

Teaching evidence-based medicine

CB Hazlett

The practice of evidence-based medicine is inherently pedagogical by its nature, requiring one to use tools that are basic lifelong learning skills. To facilitate the teaching of these skills, it is important to emphasise how the average Hong Kong practitioner's difficulty in keeping abreast of the rapidly growing body of medical literature can be efficiently resolved by using evidence-based medicine protocols. Four evidence-based medicine workshops were recently offered in Hong Kong. These workshops were organised and taught in a manner similar to one that had been found to be effective in other settings. Issues related to both the strengths and shortcomings of using this strategy in the local context are discussed. Implications for organising future workshops of this kind are also identified.

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Introduction

The practice of evidence-based medicine (EBM) requires skills that have not been taught in traditional medical undergraduate programmes. To effectively teach these skills to medical students, revisions to the medical curriculum and faculty organisation need to be made. Adequate educational resources to facilitate learning and the use of information technology are also prerequisite. As EBM has become increasingly recognised as important by the medical community, the profession itself must also address some of these same issues in its continuing medical education programmes.

Fortunately, effective pedagogical approaches have already been developed and tested on a variety of learners—medical students, members of faculty, postgraduate students, and practising clinicians.¹ The pedagogy is not dissimilar for any of these groups, primarily because evidence-based medical practice (EBMP) is inherently a paradigm for independent, lifelong learning.

However, interest in adopting EBMP across these learner groups is likely to vary significantly. Thus, tertiary institutions and professional bodies that attempt to teach this new practice paradigm must not only address the domains of cognition (knowledge) and

behaviour (psychomotor skills) but also the learner's affect (attitudes), as acquiring certain attitudes is integral to EBMP.¹ If the utility of EBM is viewed with scepticism, or if one believes EBM skills are not essential, it is highly unlikely that a clinician's decision making will become increasingly dependent on the EBM rules of evidence and protocols.

There are excellent journal articles,²⁻¹⁵ books^{1, 16, 17} and websites* that describe how one can teach EBM. These sources even include useful case studies. One text by Sackett et al¹ has been distributed to senior medical staff working in the Hong Kong Hospital Authority's (HA) public hospitals and the text describes not only what constitutes EBMP, but also how it can be taught and adopted as a practice paradigm. Little can be written here that would add to what is said in this article.

Instead, this paper will highlight some key facets that arose in the teaching of some of the EBM protocols to more than 150 medical staff from Hong Kong public hospitals, as well as some managers in the HA. To help clarify the importance of these issues in terms of sound pedagogical strategies, this paper will first describe some of the key tenets of EBM and the steps needed to incorporate rules of evidence into a clinician's medical practice.

Some feedback from the registrants who attended

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*<http://www.bmj.com/archive/7101/7101ed.htm>
<http://hiru.mcmaster.ca/ebm/>
<http://cebm.jr2.ox.ac.uk/docs/scenarios/gp.html>
<http://www.ogh.on.ca/library/ebm.htm>

one of the four 2-day EBM workshops is used to evaluate the importance of the pedagogy that was used, which was sometimes found to be inadequate, but was mostly helpful.

The tenets and assumptions of evidence-based medical practice

The principal tenet of EBMP is that “valid and relevant clinical research can greatly aid a clinician’s decision making.” This postulate has been historically accepted by medical practitioners. It is also a tenet that can be emphasised when protocols for EBMP are first introduced and then later debated as to whether adoption into one’s medical practice should or should not be seriously considered.

The second tenet of EBM is not, however, as readily accepted: “The findings of many published clinical research investigations (as much as 98%)¹ are not necessarily valid and are therefore not useful in guiding one’s clinical action.” It follows that a physician who accepts this tenet will hold an appropriate level of scepticism concerning any published advice until the associated evidence that confirms its scientific credibility is also available.

