Medicine, Evidence-Based

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A hugely influential health care movement since its inception in the early 1990s, evidence-based medicine (EBM) is popularly defined as the "conscientious and judicious use of current best evidence in the healthcare of individuals and populations" (Sackett et al. 1996). EBM's doctrine first appeared in the *Journal of the American Medical Association* as a brief polemic from the Evidence-Based Medicine Working Group (EBMWG), a group of clinical epidemiologists at McMaster University in Canada: "A new paradigm for medical practice is emerging. Evidence based medicine de-emphasizes intuition, unsystematic clinical experience, and pathophysiologic rationale as sufficient grounds for clinical decision-making and stresses the examination of evidence from clinical research. EBM requires new skills of the physician, including efficient literature searching and the application of the formal rules of evidence" (EBMWG 1992).

Instead of relying on hunches, habits, and other subjective decision-making criteria, evidence-based decision-making relies on evidence, which, in turn, is supposed to support informed and unbiased reasoning. EBM began by promoting an anti-authority medical education, teaching new clinicians to read research literature critically rather than relying on the expert opinions of senior faculty. The movement soon increased in sophistication and assisted busy clinicians by offering structured abstracts, meta-analyses, and systematic reviews intended to reduce the huge mass of scientific literature to digestible formats that drew reliable conclusions. With this appealing mandate, EBM quickly rose into prominence in medicine, with virtually every area of health care now subscribing to the evidence-based mantra.

Yet EBM has still received its share of criticism. Some early critics argued that EBM offered nothing new. Modern medicine is empirically driven, they charged, and therefore medicine has always been evidence-based. But those critics were wrong insofar as much of medical practice was untested and unconfirmed by research. Moreover, EBM introduced new methodological emphases in determining what counts as the best and most reliable evidence. These innovations included the importance of subjecting all beliefs to trial – the "gold standard" status of the randomized controlled trial – and the shift in focus from pathophysiology to outcomes research.

This is illustrated by the famous cardiac arrhythmia suppression trial (CAST) of the 1980s, which is widely regarded as a paradigm "success story" justifying the evidence-based approach. At that time, established "truths" in medicine included: (1) A major cause of death following heart attack was abnormal heart rhythms. (2) These abnormal rhythm patterns could be reduced significantly by use of a certain class of anti-arrhythmic agents, so such drugs were routinely prescribed to patients after myocardial infarction. (3) The electrophysiology of these abnormal rhythms and the pharmacology of the drugs that suppressed them were well understood. It might seem completely unnecessary, then, to do an actual clinical trial evaluating the value of arrhythmia suppression after myocardial infarction. CAST was initiated because clinicians wanted

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to know which of the two rival drugs, encainide or flecainide, was more effective in suppressing these abnormal rhythms. A three-arm double-blind randomized controlled trial was devised, allowing comparison of a placebo group, encainide group, and a flecainide group. The trial tested the hypothesis that suppression of premature ventricular complexes with class I anti-arrhythmic agents after a myocardial infarction would reduce mortality. When the CAST group reported their preliminary results in the *New England Journal of Medicine*, they overturned "what everybody knew." The trial had to be discontinued early because of excess deaths in the groups receiving encainide and flecainide. Today, medical wisdom dictates that drugs of this general class do more harm than allowing arrhythmias to continue. Post-myocardial infarction patients do still die from fatal arrhythmias, but the treatment turned out to be worse than the disease.

The moral that EBM draws from the CAST tale is that no matter how well one understands the cellular and molecular phenomena associated with a disease or therapy (the "pathophysiology"), one cannot know how patients will actually respond until outcomes have been studied in a carefully controlled clinical trial. The pre-EBM medical leadership had assumed that, once one possessed a certain level of pathophysiological knowledge, one could simply extrapolate from that to the intact human organism, and from the research laboratory to the ambulatory setting. What CAST showed – and what has been further demonstrated by large numbers of subsequent similar trials – is that extrapolations can be misguided, however reasonable they might seem.

From the lessons of the CAST trial, we see that EBM redefined what constitutes the *best* research evidence: a shift from understanding biochemical phenomena at the cellular and molecular level in favor of studying intact human organisms and populations in clinical trials. Justification for practice needs to be based on evidence rather than inference. Controlled trials allow researchers to test even well-established practices and assumptions, with randomization and double-blinding reducing important forms of bias. The famed "hierarchy of evidence," in its many formations, consistently places evidence from double-blind randomized controlled trials as the most informative and reliable source (the "gold standard") (Guyatt and Rennie 2002).

