Evidence Based Medicine: A Primer

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Physicians face numerous clinical decisions at the point of care. New medical treatments and technological innovations have made practicing medicine exciting and more challenging than ever. Doctors, busy as they are, have never had time to read all the journals in their disciplines. There are, for example, about 20 clinical journals in adult internal medicine that report studies of direct importance to clinical practice, and in 1992 these journals included over 6000 articles with abstracts! To keep up the clinician would need to read about 17 articles a day every day of the year.[1] Earlier there was paucity of available literature due to limitations in understanding of human biology and the absence of powerful research tools, but it is no longer true. Rapid advances in medical science, basic sciences and molecular biology have led to a huge increase in the possibilities for managing patients. In parallel with these scientific advances researchers have developed new research tools to identify which new ideas for diagnosis, treatment, and predicting outcome actually work.

There has been an information explosion along with easy accessibility to information in this era of internet. As a result we are confronted by a growing body of information, much of it invalid or irrelevant to clinical practice. Doctors not only need to know about the studies but also how to assimilate the knowledge and use them for betterment of patient care. Most busy doctors lack the time or skill to track down and evaluate this evidence. As a result there is a widening gap between what we ought to do and what we actually do, and it is this gap which evidence based medicine (EBM) tries to bridge.

The term "evidence based medicine" was coined at McMaster Medical School in Canada in the 1980s to label this clinical learning strategy.[2] EBM has been defined as "the conscientious, explicit, and judicious use of the best current evidence in making decisions about the care of individual patients".[3] EBM is a process of turning clinical problems into questions and then systematically locating, appraising, and using contemporaneous research findings as the basis for clinical decisions. It incorporates integrating individual clinical expertise with the best available external clinical evidence from systematic research. External clinical evidence both invalidates previously accepted diagnostic tests and treatments and replaces them with new ones that are more powerful, more accurate, more efficacious, and safer. Good clinicians use both individual clinical expertise and the best available external evidence, as neither of them alone is enough. Without clinical expertise, practice risks becoming a slave to evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient whereas without current best evidence, practice risks becoming rapidly out of date, to the detriment of patients. Evidence based medicine can be practised in any situation where there is doubt about an aspect of clinical diagnosis, prognosis, or management.

There are four steps in evidence based medicine: i) Formulate a clear clinical question from a patient's problem ii) Search the literature for relevant clinical articles iii) Evaluate (critically appraise) the evidence for its validity and usefulness and iv) Implement useful findings in clinical practice in other words acting on the evidence.

Framing the question

The questions that initiate evidence based medicine should be as specific as possible and can relate to diagnosis, prognosis, treatment, iatrogenic harm, quality of care, or health economics. Framing of a question can be best done by following the scheme better known by the acronym PICO.

- P: Population (patient): How would I describe a group of patients similar to mine? (condition, age, gender, etc.)
- I: Intervention (drug, procedure, etc.): Which main / new intervention am I considering?
- C: Comparison: What is the alternative to compare with the intervention? (placebo, standard of care, etc.)
- O: Outcome: What can I hope to accomplish, measure, improve, or affect?

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Searching relevant literature

While looking for evidence we should know where to look for and what to look for. Various types of study designs are available like case-control studies, cohort study, cross sectional studies, and interventional studies. Generally speaking we should follow hierarchy of evidence. Available evidence can be graded according to the strength. The strongest evidence comes from systematic reviews, followed by randomised controlled trials, cohort studies, case control studies, case series, case reports, editorials and individual opinion.

