

Evidence-based medicine: An overview

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Introduction

Evidence-Based Medicine (EBM) is about combining the best clinical expertise with the best available clinical information in the literature¹. At face value, this statement may seem simplistic, but closer scrutiny will lead to a reappraisal. The medical literature has increased exponentially to the point where the individual clinician can no longer keep abreast. In the area of general internal medicine, 19 articles a day, 365 days a year are published that should influence practice². These will take years to appear in the textbooks. Surveys in the UK have revealed that British medical consultants have well under an hour a week reserved for reading journals³. Further down the career ladder, the times quoted would not permit clinicians to keep abreast of recent developments. It is obvious that any clinician relying on his own individual 'database' of knowledge will rapidly go out of date, if he were only to rely on traditional methods of learning. In simple terms, EBM is relegating content (the factual things we need to know) below process (how we go about learning things and applying them) and requires different skills and attitudes to the ones that are traditionally developed at medical school⁴. As a result, EBM is being incorporated into undergraduate⁵, post-graduate⁶ and other⁷ training programmes internationally. It is also being developed in a variety of areas including adult medicine, child health, pathology, general practice, surgery, dentistry and nursing. Recently, it has become a standard requirement for the MRCP(UK) and MRCGP examinations.

Historical Development

Traditionally, the approach to looking at an area of practice was 'narrative', that is reading up the textbooks and journals and consulting senior colleagues to develop a linear overview of the information available. For many years, this was the standard approach to keeping abreast. The advent of the Randomised Controlled Trial in the 1950's changed all that, so that there is a 'gold' standard on which to base practice recommendations.

Why is it important?

It was Archie Cochrane who said "It is surely a great criticism of our profession that we have not organised a critical summary, by specialty or subspecialty, adapted periodically, of all relevant randomised controlled trials"⁸. Such a development would facilitate the implementation of management shown to work and the cessation of that found to be useless. For example, there was a ten-year interval between the publication of data showing that thrombolytic therapy was the best treatment in the management of acute myocardial infarction and its actual introduction as standard therapy.

Conversely, the routine use of lignocaine in uncomplicated infarcts persisted for almost as long after it was shown to be useless. This state of affairs has continued because the medical profession has not so far had a structured system of disseminating the best available evidence to practitioners. As a result, national healthcare systems at the cutting edge are investing heavily in developing systems to identify and disseminate the best available information so as to assist practitioners in providing the best quality of care possible. Moreover, in times of scarce resources, it becomes even more vital that these are used as effectively and efficiently as possible.

The five step process

The development and practice of EBM is a long-term, self-directed process which requires 5 sequential steps:

1. Question formulation
2. Searching for the evidence
3. Critical appraisal
4. Implementing evidence
5. Evaluation of the performance and impact of this process

1. The formulation of a precise, clinical, answerable question concerned with the care of patients

This could include questions related to diagnosis, prognosis, therapy, harm, health care economics or guidelines amongst others, and should also specify the clinical outcomes of interest.

A 60-year old woman is admitted with a swollen left calf. The Doppler Ultrasound has confirmed the presence of a deep venous thrombosis. The patient is otherwise asymptomatic and insists that she does not wish to remain in hospital. The question arises as to whether low molecular weight heparin would be a safe alternative on an outpatient basis.

This scenario is not unusual in that it has been well-shown that in the course of clinical practice, questions frequently arise to which the answers are not easily available, but which will obviously impact on the quality and cost of the healthcare provided. One study revealed that an average of five questions are generated per medical inpatient⁹ and two for every three outpatients seen¹⁰.

2. Searching the literature for the available evidence

What would be the best way to answer the question above? The areas one could search include textbooks, journals, electronic databases such as Medline, other electronic resources such as Best Evidence, American

College of Physicians (ACP) Journal Club, or Evidence-based Medicine, the Cochrane Library, Data of Abstracts of Reviews of Effectiveness (DARE), the Internet and newer publications such as Clinical Evidence.

Textbooks

The problem with textbooks is that from the moment of publication, they are out of date as regards the areas covering diagnosis, prognosis and therapy and are unlikely to survive the electronic age as first-line providers of information pertaining to patient care. Alternatives in the form of CD-ROM textbooks such as Scientific American Medicine are starting to appear. These have regular updates and are also starting to offer Internet-based texts.

Journals

Journals are good for browsing and keeping generally informed, but they are too disorganised to help in seeking the solution to a particular problem as above.

