that determine how outcomes can be translated to clinical practice. Findings are usually based on and applicable only for the "average" patient, which unfortunately does not exist. Thus, in the end, the practitioner will decide with the patient which findings can be used or waived - informed and balanced. So, health care remains a "customized" product [9], that should be evaluated and adapted continuously.

Since this complete process is more time-consuming than just taking clinical decisions based on tradition or experience and to ensure quality and implementation of the EBP process, it can be desirable to register steps and findings of this process in a CAT (Chapter 10). This CAT can be disseminated to peers, so more clinicians can benefit of the efforts made and the efficacy and efficiency of a whole team or group of clinicians can be increased. Sharing these experiences in journal clubs will facilitate EBP.

1.4 The research process

Unlike research, EBP is not about developing new knowledge or validating existing knowledge. It is about translating the evidence and applying it to clinical decision-making. On the other hand, the purpose of conducting research is to generate new knowledge or to validate existing knowledge based on a theory. Research studies involve systematic, scientific inquiry to answer specific research questions or test hypotheses using disciplined, rigorous methods.

As presented in Figure 1.2, the process begins with burning (compelling) questions about a particular topic. The first part of investigation involves a systematic, comprehensive review of the literature to provide a rationale for the study. Identified knowledge gaps typically provide the rationale for developing a specific research question.

Next, a decision can be made towards the desired study design and the research protocol to answer the question. The first consideration is who will be studied, what will be measured, methods for data analysis, etc.

In a third step the study is implemented and data are collected. Afterwards, in step 4, data are analyzed, interpreted and conclusions are drawn.

In the fifth step, researchers have the responsibility to share their findings with the appropriate audience so others can apply the information in clinical practice or for further research. Disseminating research findings can be performed through journal articles, congress presentations, etc.

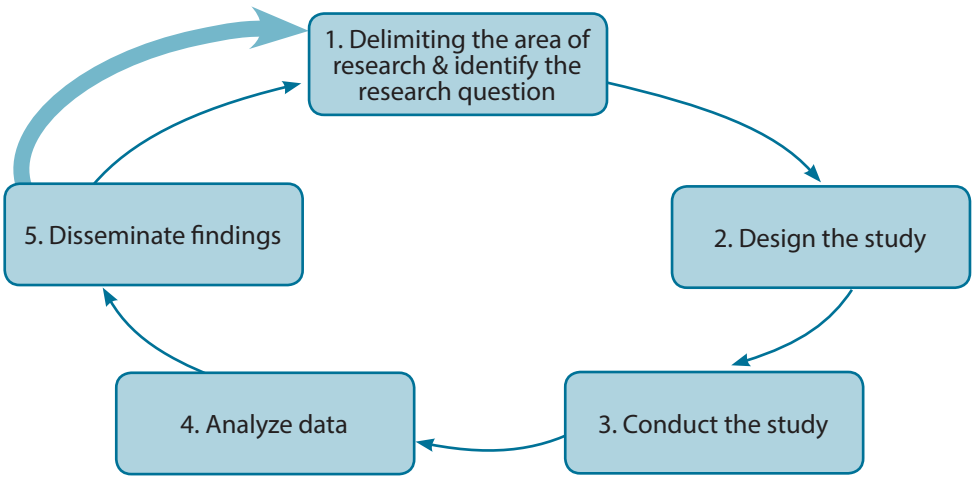

Figure 1.2. The research process and the interaction with Evidence Based Practice (EBP) [11].

Note that the research process is circular, and there is no dead end. Results of a study lead to new questions. Suggestions for further research can be made; either for researching new research questions, addressing limitations in the existing research or confirming results (in different samples or settings).

The loop also includes application of EBP. When research findings are applied in clinical practice, they can be tested in natural settings. This process will often lead to new questions, as we continue to deal with the certainties of practice [11].

1.5 Conducting a systematic review

A challenge for clinicians in maintaining up-to-date knowledge of their specialty, or learning about new areas, is the tremendous growth in medical literature and its increasing complexity. In response to this proliferation, there has been a major expansion of literature review, which aims to summarize all relevant information on the topic of interest [12]. Systematic reviews are defined as "a critical assessment and evaluation of all research studies that address a particular clinical issue, using an organized method of locating, assembling, and evaluating a body of literature on a particular topic using a set of specific criteria". A systematic review is generally regarded as a higher level of evidence than an individual study, but its design and conduct must be rigorous, with comprehensive coverage.

Therefore, the present book provides a step-by-step guide for performing a systematic literature study (Chapter 11). The aim is to promote high standards in commissioning and conduct, by providing practical guidance for undertaking systematic reviews regarding health care.

There are already many books published on the question of how to conduct a systematic review. So, what is the added value of this book? Firstly, it offers the usual themes relevant for writing a review: a general introduction and glossary of terms often faced with in scientific literature (Chapter 2), an explanation about different study designs (Chapter 3), guidance towards formulating research questions (Chapter 4), finding literature (Chapter 5), screening the search results (Chapter 6), assessing risk of bias (Chapter 7) and grading the evidence (Chapter 8). In Chapter 11 everything will be brought together. Secondly, all the knowledge and competences delivered in the previous chapters will be merged in this chapter and will be fitted within the international standards about writing systematic reviews: namely the PRISMA-statement (**www.prisma-statement.org**) and the Cochrane Handbook (**http://handbook.cochrane.org/**). Moreover, this chapter will focus on analyzing and discussing the included literature to come to appropriate

conclusions. Finally, chapter 9 and 12 will guide researchers in reference management and writing skills to get the review published.

The guidance has been written for those with an understanding of health care but who are new to systematic reviews; but also, for those with some experience but who want to learn more. This guidance might also be useful to those who need to evaluate the quality of systematic reviews, including, for example, anyone with responsibility for implementing systematic review findings.

Given the purpose of the book, the audience it is designed for (students, clinicians and researchers) and the aim to remain concise, it has been necessary to strike a balance between the wide scope covered and the level of detail and discussion included. Therefore, to support the process of undertaking a systematic review, frequent links and references are made to international sources and tools.

1.6 Animal research

Animal studies have a vital role in science development. For instance, experimental research is key for the development of new drugs. For this, the contribution of animal studies to clinical medicine is indispensable and systematic review of the existing animal experiments would represent an important step forward. In the current text book, we focus on human study subjects and clinical studies. However, general paradigms and good practices also apply for animal science, albeit not the focus here. Researchers should also adhere to the ethical procedure and follow strictly the scientific method, i.e. a well-formulated research question and hypothesis is essential.

1.7 Conducting original research

Only if scientific literature does not allow to answer your research question with the best evidence available, new research should be performed, and is not considered waste from an ethical perspective. In other words, any new research activity should be preceded and informed by a systematic review of the evidence available to increase the value of biomedical research [12-16]. The new research activities should be appropriately designed to make sure they deliver or add to the best evidence to answer the research question, while serving both clinicians and researchers. Therefore, we will also touch upon reporting from original research (Chapter 12) to answer clinical questions, building