

Evidence-based medicine: A primer for the emergency medicine resident

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“Evidence-based medicine” (EBM) is a catch phrase both overused and underused in the world of medical academia. The concept of teaching evidence rather than tradition and anecdote and the practice of basing decisions on available evidence are alluring. However, the practical reality of EBM can be misunderstood and the term misapplied. Trainees in the field of emergency medicine have a particular need and also a responsibility to understand what EBM truly is, what its limitations are, and how to use it to pursue a scientific ideal without obscuring what is right for each individual patient. This article offers a guide for residents in understanding what EBM is, what it is not, what it is not yet (what its future directions are in our specialty). We also offer a brief background and discussion of EBM, including its perceived strengths and weaknesses, and a list of current resources available to emergency medicine residents in everyday practice.

A brief history

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The future of emergency medicine and medicine in general is molded by its past, both distant and recent. Andreas Vesalius lived and practiced medicine some 300 years ago in the Scientific Age, when deductive reasoning and scientific principles began to heavily influence the leading thinkers of the western world. Vesalius, at the age of 28, wrote the first correct and practically useful anatomy text *De Humani Corporis Fabrica* and, in doing so, paved the way for modern scientific medicine. He based his teaching and writings of anatomy on hundreds of personally completed dissections of human cadavers. This practice outraged his contemporaries, who based their authoritative (although wildly inaccurate) teachings on early texts, animal studies, and speculative theorizing.¹ The work of Vesalius was impressive and revolutionary; however, in the publication of evidence-based reasoning, Vesalius was preceded by some 2,000 years: “In Medicine one must pay attention not to plausible theorizing but to experience and reason together... . Conclusions drawn from unaided reason can hardly be serviceable; only those drawn from observed fact.” Hippocrates wrote these words in the fourth century BC.²

In contemporary medical literature, the first paper³ that brought national attention to EBM as a potential “paradigm shift” in the medical establishment was published in the *Journal of the American Medical Association (JAMA)* in November 1992. Entitled “Evidence-based medicine: A new approach to teaching the practice of medicine” and authored by the Evidence-Based Medicine Working Group (primarily led by Dr. Gordon Guyatt), this paper defined the concept and coined the phrase to an international audience. It outlined the mission and basics of EBM and described an EBM-oriented resident education system already in place in Ontario, Canada.³

The medical literature that has followed this paper has reinforced its foundation. A simple MEDLINE search on the words “evidence based medicine” tells the story of EBM’s development. This search term yields 0 items in the databases before 1990, 18 items in the database covering 1990 to 1994, and 1,432 items in the database of 1995 to 1998. From 1998 to the present, almost 5,000 items can be found.

The medical literature in general now abounds with clinical guidelines and decision rules that invoke “EBM” as a central principle in their formation. The phrase “Evidence-Based Medicine” has

become nearly ubiquitous in medicine among fields ranging from acupuncture⁴ to smoking cessation⁵ to blunt abdominal trauma.⁶ Evidence that EBM has become an integral part of teaching residents is also abundant. Although important research on resident education (including randomized trials) was published before the influence of EBM,⁷⁻¹² these studies lack a central focus on evidence-based teaching, a focus that marks the more current medical literature. Since the original paper, evidence-based journal clubs and workshops,¹³⁻¹⁷ as well as specific EBM and statistically oriented teaching, have been described and evaluated repeatedly within residencies all over the country.¹⁸⁻²⁶

What evidence-based medicine is to the resident physician

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EBM is based on more than a whim or a fad; it is based on a perceived need for information rooted in evidence. Textbooks are convenient and familiar but may be up to 10 years out of date.²⁷ According to Sackett et al,²⁸ EBM is “the integration of best research evidence with clinical expertise and patient values.” It is based on knowledge of and access to the medical literature. EBM is interactive, requiring the generation of a clinical question, the evaluation and understanding of a patient’s values and goals, and the application of relevant evidence to a patient encounter. It is an information-gathering skill that can be taught to residents.^{19,21,22,24,25} And, more important, this information is sought by residents. The need for information and the frequency with which clinical questions are generated during practice among residents has been demonstrated to be impressive.^{29,30}

