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SYMPOSIUM

Evidence-based Medicine: Top Ten Things to Know!

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ABSTRACT

Evidence-based medicine is the conscientious use of the current best evidence in making health care decisions. It involves the incorporation of research findings, patient values and preferences, clinical circumstances and your own clinical expertise.

This approach is not a blinkered adherence to only randomized trials, but to the best available evidence in clinical decision making. The skills of an EBM practitioner require asking clinically important questions, conducting searches for the best available evidence, appraising this evidence critically, and deciding whether to apply this evidence to patients.

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INTRODUCTION

Despite its relatively short history, the growth of evidence-based medicine has been remarkable. The immense volume of articles, textbooks and educational resources that has been produced in the past 2 decades on the principles and practices of evidence-based medicine are impressive and impossible to quantify. For those seeking to learn about this approach to the practice of medicine, the task can be an overwhelming one. In this article, we summarize what we feel are the top 10 things to know about evidence-based medicine, from its basic definition to its fundamental principles.

WHAT IS EVIDENCE-BASED MEDICINE?

Evidence-based medicine, as defined by David Sackett, 'is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients'.[1] The clinical practice of evidence-based medicine necessitates the integration of clinical expertise and judgment with the best available evidence. Irrespective of the medical condition being treated, physicians must approach each clinical encounter individually to account for patient preferences and societal values while identifying, critically appraising and appropriately applying the best available clinical evidence.[1,2]

WHERE DID EVIDENCE-BASED MEDICINE ORIGINATE?

The shift toward critically appraising and applying evidence to clinical decision making—as it relates to the modern day practice of evidence-based medicine—began in the 1970s under the leadership of David Sackett at McMaster University in Hamilton, Ontario, Canada. Along with other dedicated epidemiologists, he puts forth a series of publications to educate clinicians on methods to appraise the literature and was an active proponent of incorporating such evidence into clinical decision making. The official term 'Evidence-based medicine' was coined in 1990 by Gordon Guyatt, an internist and clinical epidemiologist also at McMaster University. An international 'Evidence-based Medicine Working Group' was subsequently formed to educate clinicians on practical methods to apply medical evidence to clinical practice.[3,4] The practice of evidence-based medicine continues to become widespread and embedded within the daily practice of an increasing number of clinicians across the globe.[5]

WHO SHOULD PRACTICE EVIDENCE-BASED MEDICINE?

On moral grounds, the paradigm shift from eminence-based to evidence-based medicine is one that should be embraced by all physicians. First and foremost, patients deserve and rely on physicians for the best available care. Second, modern medicine continues to evolve as new evidence, perpetually contests and changes customary practices. A physician who takes immunity from the medical literature cannot be certain they are providing optimal health care to their patients; such is also the case for a physician who passively accepts all medical research as valid truth. Accordingly, to fulfil the moral obligation of providing patients with high-quality care, physicians must adopt an evidence-based practice that couples the clinician's expertise with support from critically appraised, high-quality evidence. Herein lays a fundamental principle of evidence-based medicine.

LOCATING THE EVIDENCE

With the ever expanding amount of medical literature and the time constraints of a busy clinical practice, the challenge of remaining current with evidence cannot be overlooked. With the shift to electronic journals, the efficiency of identifying and accessing medical evidence has improved substantially. Several electronic health databases are readily available, such as PubMed and Ovid that allow for manual article searches. The Cochrane library is yet another highly-valuable source that provides access to six databases. Notably, the Cochrane database of systematic reviews offers

high-quality review articles that provide a summary of the best available evidence. This circumvents the need to read and appraise several individual articles on any given topic. Innovative methods continue to be developed to aid busy physicians in their evidence-based decision making. UpToDate is an online knowledge system that allows physicians to search individual medical topics to obtain the most current treatment recommendations that are evidence-based. In the orthopedic specialty, OrthoEvidence is an electronic service that was launched in 2011 to provide the global orthopedic community with preappraised summaries of newly published high-quality orthopedic trials on a monthly basis.

