CHAPTER 1

What Evidence-Based Practice Is and Why It Matters

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INTRODUCTION

When you are choosing a diagnostic test, performing a treatment, or looking for drug interactions, you will base your decisions on many sources of information. You will rely on your accumulated knowledge of biology, biochemistry, physiology, pathology, and health care. However, vast sources of information are available to improve on that knowledge. How will you decide which sources to use and which ones are trustworthy? This text will provide you with the skills to answer that question.

Today, many sources of healthcare information are available and innumerable authorities offer recommendations. The sources are as varied as they can be contradictory: textbooks, medical journal articles, specialty organizations, the gray-haired doctor, the actor in a drug commercial, the pharmaceutical representative, health professional faculty members, supervising clinicians, brochures, websites, friends, family, and neighbors. You, your patients, and your organization might turn at times to many of these sources.

For students in health professional education programs, textbooks, healthcare-related journals in the library or in online databases, and instructors are the main sources of knowledge. These sources are sometimes presumed to be infallible. It is not uncommon for practitioners to use the phrase, "That's how it was taught in *my* program" in defense of a treatment choice. The statement implies that a choice is correct based purely on the instruction of a faculty member, regardless of how long ago the practitioner graduated. There is a tendency to assign authority to certain sources of information. A quote from a reputable journal, for example, can carry great weight with practitioners and patients alike. However, premature or misleading information can be reported, even by the most trustworthy of sources. The story of thalidomide exemplifies this point.

In the late 1950s, it became common practice in Europe to prescribe a drug called **thalidomide** (a sedative-hypnotic drug) as a treatment for morning sickness and to help pregnant women sleep.[1,2,3] It was accepted practice in more than 50 countries. Articles about the drug were published in 1959 and 1960 in sources that included the *British Medical Journal,* the *American Journal of Psychiatry,* the *British Journal of Pharmacology and Chemotherapy*, and the *American Journal of Obstetrics and Gynecology*.[4]

Many newborns of mothers who had taken thalidomide were afflicted with **phocomelia** (also known as "seal limb"). Thalidomide not only caused limb deformities, but also deafness, blindness, cleft palate, and other internal problems. Most frequently phocomelia affected the formation of the arms, which ended up looking like flippers. The condition was caused by failure of the long bones of the arm to develop. In some instances, fingers grew from an infant's shoulders (**Figure 1–1**).

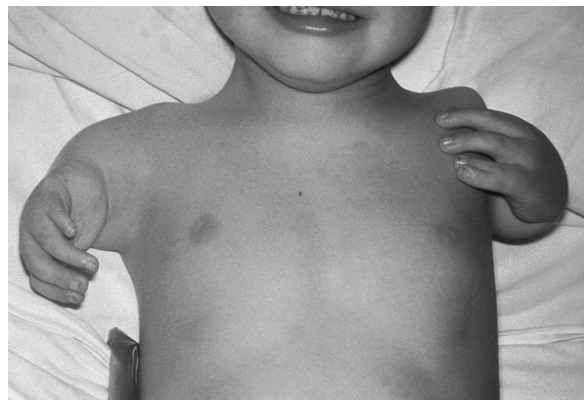

Figure 1–1 Thalidomide Baby

The drug was marketed as "completely safe" by its manufacturer, the German company Chemie Grünenthal. However, the drug did not receive approval from the FDA when a company by the name of Richardson-Merrell applied to market it in the United States years after it had been introduced in Europe. Nonetheless, the company distributed millions of doses of the drug to U.S. physicians while it performed animal studies on the safety and efficacy of the drug. This practice was legal at the time. It is estimated that some 20,000 patients in the United States received the drug.

The first articles questioning thalidomide's safety came out in June of 1960. However, the use of thalidomide in pregnant women was not banned until 1962, after more than 10,000 cases (40 in the United States) of birth defects had been reported.[1,2] Approximately 40% of these infants died within their first year of life. Today in some parts of the world women continue to take thalidomide and give birth to children with phocomelia. While the drug is dangerous to fetuses, it is known to be effective in the treatment of leprosy and certain forms of cancer. It is now approved for these uses under strict guidelines.

The story of thalidomide demonstrates the hazard of selecting a treatment without sufficient research. It also reveals the persistence of a treatment choice despite great hazards once it becomes a common practice. Although such severe examples are rare, they provide a lens through which to view healthcare decision making.

The purpose of this discussion is not to cause you to distrust sources of healthcare information. More than likely, reputable journals, your textbooks, and your instructors will be correct the vast majority of the time. You should trust them—just not unquestioningly. You should have the skills to discern if information is indeed accurate and applicable in

each case. It is essential, in fact, that you develop this skill for the sake of your patients and the longevity of your career.

As a member of a healthcare team, comprised of practitioners in your profession as well as other professions, you will eventually be responsible for the care of patients, either directly or indirectly. You will be making decisions without your preceptors or clinical faculty. You will make judgments in many different situations. For example, you will face clinical questions that do not have entries in the indexes of your textbooks. You might discover that a diagnostic tool is not as accurate as you thought it was. You are likely to encounter a patient who does not respond to the usual treatment protocol.

You might be asked by a clinic manager to develop a standard of care for your practice. You could be called upon to write letters to insurance companies explaining why they should cover the treatment you want for your patients. Terminal patients will ask you how long they have to live. You might be approached repeatedly by pharmaceutical representatives offering you samples and asking you to prescribe their products. You might even be asked to give a lecture in the very program from which you graduated. In all of these situations, and more, you will need to interpret and critically evaluate healthcare information. This chapter introduces you to a set of critical thinking skills that will enable you to engage in this activity, called *evidence-based practice*.

LEARNING STRATEGIES FOR SUCCESS IN HEALTH PROFESSIONAL EDUCATION PROGRAMS

Evidence-based practice (**EBP**) is a translational form of critical thinking. By **translational critical thinking** we mean that the theoretical skills and concepts of critical thinking are translated into real-world applications. As such, several learning strategies native to critical thinking can be applied to EBP. These strategies include the ability to solve ill-structured problems, self-awareness, self-direction, and active engagement. EBP is also a lifelong learning activity. You will engage in this process throughout your career.