The remaining tenets can elicit even more controversy: “The useful half-life of medical information has reduced so alarmingly, that medical practitioners can become quickly out-of-date—inevitably leading to suboptimal, at best, and at worst, ineffective clinical decision making.” It follows that the practitioners who accept this as a distinct possibility must commit themselves to lifelong learning, and also must find an effective means of keeping abreast of the exponentially growing body of medical knowledge.

“The non-systematic observations that are made in clinical practice are insufficient for maintaining one’s knowledge of the value of new diagnostic tests or treatments, the likelihood of harm resulting from exposure to risks or treatments, the effectiveness of prevention strategies, or the efficiency of different interventions.” The implications of this are disconcerting—that is, the traditional means of depending on one’s past medical training, clinical experience, and common sense are insufficient grounding to satisfactorily tackle practice issues such as trying to properly evaluate new tests and treatments. It also follows that reading previously purchased medical texts, consulting with senior colleagues, squeezing in time to read a limited number of journals, will not be enough to maintain optimal clinical judgement.¹

The final and most important tenet of EBMP is that: “The use of information technologies (to search medical literature databases) and critical appraisal skills (to evaluate and cull retrieved articles) will enable a clinician to find the manageable amount of valid information (evidence) that is relevant to one’s practice.” To be able to do this, the practitioner has to learn the techniques for making efficient literature searches and how to apply rules of evidence to determine the scientific validity of various types of clinical investigations.¹ With these in hand, the physician can independently find the best available evidence. The decision whether or not to use the evidence for a particular clinical decision is dependent on one’s repertoire of clinical experience and foundation knowledge in disease mechanisms. Thus, one’s past education and the years of clinical experience are indispensable.

Because this experience and knowledge will affect the decision to use the evidence in treating or advising a particular patient, it is inevitable that some clinical actions will have to be made under conditions of imperfect knowledge. This uncertainty does not lead to clinical inaction, but may possibly lead to less, or more conservative treatment, and may prompt involving the patient as a partner in the clinical decision-making process when alternative courses of action are possible.

These tenets of EBMP and their underlying assumptions are often debated. Each certainly requires evaluation and they are being investigated by EBM disciples. For others, the tenets and assumptions exert a sizeable influence on their attitudes, which must occur if the teaching of EBM is to be effective. Failure to alter attitudes will reduce the likelihood of a clinician ever adopting EBM as a practice paradigm.¹⁵

The basic learning protocols

Holding the above tenets and assumptions to be correct, EBM designers and advocates have evolved strategies for addressing the practising clinician’s dilemma. These strategies are pedagogical in nature and represent life-long learning tools.¹ The strategic steps are highlighted in Table 1.

As is outlined in Table 1, EBMP can be summarised as including: learning to express a clinical question in a way that can be searched for; conducting a search for evidence in reputable, relevant, medical literature databases; efficiently appraising the resulting retrievals for evidence of validity; estimating the clinical applicability to one’s own patient(s); and incorporating the evidence into clinical decision making and action.

Table 1. The steps involved in the evidence-based medical practice paradigm

Behaviour	Standard	Conditions	Example
(1) Phrase the clinical problem	Use explicit terms so that the question can be searched and answered	Use a context that maximises the likelihood that findings can be applied to one's patient(s)	The onset of heart failure, in women aged >65 years, shortens life by how many years?
(2) Search for external evidence	Look in reputable and relevant databases (eg <i>Medline</i>)	Use exploding terms, subheadings, <i>Index Medicus</i> terms, and free text terms, combining concepts with Boolean operators, limit searches to specific groups and employ appropriate research methods	EXP Heart failure EXP Cohort studies Female AND Geriatric
(3) Appraise the evidence critically	Assess in terms of internal validity (cause and effect), external validity (generalizability), and measurement validity (accuracy of data)	Follow published guidelines (eg <i>JAMA</i> articles on EBM) ²⁻¹⁵	Was there an inception cohort, all members of which entered at the same point in the course of their disease?
(4) Determine level of applicability	Assess in terms of ethnicity, age, gender, stage of disease, etc	Use one's clinical experience and knowledge of disease mechanisms to estimate level of applicability	Were the studied patients at the same point in the course of the disease as my patient(s)?
(5) Apply evidence to clinical action	If applicable, modify treatment, select the best diagnostic test, specify realistic expectations for re-occurrence, etc	Accept that sometimes evidence will be lacking and that clinical decisions will have to be made without certainty	Treat and educate patient(s) as to lifestyle adjustment after explaining probable outcome

