

Evidence based medicine

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“Half of what you are taught as medical students will have been shown in ten years to be wrong. And the trouble is none of your teachers know which half,” said Dr. Sydney Burwell, Dean of Harvard Medical school, to his students.

New medical knowledge evolves very quickly. It is very important to keep up to date with current knowledge for care of our patients. Evidence-based medicine (EBM) changes routine reading and reviewing the journals for interesting articles into more practical process of using the literature to benefit the patient, while simultaneously expanding the knowledge base of the clinician. ⁽¹⁾

Evidence-based medicine has been defined as *“the process of systemically finding, appraising and using contemporaneous research findings as the basis for clinical decision”* or more simply as *“the judicious use of current best evidence in making decisions about the care of an individual patient.”* ^(2,3)

Origin of evidence-based medicine was in McMaster University, Ontario, Canada; in the 1980s; where a group of researchers wanted to bring about a change in approach of medical practice from one that had its foundation in personal experience to one based on scientific evidence. Methods to critically appraise clinical information and classifying it to the strength of evidence were presented in Canadian Medical Association Journal. ⁽³⁾

In the late 1980s and early 1990s, the Journal of American Medical association published a similar series on how to critically appraise literature. Concepts emerging from the literature on “critical appraisal” promoted what has become known as

Evidence-based medicine, suggesting that clinicians should use critically appraised information in clinical practice for optimal care of their patients.

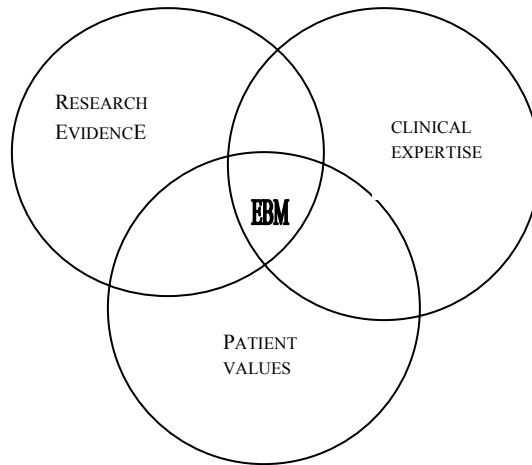
Sackett and colleagues have long argued that the clinical examination should be studied vigorously; best available evidence must be found and applied to the patient. They defined evidence – based medicine as “Integration of best research evidence with clinical expertise and our patient values”. ⁽⁴⁾

Research evidence is often from the basic sciences, but especially from patient oriented clinical research. Clinical expertise is our ability to use our clinical skills and past experience. Patient values are unique preferences, concerns and expectations each of our patient brings.

The intersecting part between the three circles, as shown in the evidence triad ⁽⁴⁾ below, is the medical evidence for a particular patient to be applied to him.

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Evidence Triad

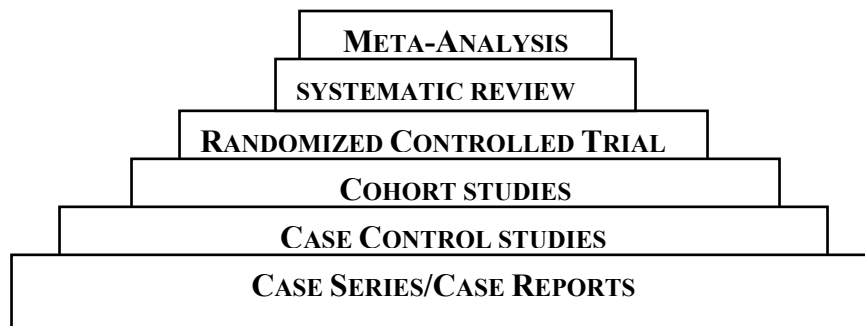
Need for evidence-based medicine

Apart from keeping up with new information and obligation of providing best care to our patients, we clinicians now have some newer responsibilities. The increased and easy access to medical information has increased patient awareness. The increase in management-led medical decision-making in West, the consumer protection act and similar movements in other countries, where non medical persons can question the medical management, has led to stress on accountability on part of clinicians. Justification of clinical decisions is much easier if it is based on sound clinical evidence. Evidence- based approach is also essential in medical reading and writings, where we need to critically appraise the available literature and compare our observations and results with those of previously published literature.

