Chapter

39 Evidence-based medicine

Section 5: Curriculum themes

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Introduction

The process of lifelong, selfdirected learning includes recognition of clinically important questions about diagnosis, therapy, prognosis and other aspects of healthcare when caring for our patients. The methods of evidence-based medicine (EBM) aim to provide skills that help clinicians to rapidly answer these questions and assimilate new evidence and ideas and put them into practice.

We can summarise the EBM approach as a four step process (Straus et al 2005):

- asking answerable clinical questions
- searching for the best research evidence
- critically appraising the evidence for its validity and relevance
- applying the evidence to groups and individuals.

To remind us to evaluate and improve our skills at these steps, a fifth 'step' is often suggested: 'Evaluating your own self education performance.

In this chapter we outline a possible curriculum plan for teaching EBM, moving from awareness and principles to skills and practice.

Introductory lecture – an hour on raising awareness

"Evidence Based Medicine is the conscientious, explicit and judicious use of the best current evidence in making decisions about the care of individual patients."

Sackett et al 2000

Initial concepts in an introductory lecture should include: what EBM (sometimes called 'evidence based practice') is and isn't, the problem of our information overload, our need to discriminate between good and poor quality evidence, and how EBM skills can help.

Important themes to develop are trying to keep up to date and the problem of overcoming the increasing world literature: over 1500 new medical research articles are published daily (Fig. 39.1). You might stop and ask your learners to reflect on how they currently learn and keep up to date. You might also ask them how much time is being spent on each process. Activities usually identified include: attending lectures, and conferences, reading articles in journals, tutorials, textbooks, clinical guidelines, clinical practice, small group learning, study groups, using electronic resources, and speaking to colleagues and specialists. There is no right or wrong way to learn, a mixture of all of these methods will be beneficial in the overall process of gathering information.

It is helpful to think of learning needs as a process of gathering information in two different ways 'push' and 'pull'. The 'push' is learning from the deluge of information that arrives in our post or email, on a variety of topics. This type of learning can be thought of as 'just in case learning'. When the information is filtered to provide only what is important to clinical practice and has already been appraised for certain validity criteria, it can be very useful. But most of our learning should focus on information 'pull': answering the questions that arise in practice – also called 'just in time' learning.

Evaluate your own learning strategies and your learners

- Write down one recent patient problem
- What was the critical question?
- Did you answer it? If so, how?

Samples of an introductory presentation are available free from the Centre for Evidence Based Medicine website (Oxford Centre for Evidence-Based Medicine downloads. http://www.cebm.net/downloads.asp).

Asking answerable questions

You should consider following or combining this session (1–2 hours) with searching skills laboratory (1–2 hours). Your librarians may have skills unbeknown to you that might help in this area. Use the PICO principle, to formulate the clinical questions:

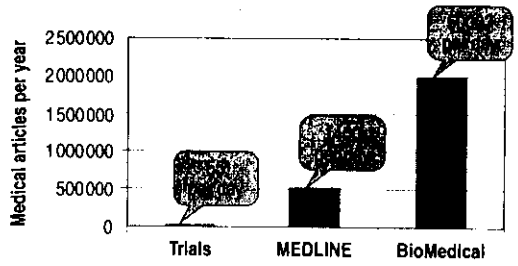

Fig. 39.1 The amount of medical research

P Population/patient – what is the disease problem?
I Intervention/indicator – what main treatment is being considered?
C Comparator/control – is this in relation to an alternative?
O Outcome – what are the main outcomes of interest to the patient?

(And sometimes we add a T for the Time to the outcome, e.g. 5 year survival).

Learners should practice dissecting the question into its component parts and then restructure it so that the components can be used to direct the search. Prior to clinical work, scenarios are useful to teach question building. For the less experienced, you might begin with short scenarios that lend themselves to dissecting the question(s) easily.

One way to begin is by giving an initial patient presentation, and ask students what medical knowledge they need to 'solve' the clinical problem. List all the questions, and then classify using the typology below (the type will affect where you look for the answer and what type of research you can expect to provide it)

Typology for question building

Clinical findings: how to interpret findings from the history and examination.

Aetiology: the causes of diseases.