The acquisition of these skills is greatly aided by instruction and guided practice.

Not all of the components listed in Table 1 were addressed in the four HA-sponsored EBM workshops.

The Hospital Authority evidence-based medicine workshops

The four HA-sponsored workshops were organised by the author at the request of senior HA management. The requirement was for workshops centred on the development of critical appraisal skills in some staff and medical personnel who were practising in public hospitals under HA auspices (including those holding medical administrative positions in these hospitals). To enhance the relevance of learning critical appraisal skills, the decision was made to teach these skills within the context of EBMP.

Given their work constraints, it was assumed that most registrants could only attend if a workshop was at the most 2 days in length. No registration fee was involved and registrants were those who responded to an open invitation to attend. The number of registrations for each workshop was restricted (a maximum of 43, a minimum of 37). No registrant attended more than one workshop.

To maximise the time devoted to developing critical appraisal skills, the workshops did not include step 2 and only simulated steps 1 and 5 (see Table 1). Reading materials were prepared and distributed prior to the workshop and the registrants were encouraged to study these before the start of the workshop. For the first two workshops, readings included the *Journal of the American Medical Association's (JAMA's)* 'Introductory users' guides to the medical literature',^{3,4} along with *JAMA's* topical guides on prognosis,⁴ therapy or prevention,^{5,6} and overviews.⁷ For the third and fourth workshops, held 1 year later, the *JAMA* topical guides were modified to include information on the use of diagnostic tests,^{8,9} harm,¹⁰ economic analyses,^{11,12} and a repeat of therapy or prevention.^{5,6} For each topic, a practice-based case study was prepared to illustrate a practice scenario for which the use of EBM protocols might be appropriate. The workshops did not have the time or facilities to allow registrants to do literature searches. Instead, one publication for each of the following topics was searched and selected: prognosis,¹⁸ therapy,¹⁹ overviews,²⁰ diagnostic tests,²¹ harm,²² and economic analyses.²³

In an effort to achieve teaching excellence, two individuals with international experience in running EBM workshops were brought to Hong Kong, one for workshops 1 and 2, and the second for workshops 3

and 4. Both instructors also had extensive experience in preparing secondary review articles—that is, applying the EBM rules of evidence to published investigations and publishing these critiques in one of two journals devoted to such reviews (the *Evidence-Based Medicine Journal* or the *ACP [American College of Physicians] Journal Club*).

As the workshops incorporated both large-group and small-group teaching sessions, teaching staff from six different departments at the Faculty of Medicine at The Chinese University of Hong Kong and two managers from the HA acted as small-group facilitators.

The small-group tutors were chosen on the basis of their interest in using EBM and/or on their experience in teaching critical appraisal skills. For the tutors, a half-day training session was conducted before each workshop. All four workshops followed a similar pedagogical strategy. For each topic (prognosis, diagnostic tests, etc), the guest lecturer provided 1.5 hours of

large-group instruction on the applicable rules of evidence and reviewed the appropriate *JAMA* guide(s). Following this, registrants were assigned to smaller groups of 8 to 10 persons, each with a tutor. Members of each small group collectively critiqued the selected publication as a practice exercise in applying the rules of evidence for a particular topic.

To aid the small-group exercises, decision checklists were provided. The respective check-lists for prognosis, therapy or prevention, and diagnostic tests are shown in Tables 2 to 4. After completing the applicable check-list, registrants were asked to determine if the reviewed article contained sufficient evidence for making a better clinical decision for the problem described in the prepared case study.