Solving Ill-Structured Problems

Solving ill-structured problems is described by the Association of American Colleges (AAC) as, "knowing that the world is far more complex than it first appears." The AAC goes on to explain that students, "must make interpretive arguments and decision-judgments that entail real consequences for which they must take responsibility and from which they may not flee by disclaiming expertise."[5] Patient care often requires practitioners, as well as health professional students, to make healthcare decisions in the face of limited or contradictory information. To make a decision, they must take into account current research, patient preferences, cost, availability of resources, legal ramifications, local standards of care, and even religion and culture. It is rare for a patient care decision to be a simple binary (right/wrong) choice. In school, students will often be faced with questions that have more than one correct answer, in which the best choice depends on a variety of situational factors. Your comfort with making decisions under these circumstances will determine your success in solving these ill-structured problems, and hence your success in your degree program.

Self-Awareness

In order to engage in critical thinking, individuals need to be aware of their own knowledge, skills, and beliefs. Practitioners need to recognize the limits of their knowledge and abilities; reflect on their successes, as well as their mistakes; have the curiosity to seek new knowledge, and possess the humility to admit they need that knowledge. We need the ability to accept mistakes so that we can learn from them. We need to be able to articulate our values and know how they interact with our knowledge and decisions. It takes self-awareness to meet these needs. It takes self-awareness, and perhaps even a little courage, to engage in critical thinking.

We say this because there is a common fear that critical thinking can cause people to become indecisive or lose their core values. There is a saying that goes, "Don't be so open minded that your brain falls out." What this saying implies is that consideration of multiple perspectives can cause you to believe there is no right answer and, hence, forever vacillate between choices. Self-awareness will prevent this from happening. Furthermore, such vacillation by definition is not critical thinking. Critical thinking is about using information to make choices. Indecision is caused by fear, not by information. Self-awareness will allow you to recognize this fear and be able to use information to choose a course of action.

Self-Direction

Critical thinking requires self-direction, which is also referred to as *independent thinking*. Reliance on experts as the sole source of knowledge makes practitioners and students *dependent* thinkers. Self-direction leads to independence. This does not mean rejecting authoritative sources, but rather questioning them in order to provide the best quality care. Self-direction means seeking to expand your knowledge and skills. It means being intrinsically motivated by a desire to learn and continuously improve. Independent thinkers seek knowledge without the provocation of an external reward. This trait is evident in clinicians who participate in continuing education beyond the minimum required hours to retain their licenses or who learn about topics outside of their specialties. Self-direction is evident in students who do more than the required readings and seek knowledge beyond the facts communicated in lectures.

Active Learning

The final key component for critical thinking, as it relates to health professional education, is active learning. Active learning focuses the responsibility for learning on the student, rather than on the instructor. It requires that students do something beyond merely listening to a presentation. Students are actively learning when they ask questions, take notes, or complete assigned readings prior to lecture (and take notes related to the readings). Active learning includes completing case studies, participating in small groups, writing papers, or giving presentations. Active learning takes many forms, but the key ingredient is student accountability.

When students approach learning as *their* responsibility they become actively engaged in the learning. Regardless of what teaching strategy is employed, students can choose to be active or passive (independent or dependent). You can merely listen to a lecture, which is passive, or you can take notes and ask questions, which is active. You can passively let other small group members complete an assignment, or you can actively do your part as well as engage your group members with their parts.

One area where this trait is most evident is in exam behaviors. You can passively expect exams to include only the facts presented in lecture, or actively anticipate that exams will address relevant knowledge and skills to the course subject area. In health profession programs, active learners recognize not only that they are responsible for seeking information, but that they are also responsible for demonstrating their command of that information on an exam, even for concepts not presented in a lecture.

THE CASE OF MR. MARTINEZ

Let's look at an example. Later in the chapter we will provide brief explanations about some of the medical concepts within this example.

Mr. Martinez, a 45-year-old male of Hispanic descent, visits his primary care provider for a routine employment-screening physical. He has been hired as a home construction site manager for a local company that requires a medical release in order for him to start his job. Mr. Martinez appears to be well, although overweight (height: 70 inches, weight: 202 pounds, waist: 38 inches).* He has no health complaints. When asked about his family history, he reports that his father died recently at the age of 65 from a heart attack. Further questioning

reveals that Mr. Martinez is quite concerned about his own heart health. He has a wife and two teenage sons. He does not want his family to lose him at a young age. Lab tests reveal that he has abnormal lipid levels: total cholesterol = 222 mg/dL; HDL = 30 mg/dL; LDL = 160 mg/dL; triglycerides = 160 mg/dL. He also admits to smoking one pack of cigarettes per day for the last 25 years. On physical exam he is found to have a heartbeat with regular rate and rhythm, without murmurs, rubs, or gallops. His pulse is 78 beats per minute. His blood pressure is 136/88 mm Hg. His lungs are clear to auscultation bilaterally.

* The CDC define overweight[6] in adults as those with a body mass index (BMI)[7] between 25 and 29.9.

As part of Mr. Martinez's primary care team, you have several immediate questions to address. What will you report to his employer? Is he healthy enough for the job? Should he be treated for overweight? Should he be treated for high cholesterol? Which types of treatments are most effective?

There are other questions you also need to consider. Is the cholesterol test accurate? What types of screening tools provide the best information and at what cost? What risk does Mr. Martinez have for diabetes, heart attack, lung cancer, or other illnesses? How might his gender, ethnicity/race, age, and lifestyle affect treatment choices? What are his needs and preferences?

The list of questions could fill an entire book. In healthcare practice, questions are as prevalent as their answers. This chapter introduces a process for contending with the questions healthcare providers ask and evaluating the answers to them. This process is known as *evidence-based practice*.

In this chapter, we introduce the fundamental concepts of evidence-based practice and provide a framework for the process. We explain its definition and purpose in light of two types of clinical outcomes: surrogate outcomes and outcomes that matter. We provide a brief history of EBP in order to help you understand what it is and why it matters. The main focus of the chapter is the process of EBP, including explanations of three different approaches (prospective, concurrent, and retrospective) and clinical categories in which it is applied (epidemiology, diagnosis, prevention, treatment, prognosis, harm, and patient education).