Some critics take issue with the methodological assumptions underlying evidence-based practice, most notably a perceived overreliance on randomized controlled trials (RCTs). RCTs successfully minimize some forms of bias, but leave others unchecked (Jadad and Enkin 2007). They can generate strong internal validity but suffer from lack of generalizability for patients outside the highly controlled confines of the clinical research setting. RCT methodology is also more conducive to certain research questions and therapeutic interventions (Grossman and Mackenzie 2005), thereby skewing the evidence base in favor of testable outcomes rather than the most favorable health outcomes for patients.

Other critics have charged EBM with oversimplifying the process of medical decision-making in the suggestion that good evidence can directly lead to good treatment decisions. Clinical decision-making is nuanced and complex, involving both interpersonal knowledge between clinician and patient and respect for patients' preferences and values. The EBMWG has responded to such criticisms by redefining evidence-based medicine: "Evidence-based practice is the integration of best research evidence with clinical expertise and patient values" (Sackett et al. 2000). Without offering detailed instruction on how to integrate those three components, and with no change in the methodology of evidence-based practice, critics maintain that this definitional change offers no more than "lip service."

As a result of these criticisms, EBM is charged with not sufficiently reflecting the values that enter into health care research and practice. Clinical decision-making is inextricably tied to underlying values regarding what patients are entitled to (in terms of health care resources) and what duties providers have toward their patients. Thus treatment decision-making is a normative process that can at best be informed, but not decided, by even the most reliable evidence (Dickenson 1999). The generation of experimental evidence depends on underlying assumptions and subjective preferences when formulating the research question, designing the trial, and interpreting of data. An appeal to the authority of evidence hides power interests and brings EBM's supposed stronghold on *reliability* into question (Goldenberg 2006). For instance, the reliance on published RCTs as the major source of evidence upon which to base practice guidelines tacitly allows the pharmaceutical industry greatly to influence medical practice, as the industry funds over 60 percent of clinical trials in Canada and the United States. "Big Pharma" is already known to generate trial data that are biased in favor of its products, and the industry carefully controls its product information through ethically questionable university–industry research relationships, as well as gift-giving and "free lunch" marketing to health care professionals.

In the end, EBM provides valuable tools for challenging untested assumptions and practices, making medical practice more responsive to the research literature, and proliferating important knowledge through online resources and clinical guidelines. The critics' warning that EBM is only as good as its evidence is a challenge for this prolific movement to reflect on its own practices and to follow its own directive by subjecting EBM's underlying assumptions to critical scrutiny.

SEE ALSO: Adverse Drug Reactions; Clinical Trials; Medical Knowledge; Medical Research; Pharmaceutical Industries

REFERENCES

Dickenson, D. 1999. "Can Medical Criteria Settle Priority-setting Debates? The Need for Ethical Analysis." *Health Care Analysis* 7: 131–137.

EBMWG. 1992. "Evidence-based Medicine: A New Approach to Teaching the Practice of Medicine." *Journal of the American Medical Association* 268: 2420–2425.

Goldenberg, M. J. 2006. "On Evidence and Evidence-based Medicine: Lessons from the Philosophy of Science." *Social Science & Medicine* 62: 2621–2632.

Grossman, J., and Mackenzie, F. J. 2005. "Randomized Controlled Trials: Gold Standard, or Merely Standard?" *Perspectives in Biology and Medicine* 48: 516–535.

Guyatt, G., and Rennie, D. 2002. *Users' Guides to the Medical Literature: A Manual for Evidence-Based Practice*, 2nd ed. Chicago, IL: American Medical Association.

Jadad, A. R., and Enkin, M. W. 2007. *Randomized Controlled Trials*. Chichester, UK: John Wiley & Sons.

Sackett, D. L., Rosenberg, W. M., Gray, J. A., Haynes, R. B., and Richardson, W. S. 1996. "Evidence-based Medicine: What It Is and What It Isn't." *British Medical Journal* 312: 71–72.

Sackett, D. L., Strauss, S. E., Richardson, W. S., Rosenberg, W., and Haynes, R. B. 2000. *Evidence Based Medicine: How to Practice and Teach EBM*, 2nd ed. London: Churchill Livingstone.

FURTHER READING

Timmermans, S., and Berg, M. 2003. *The Gold Standard: The Challenge of Evidence-Based Medicine and Standardization in Health Care*. Philadelphia, PA: Temple University Press.

Timmermans, S., and Kolker, E. S. 2004. "Evidence-based Medicine and the Reconfiguration of Medical Knowledge." *Journal of Health and Social Behavior* 45: 177–193.