The purpose of this editorial is to conceptualize evidence-based medicine (EBM) by describing its components and creating a visual construct, and to call for an international effort to create one of the key components: a Global Medical Knowledge Database (GMKD), which was recently proposed in a letter to the British Medical Journal.1

Evidence-based medicine is not the mindless application of research results. The art of medicine is alive and well inside EBM. The discipline of EBM can be visualized as having three arms and a central core (Figure 1). The central core consists of the body of refined clinical evidence, and the three arms are clinical research, clinical questions, and clinical practice. The central core of evidence is located in databases of varying formats, in many locations, all over the world; it is sometimes hard to access. A GMKD that brings together all medical databases into one, or that links all of these databases into a seamlessly searchable resource, needs to be developed urgently.

Sackett defines evidence-based medicine as "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. Practising EBM means integrating personal clinical expertise with the best available external clinical evidence from systematic research."2-5

Behind this definition lies a field of study that involves researchers, clinical epidemiologists, educators, practitioners, and patients in a complex process of clinical decision making. Evidence-based medicine has three components represented by the three arms in the diagram: First is critical appraisal and synthesis of original clinical research results into refined, usable clinical evidence (aka the GMKD), which is the main academic component and the science of EBM. Second is the appropriate application of this evidence to an individual patient's situation, taking into account the occupational, social, ethnic, cultural, financial, emotional, and religious context of the patient. And third is recognizing, asking, and properly formulating clinical questions and then finding the answers to them. This activity links the other two arms. Those who argue that EBM is cookbook medicine that belittles the wisdom of experienced clinicians do not recognize the art in EBM. Evidence applied appropriately constitutes the wise and considered practice of medicine. Management based on no evidence or evidence applied inappropriately is a disservice to patients.

Components of the discipline of EBM

Clinical evidence: the GMKD. The GMKD does not, today, exist as a single entity. Rather it can be found in many databases, in numerous formats, all over the world. We know these databases as Critically Appraised Topics (CATs),6,7 Patient-Oriented Evidence that Matters (POEMs),8 Best Evidence Topics (BETs),9 ACP Journal Club,10 the Journal of EBM,11 or Bandolier,12 to name a few. We believe an international effort is needed to bring this information together into a single, easily accessible resource for practising clinicians worldwide.

Clinical research: conducting it, appraising it, and synthesizing it into clinical evidence.

One arm of the EBM conceptual diagram begins with creating new information through clinical research or the synthesis of multiple research studies using a meta-analysis technique. The validity of this new information is assessed using critical appraisal methods and further synthesized into evidence-based knowledge that provide answers to clinical questions. The results of this process are often packaged as CATs, BETs, or POEMs and become part of the central core of EBM: the GMKD. Systematic reviews and clinical practice guidelines are an intermediate step in creating usable knowledge in EBM and, like original research, these also must be critically appraised before deciding to accept their tenets. This process of finding, gathering together; evaluating each new piece of research, systematic review, and each guideline; and then synthesizing these evaluations into what appears to be the
“best answer” to a clinical question seems overwhelming. Fortunately, criteria for evaluating various types of articles have been formalized and outlined in detail in a series of articles published in the Journal of the American Medical Association and are also available on-line.13

Clinical questioning. The second arm that leads to the GMKD starts with a clinical encounter between a patient and a clinician. The clinician recognizes that there is a question about the care of this patient for which he or she does not have the answer. The clinician goes to the GMKD. Today that GMKD would likely be one or more of the databases mentioned above. Maybe the answer is found, maybe it is not. If the answer is not found in the GMKD, the clinician might choose to review the literature. If all goes well, an appropriate article would be found, critically appraised, and the answer to the question determined. It is unlikely this answer would be shared beyond the clinician’s immediate colleagues, because there is no mechanism in place today that easily allows this.

Evidence-based medicine not only implies that we ask questions but that we learn how to structure those questions to get the answers we are looking for more quickly. Generally, questions should be structured in terms of a patient with a problem, an intervention, and an outcome.

A physician sees an elderly woman with osteoarthritis. The nonsteroidal anti-inflammatory agent prescribed at the last visit has been helping. The physician is concerned, however, about the risk of gastric bleeding if she keeps using the medication regularly. The physician wonders...
about recommending that the medication be taken on an “as needed” basis only. Or maybe the recommendation should be that the medication be taken for just 3 weeks at a time followed by a 3-week break. Is there any evidence that these strategies will decrease the risk of gastric bleeding? Or, in a more structured format, the question might be “Are women older than 65 years (the patient) who take nonsteroidal anti-inflammatory agents on an as-needed basis (the intervention) at as high a risk of gastric bleeding (the outcome) as those who take the medication regularly?” Rarely do physicians know the answer to every question that arises (or should arise).