Diagnosis: what tests are going to aid you in the diagnosis?

Prognosis: the probable course of the disease over time and the possible outcomes.

Therapy: which treatment are you going to choose based on beneficial outcomes, harms, cost and your patient's values?

Prevention: primary and secondary risk factors which may or may not lead to an intervention.

Cost-effectiveness: is one intervention more cost effective than another.

Quality of life: what effect does the intervention have on the quality of your patient's life?

Phenomena: the qualitative or narrative aspects of the problem

How you are going to integrate asking questions into your own practice?

The challenge to the teacher is to identify questions that are both problem based and orientated to the learners needs, at the same time you will also be identifying gaps in your own knowledge which may need to be addressed. Think of how you and your students are going to keep track of the questions and come to a clinically useful answer.

Remember to recognise potential questions which are clinically useful to you and your learners, decide which of the questions to focus on, guide your learners into developing useful questions, and asses their performance in building and asking answerable questions.

Searching for the evidence

Resources which you will need:

- if available, a computer laboratory with internet access
- one terminal for every two students
- if available, data projection linked up to a computer with database access for students to view searches in action
- internet access or access to medical research databases.

We recommend starting with MEDLINE for searching for the evidence.

PubMed: http://www.ncbi.nlm.nih.gov/PubMed/

Using PubMed allows all the concepts of proficient searching to be taught. The most useful is the 'Clinical Queries' section: a question focused interface with filters for identifying the more appropriate studies for questions of therapy, prognosis, diagnosis and aetiology. Ask students to do a search with and without the filters, and contrast the number of 'hits' found. Warn students that the first searches will take 15–30 minutes, but with regular practice they should get key information in a few minutes.

The session will take 1–2 hours, and there are several good guided tutorials on the web.

The success of problem-based learning depends on the ability to find the current best evidence effectively

Finding answers to questions when done well with speed can be highly rewarding or when done poorly can be frustrating and time consuming. A study of 103 GPs showed that they generated about 10 questions over a 2.5 day period. They tried to find the answers for about half of them. The most critical factor influencing which questions they followed up

was how long they thought it would take to obtain an answer. If they thought the answer would be available in less than a couple of minutes, they were prepared to look for it. If they thought it would take longer, they would not bother. Only two questions in the whole study (0.2%) were followed up using a proper electronic literature search (Ely et al 1999).

How are you going to maintain searching skills?

In teaching searching skills think of the resources you have available to you. Librarians often have knowledge in this area far beyond the skills of a busy clinician. They often run courses and workshops, if they aren't then consider approaching them to begin setting them up. On a personal level you should be proficient in searching, often you will be asked questions about searching strategies: Which database to use? Why do I seem to get so many articles?

It is often best to have a prepared scenario which generates a four part question and leads on to demonstrating some of the key components of an effective search strategy.

- In a five year old with a fever and a red bulging tympanic membrane should I prescribe antibiotics or watch and wait?

  (Clinically useful systematic review in Glasziou et al 2004)

- A 35-year-old lady came to clinic with a fresh dog-bite and she wanted to know whether she should have some prophylactic antibiotics.

  (Clinically useful answer in PubMed/Medline, in Cummings 1994).

There are two main strategies for searching bibliographic databases: thesaurus searching (all articles are indexed under subject headings) and text-word searching (where you search for specific words or phrases in the title or abstract). Once the question has been broken down into its components, it can be combined using Boolean operators 'AND' and 'OR' (Fig. 39.2, Table 39.1).

In combining terms into a search strategy, it can be useful to represent them as a Venn diagram (Fig. 39.3). Complex combinations can then be structured.