Healthcare research is traditionally broken into so-called *levels of evidence*, for which there are numerous naming systems. In this chapter, we discuss several of these evidence-level systems, such as the one used by the **U.S. Preventive Services Task Force** (**USPSTF**). The chapter concludes with sample evidence-based practice questions and an exercise in writing focused questions based on the case of Mr. Martinez.

OVERVIEW OF EVIDENCE-BASED PRACTICE

Definition

Evidence-based practice (EBP) is the process of combining the best available research evidence with your knowledge and skill to make collaborative, patient- or population-centered decisions within the context of a given healthcare situation.

In the definition of evidence-based practice, there are four key concepts to consider:

- *Best available research*. The highest-quality, most recent research available should be consulted whenever possible. Study design and funding sources are key considerations. Critiquing healthcare research publications is a critical skill, as is locating applicable research.
- *Knowledge and skill*. Your clinical knowledge and skills, which you continuously assess and develop as a lifelong learner, form the basis for every decision you make. Critical thinking is the key competency to this aspect of healthcare decision making. It is well worth your time as a student to learn more about critical thinking and to endeavor to grow in this area. Many health professional training programs are

designed to develop critical thinking skills in students. Although this topic is beyond the scope of this text, we encourage you to learn as much as you can about critical thinking. It will not only improve your clinical effectiveness, but it will help you communicate with patients and with other professionals.

- *Collaborative, patient-centered decisions*. Even the best-quality research might not apply to a given patient. Research deals with representative samples, but individual patients each have unique needs and responses to treatment as well as individual desires and circumstances. Every decision must be a collaborative process between the practitioner and the patient. This patient-centered concept will emerge many times throughout your health professional education and your career. **Figure 1–2** shows the elements of patient-centered decisions, how they interact as well as how they relate to one another.
- *Context of a given clinical situation*. Many situational factors influence health decisions, such as the specialties of clinical team members, the setting in which the patient is seen (a rural family practice versus an urban trauma center, for example), available resources (such as access to equipment or labs), urgency of the patient's complaint, the patient's ability to pay, and the preferences of the patient and the patient's family.

We feel it is essential to note here that the definition of EBP we provide differs somewhat from definitions utilized for evidence-based medicine. One of the most widely accepted, and cited, definitions of evidence-based medicine comes from the Centre for Evidence-based Medicine (CEBM) in Oxford, England: "Evidence-based medicine is the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients."[8]

We could have utilized essentially the same definition for evidence-based practice (replacing the

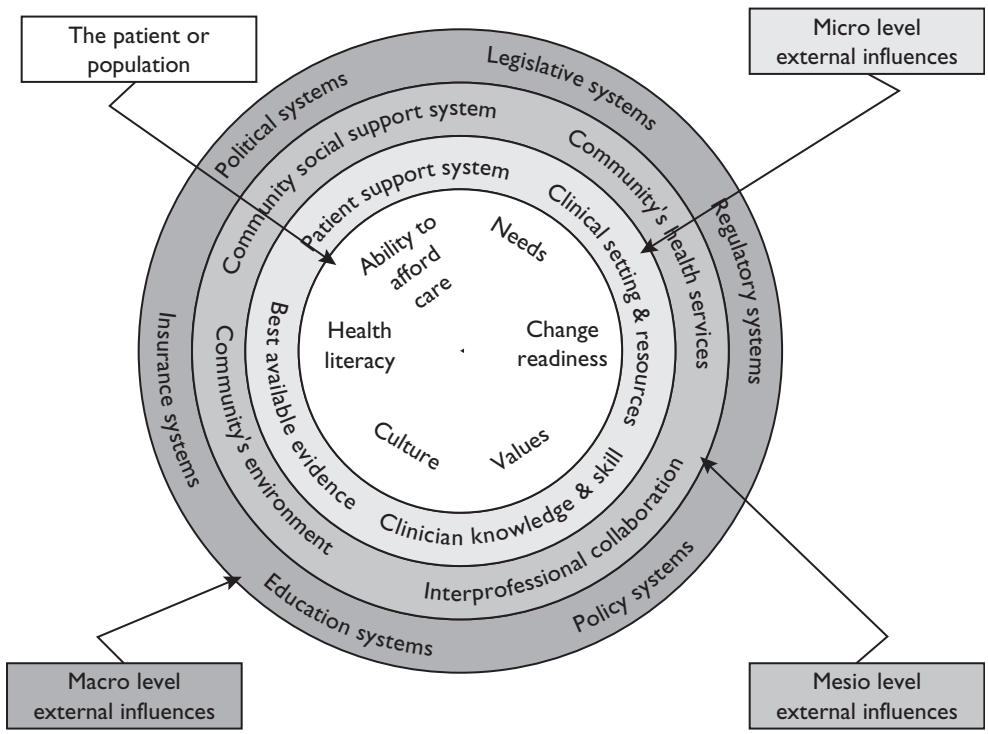

Figure 1–2 Patient-Centered Decision Making

word "medicine" with the word "practice"), but we decided the definition we wanted to use needed to reflect several important characteristics, such as the fact that EBP and EBM are both processes. Clinical decisions tend to be emergent activities, rather than static activities. The definition of EBM describes the, "use of current, best evidence," but does not indicate that decisions might evolve over time and that the activity of using evidence involves a distinct set of procedures.

Additionally, the CEBM definition focuses in making decisions without clarifying who is making them. Because we wanted to emphasize the role of the patient in making clinical decisions, we determined it was crucial to include the concepts of patient-centered and collaborative decision making. In recent years health care has been gradually shifting away from a traditional, paternalistic, and authoritarian relationship between clinicians and patients. This shift not only includes a collaboration with the patient and the patient's family, but also an interprofessional collaboration with other health professionals. We wanted the definition of EBP to reflect this current thinking.

Lastly, the CEBM definition of EBM emphasizes the focus of decisions for individual patients. We believe that the evidence-based process can, and should, be applied to population-based healthcare decisions as well as other group levels, such as families. This also reflects the interprofessional perspective of EBP we utilize. Certain health professions are focused on population-level issues, such as public health. We felt a more inclusive definition was warranted.