HIERARCHIES OF EVIDENCE

A fundamental principle of evidence-based medicine is that all evidence is not equal. The validity of a study's conclusions and the confidence with which such results can be accepted to inform clinical decision making are highly contingent upon its design and methodological quality. To aid clinicians in judging the quality of evidence, hierarchies of evidence have been established that rank order studies by design. The top of the hierarchy consists of studies that have implemented safeguards, such as randomization, which protect the study from biased and inaccurate results. These studies typically include randomized controlled trials (RCTs) and systematic reviews of RCTs. Lower in the hierarchy are studies with less robust study designs and a higher susceptibility to biases that may compromise the validity of results. These studies usually include those of an observational type, such as cohort and case-control designs.[6]

APPRAISING THE EVIDENCE

An integral skill set required for the practice of evidence-based medicine is that of critical appraisal. Even for a given study design within a certain level in the hierarchy of evidence, there exists a substantial potential for variability in study quality that can alter the reliability of the study's results. For each study design, clinicians should be able to appraise the methodological rigor of the trial. In the case of a randomized trial, this would include an assessment for study characteristics, such as allocation concealment, blinding, sample size calculation, loss to follow-up and intention-to-treat analysis, to name a few. The details regarding various study designs and the methodological considerations needed when appraising each study type are discussed in the paper 'Research made easy: Answering important questions with valid designs'.

RANDOMIZED CONTROLLED TRIALS

The gold standard study design for evaluating the efficacy of an intervention remains the RCT. The strength of an RCT lies in the power of randomization (random allocation of patients to treatment groups), which balances treatment arms of the trial for both known prognostic factors as well as unknown prognostic factors. By balancing groups for known and unknown prognostic factors, a potential source of significant bias is diminished.[6] In a hypothetical scenario, suppose we were interested in studying the effect of ultrasound therapy on the rate of fresh fracture healing. Also suppose that 25% of the population carried an unknown gene, 'x', that imparted on them a resistance to the beneficial effects of ultrasound. In an RCT design of sufficient sample size, we would expect the power of randomization to evenly distribute patients with the gene 'x' to all treatment arms. In an observational study, however, such equal distribution would not be guaranteed as this prognostic factor would be 'unknown' to the study authors. With unequal distribution, the study results may be biased to falsely overestimate or underestimate the true effect of ultrasound therapy.

SYSTEMATIC REVIEWS AND META-ANALYSES

Systematic reviews of RCTs also constitute Top Tier evidence to inform treatment decisions. These reviews garner their methodological rigor through the systematic approach used to identify, collect, appraise and synthesize information. Meta-analyses expand on systematic reviews by quantitatively pooling results from the individual studies to arrive at a single best estimate of the treatment effect. The validity of a systematic review is inherently associated with the quality of studies that comprise it.[7] Systematic reviews of high-quality RCTs will provide more compelling results that are likely to dictate clinical practice, whereas the findings of systematic reviews of poor-quality RCTs or observational studies will be less compelling. Much like the RCT, systematic reviews must also be appraised for their methodological quality. As mentioned, the details of how to appraise these studies are discussed in detail in the article 'Research made easy: Answering important questions with valid designs'.

STUDY RESULTS: STATISTICAL SIGNIFICANCE, CLINICAL SIGNIFICANCE AND CONFIDENCE INTERVALS

An important issue that proponents of evidence-based medicine often highlight is the need to distinguish between statistical significance and clinical significance when interpreting the results of a study. It is common for readers to place emphasis on reported p-values, which determine if

statistical significance has been reached. Drawing conclusions solely from p-values, however, is unwarranted and potentially dangerous, as p-values do not always reflect clinically important effect sizes or account for the precision of results (confidence intervals). A study may recruit a sufficiently large volume of patients so that even small differences in treatment effect can achieve statistical significance. Nevertheless, these small effect sizes may not be of any 'clinical significance'. Furthermore, studies that reach statistical significance but have a considerable amount of uncertainty associated with the treatment effect—a wide confidence interval—should also be interpreted with caution.[8]

THE FUTURE OF EVIDENCE-BASED MEDICINE

Alongside the development of antibiotics, the advent of vaccines, and the discovery of DNA, evidence-based medicine has been deemed by the British medical journal as one of the top 15 medical milestones in the past 170 years.[4] Although challenges and critics persist, evidence-based medicine has established the new paradigm by which medicine is being taught and practiced.[9,10] In fact, the evidence-based philosophy has been adopted by allied health groups, including nurses, occupational therapists, pharmacists and physiotherapists, giving rise to the broader term of 'evidence-based practice'.[3] As it continues to gain momentum throughout the global medical community, a promising future for evidence-based medicine is unquestionable.

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