Medline

The next port of call is MEDLINE which is currently the best available information source to answer questions owing to its breadth and to its being constantly updated. MEDLINE is an electronic database produced by the National Library of Medicine (NLM) including citations to all important studies, both clinical and non-clinical. There are over 27 versions of MEDLINE currently available, including CD-ROM based, online systems and Internet versions. CD-ROM based versions include Silver Platter system (available at the local Medical School Library), Aries and OVID (one of the most popular forms due to its facility of use). There is free access to this version for all BMA members with a modem over the Internet. Online access via modem is also available through several subscription services including NLM (Grateful Med). HealthGate internet access is available through Medical Matrix. Ready access to MEDLINE is its strength, but finding the information required can be time-consuming. Also, most clinicians will not be aware that a 'MEDLINE' search will only identify 50% of relevant articles, unless carried out by those trained in specific searching techniques. Increasingly, secondary sources are being developed to help the individual clinician. These will be discussed later.

Trying to answer our question as to whether an alternative exists to treat our patient's deep venous thrombosis, we could try a 'MEDLINE' Search. The following is an example tried out using MEDLINE PLUS available on the internet.

Selecting the database MEDLINE 1996 to present, the key term 'deep venous thrombosis' is mapped to the following subheadings: thrombophlebitis, post-op complications, phlebography, heparin, pulmonary embolism, thrombosis, plethysmography, thromboembolism, fibrinogen, streptokinase. One can then 'explode' or 'focus' the search so as to expand or narrow the search, depending on the number of citations generated. In our case, typing in 'low molecular weight heparin' produced 1688 citations, so an attempt was made to reduce these by 'focusing'. This allows a reduction in the number of citations generated. This revealed 'Enoxaparin (223 references), Nardaparin (98

references) and Tedelparin (113 references). These were further limited using 'Human', 'English language', 'Reviews', and 'Abstracts' resulting in 179 references. 'Limiting' further by including 'latest update' produced a manageable 10 references, whose abstracts were then rapidly downloaded to assess their usefulness. The total searching time was approximately 10 minutes. Conducting a search on MEDLINE takes time because of the amount of material available. Also the approach will vary depending upon the type of version being used, so that what works well with one form will not work as well with another.

Best Evidence

Possible alternatives to answering our question include other electronic resources such as 'Best Evidence', 'ACP Journal Club', or 'Evidence-based Medicine'. One way of saving time is to use resources that only utilise methodologically sound and clinically relevant articles such as 'ACP Journal Club' for Internal Medicine and 'Evidence-Based Medicine' for all major specialties. These are available in paper form and, since 1991, have combined to form an electronic database called 'Best Evidence' which covers approximately 85 major journals.

Searching 'Best Evidence' for Low Molecular Weight Heparin reveals many references, one of which is a report of a randomised control trial comparing patients on subcutaneous low molecular weight heparin treated in hospital and at home, where outpatient therapy was as safe and effective as in-hospital therapy¹¹.

Cochrane Library

Other resources that could be utilised include the Cochrane Library. This was set up with the idea of having a 100% accurate medical database that is easy to use. It includes the Cochrane Controlled Trials Register, the Cochrane Database of Systematic Reviews, DARE and the Cochrane Review Methodology Database on the Science of Research Synthesis. These are available on CD-ROM or on the Internet (See Table). The library is published by an international medical collaboration where all published trials are reviewed methodologically so as to prepare a database of effective management that is available in a user-friendly form. It is generally considered that by the year 2000, this will be the first port of call for busy clinicians responding to their information requirements.

The Internet

Finally, one last possibility is using the Internet to obtain 'evidence'. At present one can find most of the major general journals on the Internet including The Lancet, British Medical Journal, New England Journal of Medicine and Annals of Internal Medicine (See Table 1 for Internet addresses). The Internet also features sites where clinically-relevant information is available such as Medical Matrix. Also, it features sites such as BioMedNet which is an internet community for biological and medical researchers. It has a library where any article from listed journals can be obtained in full text against a small fee.