Certain types of studies are better designed to answer a particular question. If we want to look at a phenomena one should go for observational/qualitative studies. Answer regarding etiology would best come from cohort studies or case-control studies. Answers to questions pertaining to diagnosis and screening would come from cross-sectional analytical studies. Queries regarding prognosis would be answered by cohort studies. Randomised controlled trials and systematic reviews are best suited for any intervention. Because the randomised trial, and especially the systematic review of several randomised trials, is so much more likely to inform us and so much less likely to mislead us, it has become the "gold standard" for judging whether a treatment does more good than harm. However, some questions about therapy do not require randomised trials (successful interventions for otherwise fatal conditions) or cannot wait for the trials to be conducted. And if no randomised trial has been carried out for our patient's predicament, we must follow the trail to the next best external evidence and work from there.

We must look in "filtered" or "pre-appraised" sources first e.g., Cochrane Library, ACP Journal Club or other evidence based digests. If one does not find an answer to suit the question (i.e., evidence that is applicable to our patient), we must use an appropriate database to search the journal literature (e.g., Medline, PubMed, EMBASE, Web of Science, SCOPUS). One must always use a "quality filter" when searching for evidence in a bibliographic database—quality filters are search statements usually indicating study design; these statements are then combined with the subject search

Critical appraisal of literature

The third step is to evaluate, or appraise the evidence for its validity and clinical usefulness. This step is crucial because it lets the clinician decide whether an article can be relied on to give useful guidance. Unfortunately, a large body of published medical research lacks either relevance or sufficient methodological quality to be reliable enough for answering clinical questions.[4] Using critical appraisal skills one can understand the methods and results of the research and then be able to assess the quality of research.

The key steps in appraising an article are to ask oneself the following questions. 1. What are the results? 2.Are the results valid? 3. Will these results be relevant to the patient? At a first glance one should read the abstract. It is important to find out who the authors are and to assess their pedigree and their place of work, look for sources of funding and conflicts of interest. If we have an option of many articles then one should go for an article published in a reputed peer reviewed journal. Then one should pay attention to basic questions like what broadly is the topic of research? What hypothesis were the authors testing? Is the study on therapy, diagnosis, screening, prognosis or causation? What type of study was done and was the study design appropriate and pertinent to the question we are seeking an answer to? In other words the study should answer the PICO question we had formulated to begin with. If it does not answer the question then we should move to some other article. Then we can glance at the tables, figures and flow charts of participants through each stage of the study. Once we have done this we can then proceed to a critical appraisal of the paper.

The next thing to look at is, are the results valid? Validity is of two types: external validity and internal validity. External validity includes questions like whom do the results of this trial apply? Can the results be reasonably applied to a definable group of patients in a particular clinical setting in routine practice? Are the results generalizable beyond the trial setting? Internal validity on the other hand looks at the extent to which the observed difference in outcomes between the two comparison groups can be attributed to the intervention rather than other factors.

To test for validity of a study and critically appraise an article we need to ask the following questions.[5]

Who were the participants of the study?

How were they recruited?

Was there bias in the recruiting methods?

How was the data collected?

What statistical tests were used?

Where the data collection methods accurate?

Was the assignment of patients to treatment randomized?

Was the randomisation list concealed from patients, clinicians and researchers?

Were all patients who entered the trial properly accounted for and attributed at its conclusion? (Loss to follow-up rate should not exceed outcome event rate and should be equal in all groups. As rough guide a dropout rate of 5% is acceptable, anything > 20% the validity is doubtful).

Was follow-up complete?

Were patients analysed in the groups to which they were randomized?

Was there an intention to treat analysis?

Were patients, their clinicians and study personnel 'blind' to the treatment allocation?

Were the groups similar at the start of the trial?

Baseline prognostic factors (demographics, co-morbidity, disease severity, other known confounders) balanced? If different, were these adjusted for?

Aside from the experimental intervention, were the groups treated equally? What about co-interventions? Contamination? Compliance?

Acting on the evidence

Having identified evidence that is both valid and relevant, clinicians can either implement it directly in a patient's care or use it to develop team protocols or even hospital guidelines. Before we embark on implementing the evidence we must look at the results section and answer the following questions. Its only when the answers are in the affirmative and we are certain it is generalizable and applicable to the patient or the patient population, should we go about implementing the evidence. Probably the most common reporting error in medical articles is assuming that a statistically significant result is also clini-cally important. Most authors are quick to report statis-tically significant differences, but many never bother to say whether the difference is clinically important.