**Clinical practice: applying an evidence-based solution to a patient’s problem.** The third component of EBM involves the interaction between patients and clinicians when a management or diagnostic decision is being made. Practitioners must be able to provide their patients with the best evidence available for a certain course of action. However, clinicians’ knowledge of patients and of physiologic processes, as well as patients’ desires and background, must be appropriately considered along with the evidence when a decision is made. This is the art of EBM. Patients or the health care system might not be able to afford the “best” drug. The best test might be a computed tomography scan but a patient has claustrophobia. Patients’ culture, social circumstances, fears, or emotional status might make something impossible or difficult. If the best course is impossible or unacceptable, then practitioners must work with patients to determine alternative, acceptable strategies without feeling that they have failed in the practice of EBM. Although the answer in the database might always have to be black or white, yes or no, the final answer for each patient might be various shades of gray. Successful practice of EBM does not mean we always apply the one right answer to every case. It means we share with patients the evidence we have for the actions we are recommending and work with patients to come as close to implementing the one right answer as we can.

**Building the GMKD**

We believe a GMKD can and should come to be. Initiative and funding is all that is needed. This database is probably more important to primary care than to any other branch of medicine.

The Cochrane Collaboration came into existence because of a need that was expressed as a vision and that was eventually funded and supported worldwide. Unfortunately, the Cochrane Collaboration deals only with questions of therapy. Questions related to diagnosis, etiology, prognosis, clinical decision processes, and the results of qualitative research are never dealt with. Questions of harm and cost-effectiveness are dealt with only incidentally as they relate to therapy. The process that led to formation of the Cochrane Collaboration, however, could be applied to development of the GMKD.

The idea of using a single search to access many databases of critically appraised topics is not new. The TRIP database (Turning Research Into Practice), a meta-search engine, searches EBM sites, including CatBank, ACP Journal Club, and POEMs. It is, however, far from the idea of a common, structured, easily accessible, answer first, interactive database that we envision in the GMKD. But it is a start and helps with the concept.

The GMKD would include results of critical appraisals of synthesized information (clinical practice guidelines and other systematic reviews), as well as critical appraisals of individual trials. There would be two main sources of these critical appraisals: existing databases, such as CATs, POEMs, and BETs, and individual practitioners. Every time practitioners critically appraised a topic, the information could be placed in the GMKD rather than in their own filing cabinets. If a physician in Australia searches for and produces an answer, a physician in Ireland should not have to repeat the process.

For example, a physician with a question goes to the GMKD. The system will match it as closely as possible with both answered and unanswered questions. If there is an answer, the software will display this automatically. If the question is unanswered, the physician will be able to see whether someone is trying to answer it (and can offer to help). If the question is not on the database, then the physician would be prompted to post the question. Physicians offering to answer questions would search the original literature, appraise it, and synthesize the original evidence into a summary. The physician would then post the answer to the GMKD, via a peer-review process, so the next person can find the answer without repeating the work.

The GMKD would grow from a more formal process of academics, professional organizations, governments, and other groups appraising and synthesizing research evidence into answers to clinical questions to individual clinicians doing similar work based on questions they encounter in their practices every day.
The GMKD needs to be accessible 24 hours a day. It must be comprehensive; up-to-date; easy to search; and should provide simple, short, straightforward answers. It should have a standard format for storing and presenting results with the actual answer or “bottom line” presented first. It should have a dated list of the questions with answers, questions being answered, and questions with no answers. There needs to be academic and pragmatic scrutiny of both questions and answers before they are posted on the database. Clearly the effort of answering a question should be acknowledged, perhaps through some form of credit for postgraduate educational assessment.

We need to begin establishing this database as soon as possible. Such an undertaking would require substantial funding, vision, creativity, and technical expertise. It would require the cooperation of many different EBM groups around the world. And it requires a clear understanding of the process of clinical care and how such a database could be made most useful to clinicians in busy practices. This is the biggest challenge facing evidence-based primary care today.

Dr Godwin is an Associate Professor and Director of Research in the Department of Family Medicine at Queen's University in Kingston, Ont. Dr Dawes is Director of the Centre for Evidence-based Medicine at Oxford University in the United Kingdom.

Correspondence to: Dr Marshall Godwin, Family Medicine Centre, 220 Bagot Street, PO Bag 8888, Kingston, ON K7L 5E9; telephone (613) 549-4480; fax (613) 544-9899; e-mail godwinm@post.queensu.ca

References