The Internet will be answering many of the information needs of physicians in the future. It is also changing the way information is processed and

Table 1 - Internet addresses (Web Sites)

INTERNET SITE	INTERNET ADDRESS
Annals of Internal medicine	www.acponline.org, JAMA or www.ama-assn.org
Best Evidence	www.acponline.org
BioMedNet	www.biomednet.com
British Medical Journal	www.bmj.com
Cochrane Collaboration	www.update-software.com/ccweb
Medical Matrix	www.medmatrix.org
New England Journal of Medicine	www.nejm.org
The Lancet	www.thelancet.com

disseminated. For example, eBMJ is a full-text, electronic form of the BMJ, which allows a customised service with the possibility of having articles in specific areas mailed directly to you through e-mail with each new issue of the journal. This service is already operative and is open to anyone with internet access. Moreover, the site allows more correspondence to be carried than the paper-based journal and allows quicker turn-around of information. It has recently taken the radical decision to make the full-text journal available on-line at no charge to users.

Newer resources

These include 'Clinical Evidence' (BMJ Publishing Group and the American College of Physicians), due in book form in June 1999, and later in electronic form. It is a compendium of the best available research findings on common and important clinical questions, updated and expanded every six months aiming to make it unnecessary for clinicians to trawl the literature for systematic reviews and randomised controlled trials. The publication identifies the questions (which address the effects of preventative and therapeutic interventions), conducts the searches, and summarises the results. Structured summaries emphasise the balance between benefits and harms of different interventions. Contributions are written by practising clinicians with expertise in evidence-based medicine.

3. Critical appraisal of the literature

This implies assessing how valid the data is, how important the effect and how useful it would be to your particular patient. Evidence from clinical research studies is classified as being better than reasoning from basic pathophysiology or clinical intuition. The scope of the exercise is to ensure that the information is really applicable.

For example with respect to our example above, an article was identified¹² and appraised. In interpreting such data, it is important to assess the validity of the trial by answering some basic questions which assess the methodology by determining whether the trial was randomised (in our case it was), and whether all the patients entered into the trial were accounted for (they were). Also important are other points, such as whether the patients and clinicians were blind (not possible in this case), whether both groups were otherwise treated equally (they were) and whether the groups were similar at the start of the treatment (they were). Describing critical appraisal in a brief article is well nigh

impossible. A workshop covering a week just scratches the surface! Reference to more lengthy publications is therefore required^{13,14,15,16}.

4. Implementing this evidence with the patient

At this point, the best clinical information meets clinical expertise. In deciding whether to apply information obtained to the patient, certain points need to be clarified.

- Are the results applicable to your patient? Is the patient so different from those in the trial that its results cannot help? How great would the potential benefit of therapy actually be for the individual patient? (Again, in our case the results are applicable and the potential benefit for the patient is equivalent to 'standard' therapy.)
- Are the patient's values and preferences satisfied by the regimen and its consequences? (yes). Do the patient and the clinician have a clear assessment of the patient's values and preferences? (yes) and are these being met by this regimen? (yes, in fact in our case, far better than the alternative). Again further reading is required to develop an understanding of the area^{13,14,15}.

5. Evaluation of the performance and impact of this process

This can take place on an individual basis, with the clinician comparing his practice with others who are also trying to practice evidence-based medicine. Alternatively, it can be encouraged in institutions by facilitating comparison between similar units and encouraging the development of guidelines which are rigorously assessed for promoting actual best practice. The latter will only be encouraged if clinicians consider that any development will be for the better and if developed from within rather than imposed from outside.

At face value, most clinicians will consider that the above is close to their current practice, but when compared, it is obvious that the diversity of practice is not consistent with this statement. Often, the cause is the weakness of the underlying evidence. When a comparison was made of clinicians who had been trained in "traditional narrative learning" with those who had been given basic training in EBM there were significant differences in clinical competence. Moreover, the approach persisted in the long-term.

Many will also comment "But this is CME!" (Continuing Medical Education). However, when practitioners were assessed¹⁷, the results clearly showed that those who most needed CME in a particular area were the ones least likely to attend and benefit from it. In other words, those clinicians who wish to attend CME in a particular area probably don't need it! They would be better off attending CME in an area which they do not wish to follow¹⁸!

A look into the future...

Future practice should ideally be guided by having critically-appraised information made easily available for the individual clinician at patient encounter, so that it could be utilised in 'real-time'. Overseas healthcare

systems are at present facilitating the development of user-friendly databases and introducing them onto hospital networks to this end. The bottom line is having easily available, accurate and up-to-date information on which to base practice, so as to provide state-of-the-art healthcare. This requires an individual effort, together with assistance, both in terms of infrastructure, protected time, training and funding.

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