The questions to be asked are

Appraising applicability

- Were the patients in the two limbs similar for demographics, severity, co-morbidity and other prognostic factors?

Is the treatment feasible in my clinical setting?

Will potential benefits of treatment outweigh potential harms of treatment for my patient?

What are the results?

How large is the treatment effect?

Are any of the differences between the treatment groups statistically significant ($p<0.05$)?

Could the treatment effect have arisen by chance?

What is the absolute risk reduction?

What is the relative risk reduction?

Did the study have a sufficiently large sample size?

How precise is the estimate of the treatment effect?

What are the confidence intervals?

Will the results help me care for my patient?

Can the results be applied to my patients?

Is there any compelling reason why they should not be applied?

Were all clinically relevant outcomes considered?

Are substitute endpoints valid?

Are the benefits worth the harms and costs?

What is the NNT (number needed to treat) for different outcomes?

Advantages of EBM

An immediate attraction of evidence based medicine is that it integrates medical education with clinical practice. Another attraction is its potential for improving continuity and uniformity of care through the common approaches and guidelines developed by its practitioners. Evidence based medicine can also help providers make better use of limited resources by enabling them to evaluate clinical effectiveness of treatments and services.

Disadvantages of EBM

Evidence based medicine has drawbacks as well. Firstly, it takes time both to learn and to practise. For teams to benefit all members should be present from the first to the last step. It can be an expensive tool as one has to

have the requisite hardware including computers and also subscriptions to the data bases to access quality literature. Inevitably, evidence based medicine exposes gaps in the evidence.[6] This can be frustrating, particularly for inexperienced doctors. Another hurdle is that electronic databases used for finding relevant evidence are not comprehensive and are not always well indexed. At times even a lengthy literature search is fruitless. For some older doctors the computer skills needed for using databases regularly may also seem daunting. Finally, authoritarian clinicians may see evidence based medicine as a threat. It may cause them to lose face by sometimes exposing their current practice as obsolete or occasionally even dangerous. At times it will alter the dynamics of the team, removing hierarchical distinctions that are based on seniority.[7]

Criticism of EBM

More than twenty years after its inception, 'evidence-based medicine' continues to invoke polarised debate. There are several areas of disagreement between EBM supporters and detractors as well as unanswered questions about the role of EBM in modern healthcare. One of the criticisms of EBM has been, it implicitly assumes that scientific observations can be made independent of the theories and biases of the observer. However it is well known that making theory-free, objective observation is impossible. All observations are affected by the world view of the observer.[8] Another criticism is that EBM grades evidence according to the methods used to collect it. Certain types of studies, such as systematic reviews, are thought to be less vulnerable to bias and therefore 'better' evidence but it is worthwhile to note that the systematic reviews are as good as the trials included in them. There are studies to suggest that randomised trials and meta-analysis have not been found to be more reliable than other research methods.[9] Third criticism is the usefulness of applying EBM to individual patients is limited. Because individual circumstances and values vary, and also because there are so many uncommon diseases and variants, hence for "an increasing number of subgroups of patients we will never have higher levels of evidence".[10] Lastly EBM could be used as a cost-cutting tool to deny treatment where interventions are not 'proven' effective. On the other hand, EBM could also increase costs when we use measures of proven efficacy of some expensive interventions.[11]

To conclude, EBM can be a useful tool, it has drawbacks when used in isolation in individual patient care. Modern medicine must strive to balance a complex set of priorities. To be an effective aid in achieving this balance, the theory and practice of EBM must expand to include new methods of study design and knowledge integration, and must adapt to the needs of both patients and healthcare professionals in order to provide the best care at the lowest possible cost.

Conflicts of Interest: None declared

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