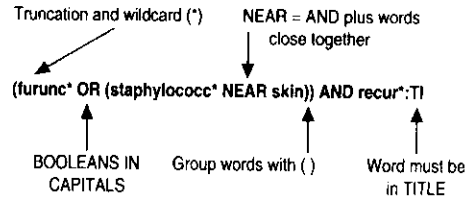

Fig. 39.2 Tips and tactics for searching

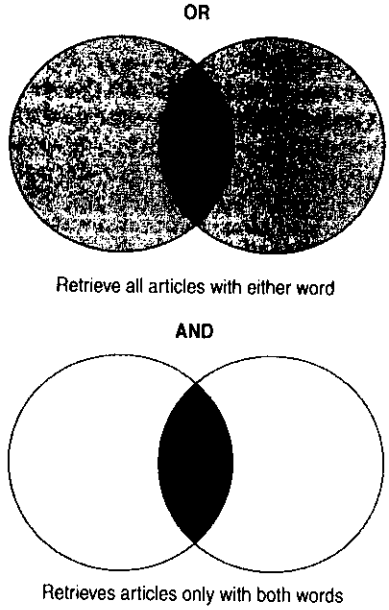

Fig. 39.3 A search strategy represented as a Venn diagram

Table 39.1

Convert your question into a search strategy

Question: In a 55-year-old man with heart failure does the addition of a β-blocker compared to usual care improve survival?

Question part	Question term	Synonyms
Patient/problem	Adult, heart failure	Left ventricular failure, congestive heart failure, NYHA classification
Intervention	β-blocker	Metoprolol, carvedilol
Comparison	Usual care, standard therapy	
Outcome	Mortality	Death, survival

Critically appraising the evidence for its validity and relevance

Initially it is worth putting over to your audience in a lecture format some of the key concepts of critical appraisal and why it is important and some of the potential pitfalls. Flecainide use in the treatment of ventricular arrhythmias (Anderson et al 1981, Echt et al 1991) is an illustration of potential pitfalls.

If you are about to embark on teaching appraisal think of how proficient you are in appraisal in the following study types:

- therapy
- diagnosis
- systematic reviews
- harm/aetiology
- prognosis
- optional – economic analysis.

If you are not feeling confident then refer back to the EBM book by Straus et al (2005) or consider attending a workshop on Teaching and Practising EBM (Oxford Centre for Evidence-Based medicine; http://www.cebm.net).

Critical appraisal

Teaching the details of critical appraisal is best done as small group work, with a specific article and flipchart or whiteboard. Small group work allows generation of free discussion of these new concepts between the group leader and the participants, enabling them to gain knowledge from their peers. As with many intellectual skills, practice, discussion and feedback are helpful for faster and deeper learning. Each of the six topics above will take a session of 60–90 minutes, so the full set may take 6–9 hours of small group work.

Working through critical appraisal

To help you in the process, we suggest that you have some prepared critical appraisal worksheets available to guide the process. You can design your own but there are many available which will help you, for example:

- Oxford Centre for Evidence-Based Medicine free downloads of critical appraisal worksheets (www.cebm.net/downloads.asp)
- Centre for Health Evidence University of Alberta (www.cche.net/che/home.asp)
- Centre for Evidence-Based Medicine, Mount Sinai, Toronto (www.cebm.utoronto.ca/).

Crunching the numbers

Learners should become proficient with most common outcome measures used in trials. Results can be expressed in many ways and you should feel comfortable in demonstrating the calculations involved:

- Relative risk (RR)
- Relative risk reduction (RRR)
- Absolute risk reduction (ARR)
- Number needed to treat (NNT)
- Odds ratios (OR)
- Sensitivity and specificity of diagnostic tests
- Pre-test probabilities likelihood ratios and post-test probabilities.

Do not expect your learners to calculate all of these every time, but they should be able to calculate NNTs and relative risks; however, the more complex calculations may put them off. Introduce the use of a nomogram (Fig. 39.4) to aid diagnostic decision making.

Confidence intervals and *P* values

Statistics will often bring fear to some of your students. Remember that most people will only need to be *users* of statistics not *doers*. So emphasise interpretation not calculation. So you might explain that all studies are

