Abstract  Introduction: Three challenges that physicians and decision makers in the health care systems have to meet are a remarkable proportion of medical decisions without a sufficient base of scientific evidence, a slow and opaque process of integrating scientific knowledge into medical practice and a steadily decreasing half-life period of the medical knowledge. Discussion: During the last two decades, a number of projects have faced these problems and forced the development of evidence-based medicine (EBM). This concept claims the explicit conscientious use of current evidence from clinical research combined with the personal expertise in the process of medical decision making. The following article explains the main steps of practising and teaching EBM illustrated by a clinical example.

Key words  Evidence-based medicine · Clinical study · Clinical scenario · Teaching EBM

Introduction

These sentences, phrased in a frequently cited editorial [1], characterise the principles of evidence-based medicine (EBM) as it is understood and propagated by many physicians and researchers as well as institutions and organisations of the health systems. The discussion regarding the need of a better integration of the results of medical research is mainly provoked by three actualities: (1) the percentage of medical decisions based on scientific evidence is estimated as 15–40%, sometimes even lower [2]; (2) there is an enormous time lag between assured scientific knowledge and the introduction into medical routine, empirically shown to be 8–10 years [3]; and (3) the medical knowledge is, at rapidly increasing speed, becoming out of date, with a steadily decreasing half-life period of about 5–45 years today, depending on speciality [4, 5].

The implications of these statements have been debated since 1970 [6], leading to a series of projects and developments in North America and the UK over the last 20 years. Stimulated by the crisis of their health care systems and other factors, many central European countries began to take part in the discussion a few years ago. Because of its broad dissemination, there is a need for all medical specialities to get involved in this development and to consider the impact EBM already has and will have for them in future.

The concept of EBM

The global target of EBM is to improve health care by bridging the gap between research and clinical practice, thus allowing medical decisions to be based on the best available scientific evidence [7, 8]. To achieve this target, the available evidence or knowledge has to be accessed in a formalised and operationalised way for an optimal output and benefit. The methodological framework for an EBM is organised in the following four steps:

1. Translating a clinical problem into a question that can be answered
2. Searching for the best evidence
3. Critically appraising the evidence
4. Applying the identified and appraised information in clinical practice

At the end of the process, a fifth step can be added, which is the evaluation of the whole process and of the clinical performance.

Translating a clinical problem into a question that can be answered

Use of everyday language is not sufficient for asking questions that will be answered by searching the medical literature via bibliographic databases. Questions suitable for a systematic search have to follow a certain logic that breaks down the overall question, transferring it into an operationalised form. Well-constructed clinical questions should contain four elements [7]:

1. The patient and/or problem addressed.
2. The intervention we are interested in (e.g. a diagnostic test, a treatment or a prognostic factor).
3. A comparison intervention, if relevant.
4. The clinical outcome or outcomes we and the patient are interested in.

For diagnostic decisions, a well-formulated question should enable the identification of an appropriate diagnostic test with its characteristics (sensitivity and specificity or likelihood ratios). These test properties are essential for evaluating a diagnostic test and its benefit for the clinical decision-making process. With the knowledge of the patients’ probability of being ill (prevalence or pre-test probability), the characteristics of a diagnostic test and the result of this test in a patient, we can calculate the post-test probability and assess the diagnostic result.

Searching for the best evidence

To identify the available evidence, modern tools such as electronic databases have to be used [9]. Today, this usually means using Medline, mainly because the access is free. However, it should be noted that even a qualified Medline-search may not produce the best existing evidence [10]. First, the reason may lie in the difficult index structure, which can be a serious obstacle for a successful search, thus inhibiting finding studies contained in Medline. Second, aside from the complex index structure, a remarkable number of articles are indexed incorrectly or incompletely [11]. Third, Medline does not comprise all journals, leaving out some journals with a large number of studies, or even worse, not covering a number of special areas. Especially in Europe, the medical database Embase (Elsevier) may be a better choice, particularly for pharmaceutical studies. New articles are included faster into Embase than into Medline and it contains journals that are not covered by Medline. Regardless of the selected databases, the search for evidence must be highly specific. In most cases, the first appropriate article has to be used because of time constraints and the conditions of everyday clinical practice, which rarely allow use of information from several articles.

To overcome this limitation and provide the busy clinicians and decision makers in the health care systems with reliable information, synthesising the existing research results is an essential step beyond relying on single studies only [12, 13]. The Cochrane Collaboration (CC), an international network of physicians, scientists, health care institutions and patients [14] started to prepare, maintain and disseminate systematic reviews of all types of health care interventions. Systematic reviews are produced under conditions designed to overcome the intrinsic errors of classical narrative reviews [12]. During recent years, they have been acknowledged as the most reliable source for appraising the effectiveness of an intervention. Therefore, in the classification of reliability of evidence, systematic reviews that are based on high-quality randomised controlled trials (RCT) receive evidence level 1 (Table 1) [15]. Logically, a search should start with systematic reviews, going down the evidence hierarchy of the table if there is no review. An easy-to-use database is the Cochrane Library [16], which contains 628 systematic reviews and 593 protocols of reviews (Issue III/1999). The Cochrane Library also contains a literature database with all clinical study citations from Medline and an increasing number from Embase. These citations are complemented by a large number of citations which were identified by systematically hand searching journals not covered by electronic databases. Providing these data on clinical studies makes the Cochrane Library one of the most effective tools.

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<tr>
<th>Level</th>
<th>Type of investigation</th>
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<tr>
<td>Ia</td>
<td>Evidence obtained from meta-analysis of randomised controlled trials</td>
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<tr>
<td>Ib</td>
<td>Evidence obtained from at least one randomised controlled trial</td>
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<tr>
<td>Iia</td>
<td>Evidence obtained from at least one well-designed controlled study without randomisation</td>
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<td>Iib</td>
<td>Evidence obtained from at least one other type of well-designed quasi-experimental study</td>
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<tr>
<td>III</td>
<td>Evidence obtained from well-designed non-experimental studies, such as comparative studies, correlational studies, and case studies</td>
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<td>IV</td>
<td>Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities</td>
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