The medical literature that demonstrates this need for information is based on the same field of medicine as EBM—internal medicine. Emergency medicine is a field with broad applications, broad knowledge requirements, and time-sensitive issues in need of deliberate and quick resolution, raising the specter of an even more immediate and broad need for access to answers in everyday practice. Emergency department needs are uniquely difficult to anticipate, may require immediate clinical decisions, and represent patient encounters during unique time periods of care that may heavily impact or even determine outcome. In addition, in those patient encounters in the ED in which impact on outcome is less apparent or less immediate, there is frequently little guarantee of follow-up care and therefore little chance for changing management or tailoring therapy. Therefore, whatever information needs have been demonstrated in the past may actually be underestimated in relation to emergency medicine. EBM is being taught and practiced by many physicians in many other fields of medicine. Emergency residents must take it on themselves to create access to resources and to use them when they are available, because, without the skills to use these resources, many believe that emergency medicine will fall behind. The proponents of EBM assert that evidence-based skills are fast becoming a mandate in order for emergency physicians to provide the level of care that patients will both expect and deserve.

What evidence-based medicine is not to the resident physician

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EBM is not a replacement for the foundations of learning. The basics such as physical examination, history taking, and diagnostic reasoning cannot be replaced with attempts to apply EBM to individual patients. In fact, EBM presumes that the patient encounter will be thorough, accurate, and informed enough to appropriately generate the correct clinical question. Investigating and finding that acute bronchitis in a patient does not require antibiotics is of no value if the patient has bacterial pneumonia. Without the integration of sound clinical skills and judgments, EBM is not medicine. EBM is not too cumbersome to use or so simple that it can be applied in a rote and unthinking fashion.²⁸

EBM is not a method of practice easily applied by an individual without resources and assistance. EBM requires access to literature sources and relies at times on the sound, principled work of others, such as the Cochrane Collaboration Group. Most individual physicians have neither the time nor the complete set of skills necessary to statistically and analytically answer the clinical questions they generate each day and with each encounter.²⁸ Finally, evidence-based practice is not a dream for the future. With current technologies and resources, it is an ideal that can be aspired to today.

What evidence-based medicine is not yet

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The efficacy of teaching EBM has been difficult to assess and is considered dependent on the experience and quantity of the faculty available to teach it.³¹ Therefore, faculty knowledge and use of EBM must be commonplace if EBM is to be passed down to the emergency medicine resident. Currently, emergency medicine is not yet where it plans to ultimately be in terms of attending physician utilization, although this knowledge and these capabilities are growing among faculty. Emergency medicine is also not yet universally tied in to online literature and reference databases from point-of-care, an eventuality that will dramatically improve EBM use and development. A comprehensive network of specialty-specific EBM databases has not yet been developed for emergency medicine providers. Similarly, educational programs and literature appraisal resources directed at emergency care are not yet in place. In short, substantially less EBM work has been done thus far in the field of emergency medicine than will be done in the future.

Criticisms of evidence-based medicine

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Although the dissemination of EBM has been largely marked by acceptance, there have been vocal critics. These critics point out that without understanding the limits and capabilities of EBM, it is possible to mislead physicians and do harm to both student and patient. They view EBM as a new name for an old practice.^{32,33} Critics have discussed what is seen as an elitism that surrounds EBM and its proponents.³³ Some have criticized the esoteric nature of the evidence-based process^{32,34} and the concerning potential for EBM to “shackle the doctors and bind them to their will” in the name of frugality and administrative efficiency.³⁵ Some have highlighted the tendency of evidence to ignore what may be considered useful “soft data.”³⁴ Others have pointed out that, by ignoring or underestimating the degrees of uncertainty that rest in any cumulative process of reasoning (with particular attention to spectrum bias), it is possible for physicians to become presumptuous or overconfident in the ultimate soundness or likely effectiveness of a clinical decision.^{34,36}

