

EVIDENCE-BASED MEDICINE: A NEW PARADIGM FOR THE TEACHING AND PRACTICE OF MEDICINE

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A new concept in the practice of medicine is gaining global recognition and acceptance. "Evidence-based medicine" (EBM) is the term used to describe this relatively novel approach to the teaching and practice of medicine. It is important that physicians become familiar with the meaning of EBM and its role in influencing the provision of patient care and use of healthcare resources worldwide.

The premise of EBM is a simple one, that excellence in patient care correlates with use of the best currently available evidence, and that physicians require a unique set of skills which are not part of traditional medical education, in order to access and utilize this information.

Historical Perspective

Historically, physicians received limited but adequate knowledge during their medical training, and added to this the experiences gained through individual patient encounters. This combination of a basic fund of information and clinical experience provided the basis for clinical decision-making. Thus, much of the evidence used to guide decisions came from patients, their patterns of symptomatology, course of illness, and response to therapy. In fact, much of modern-day decision-making still utilizes, to a significant degree, individual experience. Before the advent of randomized clinical trials, epidemiology dealt with general population health and the distribution and determinants of disease frequency. Much of the medical literature consisted of subjective case reports or series and reviews which were not scientifically rigorous. However, with the publication of the first randomized clinical trial in the 1940s, a slow but gradual proliferation of clinical research began. Clinical epidemiology emerged as a discipline where epidemiologic principles were applied to the problems encountered in clinical medicine. In the 1960s and 70s, an increasing number of clinical trials and medical journals emerged, and while a lot of this

information was valuable, much was of questionable methodologic integrity and clinical importance.

The past 20 years have seen an acceleration of the information explosion, and with it the volume of medical publications. Clinicians are now faced with the daunting task of keeping track of a tremendous amount of new and potentially important information. An early effort to provide motivated readers with the tools to locate and decipher relevant literature came from "How to Read Clinical Journals,"¹ a since widely quoted series of articles which attempted to bring physician and epidemiologist closer together.

In tandem with these developments was the growth of Continuing Medical Education (CME) as a means of keeping physicians up-to-date. In the past, this has mainly consisted of lectures given by experts. More recently, approaches such as small group learning, tutorials and interactive feedback sessions have been tried. Although it is extremely popular as a forum for information exchange and can create measurable changes in knowledge, CME has had limited impact on modifying physician performance.² This is demonstrated in studies showing poor compliance with published guidelines for the management of common conditions such as congestive heart failure, hypertension and myocardial infarction.³⁻⁵ It has also been shown that physicians' knowledge of hypertension treatment may deteriorate over time.⁶ A legitimate concern, therefore, is that many physicians will fail to recognize new and necessary changes in practice and that patient care will ultimately suffer as doctors become outdated and their performance deteriorates over time.

Evidence-Based Medicine

Evidence-based medicine has been defined as "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients."⁷ Simply put, it means applying the most recent and best information to manage patient problems. It is based on the assumption that: 1) the medical literature, and thus useful information regarding patient care, is growing at an alarming rate; and 2) in order to provide the best care for patients, doctors must be able to continuously upgrade their knowledge, i.e., by accessing, interpreting,

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Accepted for publication 10 October 1998. Received 12 May 1998.

and using the medical literature in a timely fashion. Traditionalists have perceived EBM as diminishing the role of clinical acumen and experience, fearing that the “art” of decision-making will be lost only to be replaced by “cookbooks,” such as practice guidelines and clinical pathways. However, EBM neither excludes the vital role played by experience, nor advocates the replacement of sound clinical judgment. “The practice of EBM means integrating individual clinical expertise with the best available external clinical evidence from systematic research.”⁸ EBM respects clinical skill while emphasizing the need to develop new skills in information management. The physician of the nineties, whether specialist or generalist, requires a basic understanding of research methodology to go along with practical strategies for seeking out, assessing and applying the most useful information in concert with patients’ preferences. This is the essence of EBM.

Authors and journal editors, recognizing the importance of presenting information that can be understood and used, have undertaken to standardize the way in which information is presented.⁹ A trend towards the development of “clinically meaningful” statistical measures is seen in the demise of the *P*-value as the sole indicator of a meaningful result. The terms *absolute* and *relative risk* have become familiar reading, and more recently, the use of *confidence intervals* and *number needed to treat* (NNT) have added to our understanding by bridging the gap between clinical and statistical significance.¹⁰

EBM in Practice

In the Helsinki Heart Study, a statistically significant absolute risk reduction (ARR) of 1.4% was found for the outcome of myocardial infarction (MI) in a trial of 4000 patients, comparing gemfibrozil vs. placebo.¹¹ This translates to an impressive relative risk reduction (RRR) of 34%. However, while the statistical difference of this result is not in question, its clinical significance bears close scrutiny. NNT is one way to translate significant but small absolute differences from large clinical trials into a more clinically meaningful result. In this case, a simple NNT calculation (1/ARR) demonstrates that 71 patients need to be treated for five years, in order to prevent one non-fatal heart attack. At a cost of \$50,000 per patient (our hospital cost), preventing 10 non-fatal heart attacks is a \$0.5 million venture. In examples such as this, where costly therapies require widespread use in order to provide benefit, it is reasonable for institutions and policymakers to examine the long-term financial impact in relation to other healthcare priorities.