We have daily need for valid information about diagnosis, prognosis, therapy and prevention.⁽⁵⁾ There is often a disparity between our diagnostic skills and clinical judgment which increases with age; and our up-to-date knowledge which might decline with age.^(6, 7) New types of evidences are now being constantly generated, which when known and understood, create frequent major changes in the way we care for our patients. It is important for us to be able to find and evaluate these evidences.

The evidence

Following “evidence pyramid”⁽⁸⁾ shows the evidences according to their hierarchy of rigor, the one on its apex being most rigorous. As we move up the pyramid the amount of available literature decreases, but there is increase in its relevance to the clinical setting.



THE EVIDENCE PYRAMID

The evidence pyramid illustrates the evolution of the literature. The base of the pyramid is where information usually starts with an idea or laboratory research. As these ideas turn into drugs and diagnostic tools they are tested in laboratory models, then in animals, and finally in humans. The human testing may begin with volunteers and go through several phases of clinical trials before the drug or diagnostic tool can be authorized for use within the general population.

Case Report is a report on a single patient. Because they are reports of cases and use no control groups with which to compare outcomes, they have no statistical validity.

Case Series consist of collections of reports on the treatment of individual patients

Case Control Studies are studies in which patients who already have a specific condition are compared with people who do not. These types of studies are often less reliable than randomized controlled trials and cohort studies because showing a statistical relationship does not mean that one factor necessarily caused the other.

Cohort Studies take a large population and follow patients who have a specific condition or receive a particular treatment over time and compare them with another group that is similar but has not been affected by the condition being studied. Cohort studies are not as reliable as randomized controlled studies, since the two groups may differ in ways other than in the variable under study.

Randomized controlled trials are carefully planned projects that study the effect of a therapy or test on real patients. They include methodologies that reduce the potential for bias and allow for comparison between intervention groups and control groups (no intervention). Evidence for questions of diagnosis is found in prospective trials which compare tests with a reference or "gold standard" test.

Systematic Reviews usually focus on a clinical topic and answer a specific question. Extensive literature searches are conducted to identify studies with sound methodology. The studies are reviewed, assessed, and summarized according to the predetermined criteria of the review question.

Meta-Analysis takes the systematic review a step further by using statistical techniques to combine the results of several studies as if they were one large study.

We may not always find the best level of evidence to answer our question. In the absence of the best evidence, we need to consider moving down the pyramid to other types of studies.

Levels of Evidence

Level 1: Randomized Clinical Trials

Level 2: Systematic Review of Cohort Studies
Individual Cohort study

Level 3: Case-Control Studies

Level 4: Case-series

Level 5: Expert Opinion

Level 1 evidence is the highest evidence and Level 5 is the lowest, but it is still evidence.

Steps to EBM

The six steps to evidence-based medicine are- ^(9, 10)

1. Start with the patient -- a clinical problem or question arises out of the care of the patient
2. Construct a well built clinical question derived from the case
3. Select the appropriate resource(s) and conduct a search
4. Appraise that evidence for its validity (closeness to the truth) and applicability (usefulness in clinical practice)
5. Return to the patient -- integrate that evidence with clinical expertise, patient preferences and apply it to practice
6. Evaluate your performance with this patient

1. Identifying the Problem

We are often faced with many unanswered questions in our clinical practice. Clinical questions can arise from following eight areas-

1. Aetiology
2. Pathogenesis
3. Clinical features
4. Differential diagnosis
5. Prognosis
6. Treatments
7. Prevention
8. Continuing education

2. Constructing the question

The questions once identified need to be formulated in an answerable format. Unless a question is properly formulated, an accurate search for evidence will be a problem. The key elements of a well framed question include-

1. The patient or population
2. The intervention or exposure
3. The comparison intervention or exposure (if relevant)
4. The clinical outcome (s) of interest

For example, our question could be- “What is the role of antenatal steroids on foetal lung maturity of a preterm infant?” Here the population is women in preterm labour, the intervention is steroids, the comparison is between subset of patients getting steroids versus those not getting steroids and the outcome is incidence and severity of hyaline membrane disease in newborns. So, we can say that this question is well formed.

3. Finding the evidence

Medical information can be found in textbooks, articles in medical journals, bulletins, newsletters, and “grey literature” which includes unpublished materials such as reports conference proceedings, databases, theses, dissertations, and personal and others’ experiences.

Traditional textbooks have been the main source of information till late. By the time textbook reach bookstores, the information may be outdated. Some textbooks come out with online updates and are much more useful.