We do not, however, believe or wish to convey the message that other definitions of EBP (or EBM) are incorrect. The various definitions available have a common core that allows each to be correct and to reinforce or inform the others. The differences between definitions are generally about nuances, and the meaning is essentially the same from one to the next.

The collaborative process of making decisions following EBP involves multiple influences at multiple levels. A systems approach to decision making best describes the EBP patient-centered decision making process. Figure 1–2 displays the various sources and levels of information to be considered. The patient is at the center and is the focus of the model. There are three rings surrounding the patient, representing external influences at different levels. The further from the center, the broader the influence.

The outermost circle represents macro-level influences, such as political systems, regulatory systems, and so on. The next circle includes mesio-level influences, including interprofessional collaboration among different healthcare disciplines as well as community influences, such as availability of healthcare services. The next circle, the one closest to the patient, is the micro-influence level. The micro-influence level includes the expertise of the healthcare professional, the best available evidence (including qualitative and quantitative evidence), the patient's support system, and so on.

Again, at the center of the process is the patient or the population being served. The patient/population level in the diagram includes influences such as values, needs, level of health literacy, culture, ability to afford care, and readiness to change. There is an interplay among all of the influences represented in the chart. These influences occur consciously and subconsciously for clinicians, for patients, and for communities. Healthcare professionals need to be mindful of all of these influences as well as the various levels of influence, as opposed to focusing on just one level or just one influence.

History of EBP

Historically, clinical decisions have relied almost solely upon the knowledge and authority of the clinician. A paradigm shift has occurred, however, in recent years. Beginning in 1981, a series of articles was published by clinical epidemiologists from McMaster University in Ontario, Canada. These articles provided guidelines for critical appraisal of medical literature. The McMaster team's goal was to teach medical residents the critical appraisal skills needed to use current medical literature to support

their clinical decisions.[9] In 1991, the first use of the term *evidence-based medicine* appeared in the American College of Physicians' Journal Club.[10] The term *evidence-based practice* emerged later when other disciplines began to utilize the concept, and there was a realization that the evidence-based process could be applied to many fields of endeavor, both within and outside of health care.

The team from McMaster University connected with a group of academic physicians in the United Stated and formed the Evidence-Based Practice Working Group. The group produced a series of 25 articles entitled, "The User's Guide to Medical Literature," which was published in the *Journal of the American Medical Association (JAMA)* from 1993 through 2000. These articles have been referenced in literature countless times, and today there are many courses, centers, and professionals teaching and engaging in evidence-based practice. Over that same period of years, the Internet, as we know it, came into existence.

Before the early 1990s, desktop computers were rare and electronic publication was just a dream. In the span of less than a decade, access to information exploded across the planet and clinicians began to have instant access to more information than they could manage. Evidence-based medicine (as it was called at the time) appeared at the right time in light of the emergence of the Information Age. It also provided solutions for contending with the ever-expanding web of health information.

The rationale that underpins EBP has had great appeal in many professions and areas of study, so much so that the term has been adopted and modified to fit a variety of fields. The term *evidence-based practice* is now commonly accepted to apply to any discipline that employs the model. For example, there is *evidence-based nursing*, *evidence-based policing*, *evidence-based management*, and even *evidence-based teaching*.

A central concept to the EBP model that has changed the practice of biomedical research is the type of outcomes of interest to practitioners. Historically, physiologic measures (such as laboratory results) were accepted as sufficient representations of illness. EBP advanced the notion that there are other outcomes that matter to providers and to patients in addition to physiologic outcomes. Today, biomedical research often considers these other outcomes in addition to traditional laboratory data.

Outcomes of Care

The term **outcomes of care** in the context of health care, refers to the measurable or observable results of illness or treatment. Outcomes provide the objective data points for healthcare research. Weight change might be the outcome measured in studying the effects of an exercise program, for example. Satisfaction with nursing care might be an outcome measured in emergency department research. Reduced triglycerides might be the outcome measured in a medication trial.

In EBP, measures of **mortality** (death), **morbidity** (illness), and clinical signs (symptoms, test results) are utilized to determine the presence and severity of disease. They also are used to determine the patient's level of wellness and functioning, as well as efficacy of treatment. A landmark study called the Medical Outcomes Study[11] (MOS) first offered a framework to measure effectiveness of physician practice. The MOS provided outcomes in categories including clinical end points, signs and symptoms, laboratory values, functional status, general well-being, and satisfaction with care. Similarly, the field of nursing utilizes a set of nursing-sensitive patient outcomes called Nursing Outcomes Classification (NOC).[12]

Outcome measures give us information of different types and of relative importance to us as providers and to our patients. For example, a cholesterol test gives us physiologic information, but it does not tell us if the patient has any symptoms, nor does it confirm if heart disease is present. The outcome of a cholesterol test might not matter as much to a patient as the presence of chest pain. Also, the outcome of high cholesterol might not indicate the presence of disease at all. For this reason, it was recognized by the founders of EBP that researchers must measure *outcomes that matter* whenever possible.

Surrogate Outcomes

A **surrogate outcome** is a process of using one outcome to reflect another. Surrogates are selected based on the association of a physiologic or biologic measure with another known clinical end point. For example, arterial blood gas (ABG) levels act as a surrogate for respiratory acidosis. Respiratory acidosis is a medical condition that results from decreased respiration. It leads to increased carbon dioxide (pCO_2) in the blood and decreased blood pH.[13] This state occurs in a number of disorders, including asthma, COPD, and drug overdose, and it can be immediately life threatening.

Many physiologic measures are utilized as surrogates, such as blood pressure, heart rate, cholesterol levels, and white blood cell count. (It would quite impossible to compile a complete list of surrogate measures used in health care.) There is a problem, however, with surrogate outcome measures. Because the surrogate is not a direct measure of what it represents, it can be inaccurate. For instance, a patient might have heart disease, but might not have elevated blood pressure or high cholesterol. And not all patients with high blood pressure or cholesterol have heart disease. Furthermore, any given surrogate might represent many different clinical end points. High blood pressure can be an indicator of a host of different conditions. By itself, high blood pressure provides little information about the condition of a patient.