Recent examples from our institution illustrate other ways in which EBM can affect practice. A patient with massive pulmonary embolism (PE) and a stable blood pressure is treated with t-PA in the emergency room. The

treatment decision was based on the severity of right ventricular (RV) dysfunction on echo and a low bleeding risk. The patient recovered well, but the attending internist decided to review the literature surrounding the use of thrombolysis in PE, and the results of a recently published Pulmonary Embolism Registry were found.¹² Data from this study, though not conclusive, suggests that the use of thrombolytics in carefully selected patients with massive PE may extend beyond the classically accepted indication of massive PE with hemodynamic instability. As a result of this patient encounter and subsequent literature review, the Thromboembolism Service at our hospital is now re-examining our approach to the treatment of certain cases of PE.

An elderly patient questions his primary physician about the need to take digoxin. He has a history of heart failure but has been stable for many years and is on an ACE inhibitor. A 10-minute literature search produces a recent paper from the Digitalis Investigation Group.¹³ This large multicenter study gives the most recent and definitive answer to the question, that is, that continued use of digoxin in patients such as this will not prolong life, but may reduce hospitalization rates, with minimal drug toxicity. The NNT calculation reveals that for every 12 patients treated, one hospitalization will be saved. The physician and patient, both reassured, decide to continue with digoxin treatment. The physician is confident that his practice is current, cost effective (perhaps saving hospital beds) and that his patient is receiving care based on “best

EBM Resources

There has been a proliferation of literature about EBM. User-friendly guides which provide a useful template for interested learners have appeared in prominent medical journals such as JAMA and BMJ.^{14,15} In particular, they emphasize the value of understanding the randomized controlled trial (RCT), the gold standard for assessing drug therapies, and the value of systematic overviews and meta-analysis as the best form of summary data where multiple or conflicting clinical trials exist. Textbooks, including *Evidence-Based Medicine* (a step-by-step pocket guide to EBM), *Evidence-Based Vascular Surgery*, *Evidence-Based Healthcare* and *Towards Evidence-Based Medicine in General Practice* have become commonplace.^{8,16-18}

Perhaps more intriguing is the rise to prominence of the so-called “reappraised literature.” These peer-reviewed publications retrieve and appraise recent articles from prominent medical journals through rigorous criteria. The most notable of these are the *American College of Physicians Journal Club* and *Evidence-Based Medicine*, a joint venture between the ACP and BMJ. They represent a high-quality, cross-sectional synthesis of the important mainstream literature. Published bi-monthly, they are also available on CD-ROM and serve as an instantly accessible

resource. *Evidence-Based Nursing* has also just been launched. In addition, numerous international workshops and conferences are well established to aid the acquisition of skills in practicing and teaching EBM. The most renowned take place at McMaster University in Hamilton, Ontario, Canada, and Oxford University at the NHS R&D Center for Evidence-Based Medicine in the UK.^{19,20}

The Cochrane Collaboration deserves special mention. This international network of more than 4000 scientists and clinical epidemiologists is dedicated to "preparing, maintaining and disseminating systematic reviews of health care."²¹ Cochrane Centers exist in Europe and North America, and have been founded on the principle that summary data in the form of scientifically conducted review articles (systematic overviews) represent the most efficient means by which clinicians can quickly access relevant information. The Cochrane Collaboration, through the Clinical Trials Registry, has also undertaken to catalogue all clinical trials (including those which are unpublished), an impressive undertaking. It is hoped that the collaboration will become a primary resource for health care practitioners of the future.

Potential Impact of Evidence-Based Medicine

Patient Care

EBM will hopefully modify individual patient care, leading to the use of proven therapies and diagnostic tests only where data exists to support their use, to the withdrawal of those which are unproven, and to closer scrutiny of those for which clear evidence for continued use is lacking. As physicians become more aware, patients become better educated and a more equitable physician-patient relationship ensues.

Institutions

From an institutional perspective, there will be improved resource utilization, resulting in more effective and efficient care, and reduced cost per patient. The diligent use of evidence-based clinical practice guidelines and clinical pathways is essential, as they have been shown to produce significant benefits in patient care and the use of hospital resources.²²

Health Care Policy

Clearly, government health policy must be reliant on using the best available evidence to aid funding decisions. This is especially true of initiatives to do with screening (cancer, genetics), preventative healthcare (cholesterol lowering), in determining resource distribution within communities (inpatient vs. community-based care), and in new health technology assessment. Some governments and healthcare organizations have already caught on to the value of EBM. In the UK, the National Health Service has undertaken a major initiative which uses best evidence to guide the rationalization of healthcare resources. In the

USA, the Agency for Health Care Policy and Research (AHCPR) has placed EBM as a priority, establishing an Evidence-Based Practice Program, consisting of Evidence-Based Practice Centers and a National Guideline Clearinghouse.²³

Medical Education

In medical education, there has been a progressive worldwide trend toward programs which espouse self-directed, problem-based curricula which have been shown to produce more up-to-date physicians. The natural extension of this at the postgraduate level has been much slower to take hold, in part because of the lack of effective consultant role models upon which to base such a curriculum.