Finding the right evidence from over 2 million articles published in around 20,000 journals is a very difficult task. It is estimated that a doctor has to refer 30 medical journals a week to keep abreast in his specialty.⁽¹¹⁾ All this is almost impossible. This is where information retrieval services and other sources that provide the information needed in a concise form come in.

Appropriate resources of evidence

Text books with regular updates are valuable resources. We have opportunities to attend various CMEs. Traditional CME in a nice place with pleasant after lecture diversions is, unfortunately, completely ineffective in changing our behaviour.^(12, 13) Guidelines can be very useful but there are problems. They don’t all agree. We do not know which ones to use and have to determine validity. We often do not know whether they are applicable to our patients, practice or community. Once their validity is

established they are excellent resources. Experts are in the same position we are with information overload. They often look at a patient and a disease in a fundamentally different way because they deal with a selected patient population. However they are excellent resource once reliability has been established. Yet we do have daily need for valid information and we are unable to set aside significant amount of time for general reading and study. This is where the role of Information Retrieval Services and other sources that provide information comes in.

Medical databases

The easiest way of collecting evidence is from various computer bibliographic databases. The most popular database in medicine is the Medline and Embase. Subject specific databases include the AIDSLINE and TOXLINE, BIOETHICSLINE, SOCIOFILE (for social and health issues) and ECONLIT for health economics. Searching databases needs to be specific to get the best information.

Medline is the most comprehensive database that is maintained by National Library of Medicine, USA. The database includes the collection of over 4000 journals that are included depending on the quality of their research. Online access is through an interface called PUBMED, while INDEX MEDICUS is the print version of MEDLINE. The other ways of accessing MEDLINE is through providers like OVID or SILVERPLATTER. THEY require a subscription in contrast to PUBMED, which is free. Citations in the Index Medicus from 1966 are available in PUBMED; abstracts from a later date are available. The quality of a journal depends on its listing in Index medicus and other listing services like the Science citation index. Most journals and quite a few text books are online and available as compact disks (CDs), thus making the access to information easier. With the advent of Pubmed central, there is a growing trend of journals offering their full text free of charge especially to the developing countries. Some journals however restrict full text access to subscribers, while abstracts and table of contents are available free. HINARI initiative provides more than 3000 titles of journals free for developing countries.

EMBASE is the European equivalent of MEDLINE and is maintained by Elsevier. It is available online as well as CD format and requires a subscription. EMBASE contains over 9 million articles dating back from 1974 and has a strong presence in pharmacology.

Search engines

Search engines search through various websites and give out results. The most popular one is Google (www.google.com). The advantage of search engines is that unlisted “grey” literature, conference proceedings and meeting reports that are not indexed can be located. They widen the scope of the search and provide better evidence. Some of the other popular search engines are AltaVista, a general

search engine; OMNI and Oncoline that are medicine and oncology specific search engines respectively.

Medical news services

These are websites that provide the latest developments in the field of medicine online. The common medical news services are Medscape, Reuters Health, Doctor’s guide, Intellihealth and Amadeus. Subscription to most is free.

Sources of Information	
Information Source	Address / URL
Databases	
MEDLINE/ AIDSLINE/ TOXLINE	www.ncbi.nlm.nih.gov
Ovid	www.ovid.com
Silverplatter	www.silverplatter.com
COCHRANE Library	www.cochrane.org
EMBASE (Biomedical and pharmacological Database)	www.embase.com
SEARCH ENGINES	
Google	www.google.com
OMNI	www.omni.ac.uk
Oncolink	http://cancer.rhed.upenn.edu
Altavista	www.altavista.com
Medical Portals	
Amadeus	www.amaedeo.com
Intelihealth	www.medscape.com
Medscape	www.medscape.com
Reuters Health	www.reutershealth.com
Biomednet	www.bmn.com

4. Appraisal of Evidence and evidence-based literature

Once a scientific article is identified, there is a need to critically appraise it. Appraisal of an article is a three-step process as described by William F Misor. The steps are listed here-⁽¹⁴⁾

1. Initial assessment regarding the source of article- Is the journal peer reviewed? Will the conclusion benefit patient care?
2. Can the clinical questions answered by the article be applied to aetiology, diagnosis, treatment or prognosis?
3. Assessment of validity.