From a medical research standpoint, however, it is easier, faster, and less expensive to collect surrogate outcome data. The alternative to surrogate outcomes is clinically relevant outcomes such as death, tissue samples, measures of activities of daily living and levels of pain, and so on. It can take significant amounts of time for a clinically relevant outcome to occur, which can allow disease to progress beyond the point of intervention. Clinically relevant outcomes can be difficult or impossible to measure, and their measurement can be invasive. For example, the only way at present to make a definitive diagnosis of Alzheimer's disease is through autopsy of brain tissue.

Outcomes that Matter

Clinically relevant outcomes that provide direct measures of disease are preferable to surrogate outcomes. The term **outcomes that matter** is often used to describe these direct measures of functioning or disease. This term is used because it encompasses more than clinical data; it also includes other outcomes that patients and providers care about, such as the patient's ability to function or the cost of care. Outcomes that matter include such factors as quality of life as well as mortality.

For example, the Action to Control Cardiovascular Risk in Diabetes (ACCORD) trial[14] utilized *incidence* of cardiovascular events (nonfatal myocardial infarction, nonfatal stroke, or death from cardiovascular causes) as its primary outcome measure. The study focused on type 2 diabetes, which has emerged in recent years as a significant health problem in the U.S. population. Type 2 diabetes increases patients' risk for a variety of health problems, including, cardiovascular disease, premature death, blindness, kidney failure, amputations, fractures, frailty, depression, and cognitive decline.[14(p. 2245)] Severity and frequency of these problems are associated with the degree of *hyperglycemia*, which is measured by plasma glucose or glycated hemoglobin level (a measure of the mean blood glucose level during the previous 2 to 3 months). These two tests are commonly used as surrogates for the many potential disease states that occur in patients with type 2 diabetes.

In the ACCORD trial, the outcome that mattered contradicted the surrogate outcome. The surrogate outcome showed that intensive glucose-lowering therapy was more effective than standard therapy. After 1 year of treatment, patients receiving intensive therapy had greater improvements in glycated hemoglobin levels than patients receiving standard therapy. However, intensive therapy also resulted in increased mortality and did not significantly reduce the incidence of major cardiovascular events.[14(p. 2545)] Although these findings occurred early in the study, intensive treatment was discontinued due to the risk to patients. Had only a surrogate outcome measure (glycated hemoglobin level) been used, intensive therapy might

have continued, resulting in disastrous outcomes for some patients.

Another example of the value of using outcomes that matter came from the Cardiac Arrhythmia Suppression Trial (CAST).[15] The study demonstrated that several drugs that were highly effective in treatment of arrhythmia actually increased mortality after myocardial infarction. Prior to the publication of the CAST study, it was common emergency department practice to give patients antiarrhythmic drugs to suppress asymptomatic arrhythmias following an acute myocardial infarction.[16] This practice has been curtailed since the release of this study and others with similar findings.

EBP Skills

The process of EBP involves accessing the best-available evidence when a patient-care question arises and then considering that information in the context of the clinical situation. To engage in this process clinicians must hone three key skills: (1) developing **focused clinical questions**, (2) quickly locating applicable information, and (3) critically appraising that information. The following discussion introduces each of these concepts.

Focused Clinical Questions

Some examples of the kinds of questions that arise during patient care were brought up earlier in the case of Mr. Martinez. He is overweight, smokes cigarettes, and has elevated low-density lipoproteins (LDL) and triglycerides. In addition to these risk factors, his father died of a heart attack at a young age. Mr. Martinez is of Hispanic descent and is 45 years old. Each of these factors contributes to a focused clinical question. For example, which treatment for elevated LDL is most effective in male patients of his age and ethnicity? Focused clinical questions include the following elements:

- A specific condition or outcome (e.g., treatment of high LDL)
- Patient demographics (e.g., age, ethnicity, gender)
- Patient risk factors (e.g., smoking, overweight)

These details are essential in finding answers that fit with the patient individually. They guide and focus your search.

Locating Applicable Information

Once you have a focused question, the next skill you need is the ability to access appropriate resources. With time and experience, you will develop the ability to perform this task quickly. There are two keys to success with locating information. The first is having your own search protocol, which involves knowing the types of information available in the sources to which you have access. The second is developing a search practice that is *prospective*, *concurrent*, and *retrospective*.

Your search protocol should target sources that are most likely to contain the type of information you need. Each source tends to provide specific kinds of information. For example, PubMed and CINAHL are sources that include original scholarly research articles, whereas an evidence-based service such as DynaMed, Nursing Reference Center (for nursing), or PEDro (for physiotherapy) provide synthesized, peer-reviewed evidence summaries on focused clinical topics. A primary care textbook provides basic science information and common practice procedures, whereas journals such as the *American Journal of Nursing* or the *New England Journal of Medicine* provide results of recent developments and research. A textbook's information is likely to be broad in nature but somewhat dated, whereas a journal is narrow in focus but likely to be more current. The more sources you know of, and the more you know about each source, the faster you will be able to locate focused information. We recommend asking other students, faculty, and clinicians what sources they use as well as what advantages and limitations they see in each source.

You need to combine your search protocol with a prospective, concurrent, and retrospective EBP approach. **Prospective EBP** means seeking information in advance, rather than only in response to patient encounters. It means developing your fund of knowledge and being able to draw on that knowledge in clinical situations. It is about making

a habit of searching for the latest developments in your areas of interest and practice. This is often referred to as *scanning*.

Generally, you will engage in prospective practice in order to sustain your license, because many professions require a certain amount of continuing education. Beyond certification requirements, prospective searching also means being watchful for new information. This aspect of practice includes subscribing to journals or online news services, participating in specialty organizations, asking pharmaceutical representatives what new drugs their companies are developing, and participating in a journal club in your organization. With prospective EBP, what you learn today will help the patients you see tomorrow.