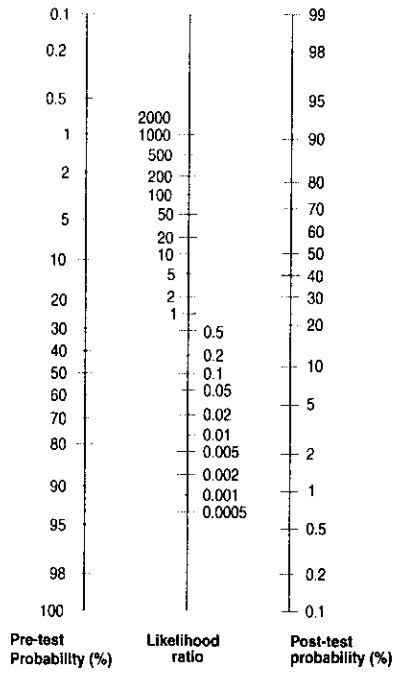

Fig. 39.4 Nomogram for converting pre-test probabilities into post-test probablilties for a dianostic test result with a given likelihood ratio. (Reproduced with permission from the Oxford Centre for Evidence-Based Medicine from http://www.cebm.net/index.aspx?o=1161)

subject to some random error, and that the best we can do is estimate the true risk based on the sample of subjects in a trial (called the 'point estimate'). Statistics provide two ways of assessing chance:

- *P*-values (hypothesis testing)
- Confidence intervals (estimation).

Do not go into the statistical methods of calculating the answers. Provide discussion about the relevant methods and why an intervention can only be considered useful if the 95% confidence interval (CI) includes a clinically important treatment effect. A useful exercise is a 'forest plot' from a meta-analysis. Ask students to read off which is the largest and smallest studies, which are statistically significant, and which are clinically significant, etc.

Make clear the distinction between statistical significance and clinical importance:

- *Statistical significance* relates to the size of the effect and the 95% CIs in relation to the null hypothesis
- *Clinical importance* relates to the size of the effect and to a minimum effect that would be considered to be sufficiently important to change practice.

Applying the evidence

The questions you should think of before you decide to apply the results of the study to your patient are:

- Is the treatment feasible in my setting?
- Are your patients similar to those of the study?
- What alternatives are available?
- Will the potential benefits outweigh the harms?
- What does the patient value?

Evaluating your own performance

The most important evaluations are the ones you and your learners design and carry out yourselves. The questions you might want to ask of yourself include:

- How many questions am I recording?
- Are you using different databases in your search strategies?
- Are you challenging your colleagues about everyday decisions?
- Are you answering your questions?
- Has your practice changed?

Think of how you might want to be evaluated. Small presentations such as in a journal club can be a valuable way of appraising students, whilst increasing everyone's knowledge. Are you creating critically appraised topics (CATs)? These are structured appraisals incorporating all of the relevant points you would want to know from a study. There is a free downloadable version of a CAT-maker available at the CEBM web-site (Oxford Centre for Evidence-Based medicine. http://www.cebm.net, Evidence-Based Medicine. http://www.evidencebased-medicine.com).

Are you setting clearly defined objectives in your small groups, and is this meeting the needs of your students. If your learners are creating important information, think of how you might want to store this resource. You could create a database that could be accessed by others in your related fields.

Integrating EBM into your curriculum

Think of finding a like-minded individual who will help you to design and carry out the introduction and maintenance of an EBM course. You can have a rapid introduction to EBM in one-day courses: there are several good workbooks available to guide you in this process (Glasziou et al 2007). A one-day course would comprise an introductory lecture, searching skills and critical appraisal (of just 1 study type) in small groups. It is possible to integrate EBM throughout the course of a year, making your scenarios relevant to the different disciplines that a student will face. It is essential to demonstrate that you are practicing EBM in your own clinical duties; leading by example is an excellent way to illustrate how evidence can be incorporated into your patients care. Be adventurous and try different strategies, mix and match lectures and small group work, think about introducing a journal club for all those questions that still need answering. Join up with practitioners from different areas, and consider refreshing your skills at one of the many courses available.

Summary

The traditional Continuing Medical Education flow is for research to be formulated into guidelines or reviews (evidence-based we hope!), packaged into CME, and presented written (in journals) or at educational sessions to be later retrieved and applied at the appropriate clinical moment. Instead we suggest that the traditional flow be reversed, and the choice of topics on which to gather information should come directly from caring for our patients (Del Mar & Glasziou 2001). Use a variety of strategies to incorporate the five steps of EBM into your course.

Essential to this process is the teacher's role as an effective practitioner of EBM.

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Further reading

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