Following are useful resources in helping us in appraising the evidence-

Appraising evidence	
Cochrane Collaboration Handbook	http://www.cochrane.org/cochrane/hbook.htm
CASP Appraisal Checklists	http://www.phru.org.uk/~casp/resources/index.htm
EBM toolbox	http://www.med.ualberta.ca/ebm/ebm.htm

It is however an arduous task trying to scan through the mass of journals and try to appraise the evidence. Though majority of important articles for each discipline are sequestered in small subsets of journals (evidence-based secondary journals) ⁽¹⁵⁾, going through even these for each question is not easy.

Evidence-based literature

The easy option is to go for evidence-based literature. There are journals and websites devoted to evidence-based medicine. These are listed below.

Major online evidence-based databases (EBM Foraging Tools)

These resources combine many of the above resources into one tool that search multiple resources.

- A. Cochrane Database of Systemic Reviews have highest level of rigor, systematically reviews the entire English publications on a topic. Abstracts are free at their websites. Full texts are available through OVID. Cochrane reviews on the topics only contain randomized clinical trials.
- B. ACP Journal Club critically appraise two journals, the ACP Journal Club and Evidence Based Medicine
- C. InfoPOEMS Patient Oriented Evidence that Matters is published daily and is ongoing since 1996. The editors review more than 2000 studies monthly from 100+ journals, presenting only the best.
- D. Database of Abstracts of Reviews of Effectiveness (DARE) Access is through Ovid.
- E. National guidelines Clearing House is storehouse of most clinical practice guidelines, some evidence-based, some specialty based.
- F. US Preventative Task Force is an independent panel of experts in primary care and prevention, which systemically reviews the evidence of effectiveness and develops recommendations for clinical preventive services.

EBM Hunting Tools

- A. Clinical evidence is evidence-based evaluations of interventions for common clinical conditions .It is developed in collaboration with the American College of Physicians, the American Society of Physicians and BMJ.
- B. InfoRetriever is collection of systematic review and other evidence based resources. InfoRetriever includes Cochrane abstracts, InfoPOEM reviews, guidelines, clinical prediction tools, 5 Minute Clinical and much more.
- C. DynaMed is clinically organized summaries of nearly 1,800 topics and is updated daily. It includes the Cochrane abstracts, ACP Journal

Club, guidelines, its own reviews, as well as background materials.

Thus we see that Medline at Pubmed would usually be last step to track down the evidence and only few people in clinical practice need to have expertise to evaluate the literature as extensively as to be able to make systematic reviews or a metaanalysis. Instead all need information management. ⁽¹⁶⁾ Some hospitals have formed “evidence teams”, which discuss the available evidence before its application.

1. Integrating the external (from literature) and internal (from patient) evidence

The evidences of information from patient and literature may be supportive, non supportive or conflicting. The decision in later two situations then depends on multiple factors such as patient values and available standard of care. ⁽¹⁰⁾

2. Evaluation of decision making process

Once the decision has been made, the process and outcome are considered and opportunities for improvement are identified.

Limitations of evidence-based medicine

At this stage evidence based medicine is thought to have some limitations. ⁽¹⁷⁻²¹⁾ Providing evidence based health care is feared to be more costly. There is criticism that it promotes “cookbook medicine” practice and ignores the experience and judgment of the treating physician. This is in fact not true as is clear by looking at the evidence triad. The research evidence is considered along with clinical expertise and patient values. Evidence is based on mainly RCTs and systematic reviews, which are not available for all clinical problems and cannot provide answers to all clinical questions. There is a “Time Gap” between developments of research proven evidence to its widespread adoption for example this time gap was 13 years for thrombolytic therapy and 10 years for corticosteroids to speed foetal lung maturity ⁽²¹⁾.Practice of evidence-based medicine requires learning of new skills. Busy clinicians may not have time to develop these skills.

Conclusion

Evidence can enhance clinical judgment, but does not replace it. Evidence derived from critical appraisal needs to be integrated with clinical experience and patient values so that the patient is benefited. Practicing evidence-based medicine, even in remote areas is now possible because of development of strategies for efficiently tracking down and appraising evidence; creation of systematic reviews and concise summaries; creation of evidence-based

journals of secondary publications that publish the 2% of clinical articles that are valid; creation and availability of evidence-based literature and finally creation of immediate clinical use of information systems for bringing those to us in seconds. We should apply these effective strategies for lifelong learning and improving our performance.

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