Concurrent EBP means looking up information in response to clinical questions and using that information to make decisions regarding an individual patient. This practice can occur while the patient is in clinic. Many healthcare organizations provide ready access to information services. Many clinicians also purchase access for themselves on portable devices such as smartphones, PDAs, and laptops. E-Pocrates and DynaMed are current examples of subscription resources that are available for handheld devices. Concurrent practice requires rapid searching and assessment of information. Sources that provide peer-reviewed, focused summaries fit best with concurrent practice. Your ability to engage in concurrent practice will depend greatly on your success with prospective and retrospective practice. With concurrent EBP, what you learn today will help the patients you see today.

Retrospective EBP means looking up information subsequent to a clinical encounter. During a clinical encounter, you might not have time to search for information. Your clinic day might be too busy or your patients' needs too urgent to allow you to perform searches. However, when you have time later you can follow up on a question. In some cases you might be able to hold off making a decision with a patient until you have the information you need. This practice might be preferable to selecting a course of action when you still have an unanswered question. You might choose a treatment and change your plan after learning more subsequently. It takes a certain amount of humility and finesse to engage in retrospective EBP, but it can save lives and improve quality of care. With retrospective EBP, what you learn today could help a patient you saw yesterday.

Critically Appraising Information

Critical appraisal is a process of evaluating the trustworthiness and relevance of a resource within the context of a given clinical situation. Appraisal involves questions such as potential sources of bias, representativeness of a study's sample, consistency of a study's methods, accuracy of the data collected, duration of the research in light of the question explored, and even just the common sense of a study. In appraising a resource, you will determine where it lies within a *hierarchy* of evidence, a concept discussed later in this chapter (see "Assigning Levels of Evidence").

The resources you access might not be strictly empirical research. Much of what is available, in fact, comes in the form of expert opinion. An essential task when appraising a source is to determine if it is opinion. This situation can be more difficult than it seems, or it should be. Often expert opinions are communicated similarly to research, having the tone and organization of an empirical study. Such opinions are often nothing more than well-written reviews of the literature. Many expert opinions are based on the research of others. Sometimes one expert opinion is derived from prior expert opinions, and there is a complete lack of empirical research. Accessing the publications of the original research can help practitioners avoid this layering of opinions.

Original research publications are referred to as **primary literature**, whereas expert opinions typically fall in the category of **secondary literature** or **tertiary literature**. It is important that you can discern *primary* research from *secondary* and *tertiary* publications. All types are useful and serve important roles in informing providers. Your ability to recognize the type of publication will help you determine how to apply the information it contains.

The EBP Process

The EBP process brings together all of the resources just mentioned with your knowledge, skills, and practices into a model for clinical decision making. With time, you will develop your own EBP process. We provide you with an outline you can use to begin (**Figure 1–3**).

Step 1: Recognize the Need for Information

The first, and perhaps most obvious, step is acknowledging that information is needed. It is essential for you to recognize the boundaries of your knowledge and to be able to say, "I don't know." More than likely, you will easily identify a gap in your understanding, but it may not always be obvious when you need information for other reasons, such as recognizing a controversial standard of care. The prescribing of antibiotics for all acute middle ear infections (otitis media) in children is an example of this. It is a practice that was common in family medicine until recently but has been called into question due to antibiotic resistance, side effects, and allergic reactions. Also, uncomplicated ear infections in otherwise healthy children are often viral and self-resolving.

1. Recognize the need for information
2. Establish the purpose
3. Formulate focused question(s)
4. Identify target resources
5. Perform the search
6. Organize findings
7. Appraise trustworthiness
8. Assess relevance
9. Select action
10. Implement and evaluate

Figure 1–3 The EBM Process

Viral infections are unresponsive to antibiotics.[17] However, sometimes circumstances call for the use of antibiotics to treat acute otitis media. In this first EBP step, the key is recognizing your need to know if watchful waiting or antibiotics are indicated. You must identify your assumptions and those of patients and other clinicians, and you must be willing to question those assumptions. Experience will greatly improve your ability to accomplish this step.

Step 2: Establish Purpose

Establishing the purpose of your query is about setting a goal, such as providing optimal fluid management in a hospitalized patient, and categorizing your question in terms of the type of information needed. Categories include **etiology**, **risk factors**, diagnosis, treatment, harm, **prognosis**, and patient education. The reason for identifying the category is twofold: first, it helps with selecting sources in which to search, and, second, it provides a search term to help narrow your results. For example, if you were caring for a patient with a fluid-volume deficit, you might be most interested in etiology (cause) and treatment. A search for "fluid-volume deficit" alone would provide many results unrelated to your question. By adding the term "etiology" or "treatment," you would likely find more focused information more rapidly.

An important companion to the purpose of your question is the nature of the information you seek. Is the information basic science, such as anatomy or physiology? Is it about medications or laboratory tests, or do you have questions across several topics? In the case of Mr. Martinez, for instance, you might be faced with choosing between medication or nutrition with exercise to treat his high triglycerides and LDL. This question clearly falls in the category of treatment. But this treatment question might require you to know or find the answer to other questions, such as whether a given treatment choice is as effective for lowering LDL as it is for lowering triglycerides. You might need to know the *physiology* of each of these compounds in the body in order to make the best treatment choice.

Step 3: Formulate Focused Question(s)

Once you have categorized your informational need, the next step is to add patient characteristics such as sex, age, ethnicity, and other health problems. These pieces are then brought together to formulate your question or questions. The more specific you are, the more successful you will be. For example, a broad question you might ask is, "What is the best treatment for lowering LDL and triglycerides?" But, when you consider Mr. Martinez, you can be more specific, "What is the best treatment for lowering LDL and triglycerides in an adult male of Hispanic descent?"

However, this question is still too broad, because it does not specify which treatments you are considering. Many treatments are available, ranging from a variety of nutritional interventions, exercise programs, and drugs, to even surgery. Furthermore, combinations of interventions are possible, such as diet plus exercise or nutrition plus medication. It is exceedingly rare to find studies that compare all of the possible treatments and combinations of treatments for a given condition.

Thus, a focused question regarding the case of Mr. Martinez might be phrased, "Is a nutrition/exercise program as effective as *statin* drugs in lowering LDL and triglycerides in an adult male of Hispanic descent?" Two more elements in this question must be considered: What type of outcome do we want to see, and what level of evidence do we need? Are we concerned with physiologic outcomes (cholesterol) or rather with the outcomes that matter, such as atherosclerosis, coronary heart disease (CHD), heart attack, or stroke? We might still be interested in evidence regarding cholesterol-lowering treatments, but we should also look for evidence that treatment will reduce morbidity or even mortality. Simply because one treatment is better than another for reducing LDL or triglycerides does not necessarily mean that treatment will result in fewer heart attacks. On a related note, you might also be interested in the potential harms of the various treatment options.