The final exercise involved the small groups reporting their conclusions to the whole group. This was followed by comments from the guest instructor and to provide further comment, an *ACP Journal Club* or an

Table 2. Worksheet for evaluating an article on prognosis

Citation:

Guide	Decision
<i>(1) Are the results of the study valid?</i>	
a. Was there a representative and well-defined sample of patients at a similar point in the course of the disease?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
b. Was follow-up sufficiently long and complete?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
c. Were objective and unbiased outcome criteria used?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
d. Was there adjustment for important prognostic factors?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
e. Summary on validity Can the results of the study be trusted?	<input type="checkbox"/> Yes (proceed beyond methods) <input type="checkbox"/> No (skip remainder of article)
<i>(2) What are the results?</i>	
a. How large is the likelihood of the outcome event(s) in a specified period of time?	
b. How precise are the estimates of likelihood?	
<i>(3) Will the results help me in caring for my patients?</i>	
a. Were the study patients similar to my own?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
b. Do the results lead directly to selecting or avoiding therapy?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
c. Are the results useful for reassuring or counselling patients?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell

Table 3. Worksheet for evaluating an article on therapy or prevention

Citation:

Guide	Decision
<i>(1) Are the results of the study valid?</i>	
a. Was the assignment of patients to treatments randomised?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
b. Were all patients who entered the trial properly accounted for and attributed at its conclusion? (Was follow-up complete? Were patients analysed in the groups to which they were randomised?)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
c. Were patients, health workers, and study personnel 'blind' to treatment?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
d. Were the groups similar at the start of the trial?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
e. Aside from the experimental intervention, were the groups treated equally?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
f. Summary of validity Can the results of the study be trusted?	<input type="checkbox"/> Yes (proceed beyond methods) <input type="checkbox"/> No (skip remainder of article)
<i>(2) What are the results?</i>	
a. How large was the treatment effect?	
b. How precise was the estimate of the treatment effect?	
<i>(3) Will the results help me in caring for my patients?</i>	
a. Can the results be applied to the care of my patients?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
b. Were all clinically important outcomes considered?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
c. Are the likely treatment benefits worth the potential harms and costs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell

Evidence-Based Medicine Journal secondary review of the selected publication was distributed and discussed.

The above teaching strategy is not unique and incorporated protocols that have been used in other EBM workshops in Canada and Britain. The use of case studies to guide large-group and small-group teaching sessions also follows sound pedagogical principles; the strategy has been found to be effective in research grant writing workshops that have been held regularly for the local health care community.

Evaluating the workshop

Feedback from the registrants and the tutors was solicited in each of the workshops. In addition, review discussions were held with HA management, the

guest instructor, and myself. The following conclusions regarding the usefulness of this type of workshop for practising clinicians in Hong Kong are based on these discussions.

(1) The distribution of workshop reading materials with instructions to read the material before the workshop, did not ensure registrants came adequately prepared for an intensive 3-hour teaching session on any of the EBM topics. This held true whether the material had been distributed 1 day or 1 week prior to commencement of a workshop.

Sackett et al¹ say they expect more than 12 hours of preparatory work to be done before their registrants embark on a 1-week EBM workshop. These same authors also have recommended that individual study

Table 4. Worksheet for evaluating an overview

Citation:

Guide	Decision
<i>(1) Are the results of the study valid?</i>	
a. Did the overview address a focused clinical question?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
b. Were the criteria used to select articles for inclusion appropriate?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
c. Were the relevant studies included?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
d. Were the included studies assessed for validity?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
e. Were the reviewers' assessments consistent?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
f. Were the results similar from study to study?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
g. Summary on validity Can the results of the study be trusted?	<input type="checkbox"/> Yes (proceed beyond methods) <input type="checkbox"/> No (skip remainder of article)
<i>(2) What are the results?</i>	
a. What are the overall results of the review?	
b. How precise were the results?	
<i>(3) Will the results help me in caring for my patients?</i>	
a. Can the results be applied to the care of my patients?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
b. Were all clinically important outcomes considered?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell
c. Are the benefits worth the potential harms and costs?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Can't tell

time, and time for registrants to have informal discussions among themselves and with instructors and tutors, should be interspersed among the large-group and small-group teaching sessions. On reflection, this author would agree with this strategy.