It has been pointed out that EBM relies heavily on the quality and breadth of a medical literature database that is in the early stages of development and is in many ways incomplete for achieving answers to the questions we ask. Evidence-based practice may therefore be seen as unreliable and, in many cases, no better than clinical experience or traditional management for the clinical challenges we face. In addition, physicians interested in teaching in an evidence-based mode can feel rushed, making it difficult to convey to residents or apply to individual patients.^{27,37} The same limitations that challenge our practice and make evidence-based practice appealing (high-intensity time windows, lack of follow-up, limited time for decisionmaking) also make EBM difficult to use while practicing in a busy ED.

Resident resources to learn the principles and practice of evidence-based medicine

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Once we understand the basic elements of EBM, we must know how to find the evidence we seek, and residents must have access to a multitude of resources to accomplish this. We suggest the following:

1. A practical resource to residents is one that is either available at home or portable to work. There are several introductory EBM books that offer strong and useful discussions of the topic with suggestions on how to start practicing EBM immediately.^{27,38-43} The local medical bookstore is likely to carry them or be able to order them.
2. It is critical to have access to computer databases of the medical literature. Basic medical literature searches will be the staple of the EBM practitioner. Although most US residency programs do have computer access for residents, outside of the United States this may be a barrier. If there are not Internet- and database-capable computers currently available for online use inside your ED, we recommend suggesting and requesting their placement there.
3. Collaborative topic reviews are available online through multiple sources and offer a “best evidence” look at numerous organized collections of medical literature. *Clinical Evidence* is an offshoot of the *British Medical Journal* that offers new summaries and analyses of recent and clinically important study publications. The *ACP Journal Club* is another ongoing database of topic reviews that offers evidence-based discussions of pooled and individual data on many topics. The *Cochrane Database of Systematic Reviews* is a tremendous and impressive database of thoroughly researched answers to relatively specific clinical questions. Each of these resources is available through most basic medical literature computer access systems such as Ovid. Other literature-based resources are also available. Of note is a series of articles in *Annals of Emergency Medicine* that has been directed at “bridging the gap between research and practice” in an attempt to bring EBM into wider recognition and use among attending and resident physicians alike while the field continues to grow and foster its EBM base.⁴⁴
4. Use the best resources that residents have: their faculty. Some of your faculty members may be practitioners of EBM. Unfortunately, this may be difficult to find at many institutions because of the relative youth of emergency medicine as a specialty in the field of EBM. Do not limit yourself to emergency medicine faculty; there may be other faculty members who can provide a sense of how EBM can be integrated into clinical practice. Find out what resources have been most helpful to the attending physicians whom you work with, what they have become most comfortable with, and whether and how they seek out and apply the principles of EBM in their own practice.
5. For those who are interested in going farther, basic classes in epidemiology and biostatistics will offer the beginning tools for a deeper understanding of how to use clinical research in a way that has applications to individual, everyday practice.

Imagine having the knowledge and experiences of the entire history of the world's medical literature and the ability to pool that information of millions into a database available to one. Now imagine having the skills and ability to efficiently use that information to deduce a specific answer to a specific clinical question. This is the strength and the ideal of EBM. It is also a reality that is potentially attainable today. The popularity of evidence-based practice comes at an important juncture in medical and human history. With the worldwide dissemination of basic and advanced medical information in the form of the Internet, clinicians are increasingly expected to have access to data and the skills to interpret that data.

The “information age” is upon us, and access to this information is increasing. The resident physicians of today and tomorrow are the physicians who are most facile and comfortable with the information age and the technology it brings and must be ready to offer their assistance and even their leadership in the journey toward improving patient care and outcomes through the practice and understanding of EBM. Residents should learn the basics of EBM, understand its indications and limitations, and use it in practice when possible. And, of course, they should pass

it on. In the information age, it is the deliberate, selective, and wise interpretation of that information that will improve the lives of our patients and distinguish the competent and caring physicians among us.

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