The level of evidence might be a matter of simply starting with the highest level, such as a meta-analysis, or it might be a matter of the type of question. In some cases, you might want to know if there has been a meta-analysis, and in other situations you might be seeking a **practice guideline** or an evidence-based review. Perhaps a meta-analysis was published earlier, but more recent randomized control trials have been conducted and you are looking for them. Later in the chapter we discuss the levels of evidence.

In your search, you will break up the components of your focused question, or questions, and use them in different ways. You might start by typing your complete question verbatim into a search field. This will likely produce few results. Instead, it is typically more effective to use the components of your question in a structured search. You will learn more about this strategy in step 5. For now, write out your question, making note of each of the vital components.

Step 4: Identify Target Resources

Different resources have different areas of emphasis or types of information. The objective at this stage in the process is to select the sources that best fit with the type of information you seek. As you gain experience, you will come to have a general knowledge of what is contained in the various information sources, making this step nearly invisible in the process. A number of sources offer focused evidence-based reviews, including DynaMed, Physician's Information and Education Resource (PIER), MD Consult BMJ Point of Care, and others.

Focused evidence-based resources are convenient, quick, and *likely* to be valid. (We equivocate here with the word *likely* because you should never assume any source is valid, regardless of its reputation.) Other sources of high-quality evidence are more in-depth, such as the Cochrane Collaboration and the Oregon Evidence-Based Practice Center. Focused evidence-based sources often charge access or license fees.

A rule of thumb we recommend is that if you want to find a comparison of the most commonly used treatments for a well-researched disorder,

start with the in-depth sources. For example, with Mr. Martinez you might be interested in finding the highest-level research regarding different cholesterol-lowering medications. Because heart disease and stroke are significant causes of morbidity and mortality, many studies related to the treatment of high cholesterol are available. Medications are increasingly relied upon for this purpose, and there are several medications to choose from. Additionally, lifestyle modifications (nutrition and exercise) have received considerable attention in the literature. An in-depth, high-quality source such as the Cochrane Library offers comparative studies that include multiple treatments.

Although there is a great deal of evidence for a topic such as high cholesterol, many topics have received little attention from researchers. High-level sources are unlikely to contain articles related to such topics. For example, we were recently interested in comparing the generic form of levothyroxine sodium with the brand name form of the drug. We wanted to know if the generic form is as effective as the brand name. Levothyroxine sodium is the treatment of choice for hypothyroidism.[18] Hypothyroidism is abnormally low secretion of thyroid hormone. Hypothyroidism is a somewhat common health problem with several widely accepted treatments (depending on the type and cause of the disorder). Hypothyroidism tends to be slow to progress and, if treated, rarely leads to life-threatening complications,[19] unlike high cholesterol.

We searched the Cochrane Library using the term "levothyroxine," and three articles were retrieved. None of the articles, however, addressed our question. One article examined treatment of subclinical hypothyroidism in pregnant patients, one examined the efficacy of treating subclinical hypothyroidism in general, and the third article compared high- verses low-dose initial treatment of congenital hypothyroidism. Levothyroxine sodium is a relatively inexpensive drug that has been available since the 1950s and is generally known to be highly effective. Hence, there is little incentive to perform new research in the treatment of hypothyroidism.

If you have a patient who does not respond well to the standard treatment for hypothyroidism, you might find it challenging to locate high-level research about this disorder. It is still advisable to start with in-depth or focused evidence-based sources, but you will need to have additional sources at your disposal. More than likely you would need to search in PubMed, go through endocrinology journals (hypothyroidism is a disorder of the endocrine system), or look for studies published by a specialty society. In this case, you might try the journals published by the Endocrine Society. Another option would be to search the National Guideline Clearinghouse for a practice guideline. You must keep in mind that as you move away from evidence-based sources such as the Cochrane Library you must be increasingly wary of resources that are based on opinion rather than on research. The objective at this step in the process is to have a search plan that includes sources with the highest-level evidence available in your area of inquiry.

Step 5: Perform the Search

Most college students have used electronic search tools extensively. You most likely already know how to perform a single-field search. You have probably performed thousands of single-field searches on the Internet. You have also probably had the experience of getting many irrelevant hits in an Internet search. A *single-field search*, in case you are wondering, is when you go to a search page that has just one search field on it and you type words into that field and click a button (**Figure 1–4**). This is the most common search procedure.

We recommend making a habit of choosing the "advanced search" option. Typically, the advanced search screen will allow you to add criteria to your search that will produce more focused results. On an advanced search screen, you can select options such as a date range or type of publication. **Figure 1–5** shows some of the many options available in an advanced search. The "exact wording