Requiring registrants to attempt to apply rules of evidence to a published article, a priori, is not likely to work. Without prior instruction, expecting an individual to use some rules of evidence is expecting too much. In particular, the rules of evidence for overviews and economic analyses were found difficult to use even after formal instruction. This same difficulty would likely apply to articles on decision analyses, given the complexity of that topic.

Therefore, within the context of offering such workshops to busy Hong Kong practitioners, the most reasonable path is to introduce time gaps of a few days between the large-group instruction, and the small-group discussions. During this time, registrants could practise applying the rules of evidence to a selected article, and thereby come to the workshop better prepared to contribute to the small-group seminars.

(2) The adjustments made over the four workshops as regards teaching the tenets and practice implications of EBM, demonstrated that many misapprehensions about EBM could be circumvented. Any reference to the relative importance of evidence and experience in clinical practice should be avoided at least until it

becomes apparent that one's knowledge of disease mechanisms and clinical experience is vital for determining if and when evidence is applicable to each doctor's practice. Failure to consider this will increase the likelihood that some registrants will feel an unintended disregard for the value of their years of clinical experience.

The less controversial advantages of adopting EBM protocols should be emphasised initially—the fact that they represent a means for helping a clinician to stay abreast of the literature; give confidence that a literature search will result in omitting only non-essential articles; give reading skills and reduce apprehension about skimming articles; and lastly will increase the participant's clinical decisiveness. These are all advantages that quickly become self-evident to the registrants and these features can also help a teacher overcome any misconceptions about the utility of EBMP.

(3) It is important that registrants do not leave the workshop with an overly critical attitude. Among those with newly-acquired, critical appraisal skills (but who are still inexperienced in applying rules of evidence) there is an initial tendency to find no article worthy of consideration. With practice, this zeal will become properly modulated. A real danger exists that this modulation will not be achieved within the limits of a short 2-day workshop. Again, this is an indicator for spacing large-group and small-group teaching sessions and allowing more time for registrants to consider all aspects of EBM and its implications for medical practice.

If such rescheduling were done, the level of learning, and the degree of EBM use in practice, might well improve. However, Hong Kong registrants consistently rated almost all aspects of the workshops as good or very good, with 98% stating that they would recommend such a workshop to their colleagues if one were again held. Given this level of positive feedback, one might argue that rescheduling from 2 days to at least 1 week would make little overall difference. However, unless registrants do become fully versed and comfortable with EBM, it is unrealistic to expect most will adopt EBM as a practice paradigm. For the teaching to be successful, scheduling sufficient time for assimilation remains a critically important factor.

Increasing the number of days for a workshop (but not necessarily the total amount of time devoted to teaching) has implications for recruiting tutors and instructors. For these workshops, scheduled over two

consecutive days, 80% of the tutors strongly agreed with the statement, "I got more out of tutoring in the workshop than I had to put into it"; all remaining tutors simply agreed with the statement. If one were to offer future workshops so that individual study time was possible, it would be necessary to determine if such rescheduling presented more difficulty in securing adequate tutorial help—an important facet for teaching EBMP effectively.

Regardless of the length of a workshop, it is recommended that the basic teaching strategy should parallel that used in these workshops. These teaching methods were originally developed and tested by the originators of EBM. To a large degree, these teaching methods were found to be as applicable to Hong Kong doctors as they have been found to be elsewhere and their perceived usefulness probably accounted for the reasonable level of success that was achieved.

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