EBM and the Middle East

Emerging healthcare systems, such as those in the Middle East, have the opportunity to gain from the experience of those in developed countries which now face crises in resource management. Evidence-based medicine has the potential to steer such systems away from cost-ineffective practices and to equitable distributions of healthcare funding among primary, secondary and tertiary care. It is especially relevant to those countries with adequate resources to support such program development.

Recognizing that the use of best evidence is a necessary component of program development and healthcare delivery requires a philosophical change analogous to the "paradigm shift" described by the EBM Working Group.⁷ In other words, a comprehensive, progressive approach and a commitment to retrieving in a systematic fashion the best current data. In many cases, this may require a willingness to forgo the allure of "high-tech" care. Numerous Western nations are battling costs of technologies which are of uncertain benefit. Recent examples include the emergence of electron beam computed tomography for "coronary calcium scanning,"²⁴ the widespread use of angiotensin-converting enzyme inhibitors and calcium channel blockers as the initial treatment of essential hypertension, when effective, cheaper alternatives (beta-blockers and thiazide diuretics) exist, and the prescribing of cholesterol-lowering agents for low-risk populations. In large part, their use reflects aggressive promotional campaigns by healthcare industries. Purchasers must, therefore, develop healthy skepticism towards attractive products for which evidence of meaningful clinical efficacy may be lacking. A "good deal" may not be cost effective if the test or treatment in question is of unproven benefit.

Pursuit of an evidence-based agenda requires the commitment of hospital administrators to provide their professional staff with essential resources and technology. This includes adequate and accessible library and internet (Medline) facilities. Hospitals must look toward the

implementation of clinical pathways and guidelines, adapted where necessary to local circumstances. Their use underscores the value of evidence-based decision-making, encourages effective resource utilization, and provides for continuous reassessment of the effectiveness of current practices. The skills to design clinical pathways are easily acquired and their use should not be restricted to major or tertiary centers. Healthcare providers who can implement such evidence-based maneuvers will have a significant advantage in the provision of cost-effective and efficient healthcare.

Adopting a comprehensive evidence-based health policy also requires grassroot support. This begins with medical education where, in parallel with the required molding to pass exams, there must be an emphasis on the principles of clinical epidemiology and EBM. This in turn requires the support and commitment of university professors of medicine and clinical educators, not only as teachers of EBM but as role models of its practical use. In many cases, this will require a reappraisal and reshaping of one's own practices and teaching methods. For the uninitiated, a workshop such as those offered at Oxford or McMaster universities would be a good starting point.

Health ministries and academic institutions should consider examining the feasibility of establishing their own EBM centers or collaborative initiatives in conjunction with existing international networks, such as the International Clinical Epidemiology Network (INCLIN),²⁵ or through links with the NHS or AHCP, to serve as a focal point for education and information dissemination.

Summary

Physicians have long used evidence to support clinical decisions. However, both the nature and quantity of evidence have changed drastically in the last 20 years. The proponents of evidence-based medicine argue that only through the development of skills in information management can individual clinicians be confident that they are providing their patients with the best possible care. Since first espoused in 1992, EBM has taken a foothold in North America and Europe. Its impact is seen across the spectrum of healthcare providers, from physiotherapists and dentists to nurses, physicians and beyond. Medical educators have recognized the importance of producing a generation of physicians skilled in information management, and for whom a career in medicine is synonymous with lifelong learning.²⁶ Hospitals, through the use of clinical pathways and guidelines, are applying the principles of EBM in concerted efforts to improve quality of care and to curb costs. Likewise, health policymakers have seriously undertaken to put weighting of evidence at the forefront of decision-making in an attempt to distribute shrinking resources wisely. The greatest challenge may lie with individual physicians who are outside of academic medical

centers, many of whom feel the rhetoric is inapplicable to their own practice. It is to this majority that we must strongly address the message, for they represent the vast bulk of practicing physicians, and thus have the greatest impact on the provision of quality care.

Finally, the practice of EBM is especially relevant to regions such as the Middle East, where health care delivery systems are evolving, where the educational and management tools exist and where resources, though finite, are sufficient to implement it. It is incumbent on academic centers and healthcare policymakers to adopt and disseminate the philosophy of EBM sooner rather than later. Embracing an EBM philosophy now may be the pivotal step towards provision of "best care" in the new millennium.

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