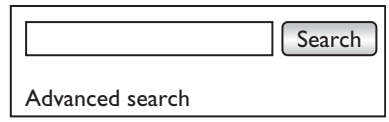

Figure 1–4 Single-Field Search Screen

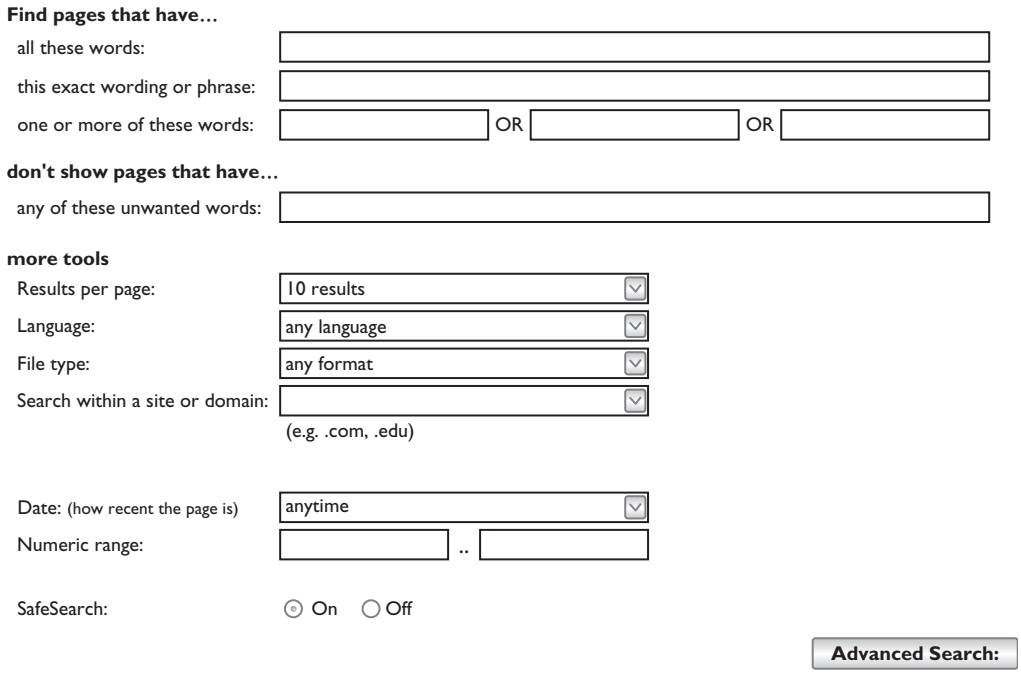

Figure 1–5 Advanced Search Screen

or phrase" field can be particularly useful, as can the "unwanted words" field. The main point we want to convey at present is that for step 5 of the search process you should become familiar with the search options available on the sites you use and to take advantage of them.

While you are searching, be sure to keep track of what terms you have used, in what combinations, and where you have searched. Watch out for different conjugations of words, such as singular versus plural (e.g., *feet* versus *foot*). Do not be afraid to use a basic Internet search engine, such as Google or Yahoo!, or even Wikipedia, to give you ideas and help you identify other places to search. In high school and college, students are often taught not to perform general Internet searches. This is a good rule to follow, because it will help you avoid getting incorrect information. However, a basic Internet search can be useful.

One final message here about step 5: You will have greater success finding valid resources if you are willing to go to the library. Although many resources are available online, many are not. It is common for the current year of a journal, for example, to be available only in print form. In health care, information evolves rapidly. Often you will need the most recent publication on a topic, but it will only be available in print form. For the sake of your patients, and probably your grade, it is critical that you go into the library to perform your searches. Also, library staff can offer terrific insights when you are digging for information. Their expertise can make your search not only more complete and current, but also more rapid.

The library usually has the ability to order copies of publications that are not in any of its collections. It is not acceptable in the practice of health care for you to miss information simply because your library does not have it. If an item that has information you need is not available through your library, then order it through interlibrary loan or some other means. In fact, your instructor might be able to order it for you without being charged a fee. Do not hesitate to ask. Ultimately, it is your responsibility to get a copy of the resources you need, to read them, and to critically appraise the information contained within them.

Step 6: Organize Findings

As you search, organize your findings into a usable format. This strategy could be as simple as jotting down a few details on a sticky note. It might mean printing patient education materials or using a formal organizational structure, including references. The procedure you use will depend on the complexity of your question, the number of locations you search, and the purpose of your search. For example, imagine that your urgent care clinic is evaluating its standard of care for patients suspected to have pneumonia. You would need to identify the most accurate and affordable diagnostic procedure for community-acquired pneumonia. This is a complex question, because multiple diagnostic tools are available, such as history and physical exam, x-ray, CT, MRI, and blood tests. Clearly CT and MRI are expensive tools, but they might be more accurate than the other options.

In a search for literature related to this question, you would find that there are many studies on each type of diagnostic procedure, but no single study that compares all of them. Because you would have to search in several places, it is important to use an effective organizational strategy to track your findings.

Step 7: Appraise Trustworthiness

In step 7, your goal is to determine if the information provided by a given resource is trustworthy (also referred to as *reliability* and *validity*). How you evaluate trustworthiness depends on the type of resource you are examining. Many different types of resources are available, including textbooks, websites, practice guidelines, case studies, randomized control trials, systematic reviews, and many others. Each type of publication has different traits you will assess. In general terms, you will look for bias, errors, and untested assumptions.

Many of the publications you appraise will be in the form of primary research or summaries of primary research. For these types of resources, you will apply concepts of research design, statistics, and just plain common sense in appraising trustworthiness. You will ask questions such as: Did the sampling strategy introduce bias? Was an adequate control group utilized? Was the study of sufficient duration? What funding supported the study? Were the correct analytical procedures selected for the type of data? Did the study have an appropriate sample size?

We could go on and on here listing the questions. It is not possible for us to write every question that can be asked during this step. The questions you use when appraising trustworthiness will depend on a number of factors, such as the purpose of your search and the amount of time you have to invest in the search. As with other steps in the EBP process, it takes time and experience to develop the skills needed to perform this step.

We advise you to employ a team approach to EBP. Each member of a clinical team brings different knowledge and experience. When combined, the collective ability of the team to appraise the trustworthiness of a resource is greater than the ability of an individual.

Step 8: Assess Relevance

In step 8, you determine if the information provided in a resource applies to the patient. For example, research on adults might not provide relevant information for a pediatric patient. Or, a study in which the sample was comprised of patients with a previous cardiac event might not provide relevant information to a patient who has not had a cardiac event. The title of the article, if it is well written, will help in making a determination about relevance. Here is an example of an article whose title gives you information on relevance, although not everything you need to know: "Interventions in the management of serum lipids for preventing stroke recurrence."[20] The word *recurrence* in this title is an important clue regarding relevance. It tells you that this study included patients who had already had a stroke.

Consider Mr. Martinez. If you searched the Cochrane Library for articles on "cholesterol," the above article will likely come up in your search results. This study was a systematic review of research involving patients 18 years or older with

a history of stroke or TIA (transient ischemic attack). The article is applicable because it involved adults and it related to cholesterol treatment, but it might not be relevant to Mr. Martinez because he has not had a stroke. In this case, it was easy to determine that the article was not relevant because of its title.

Factors to consider regarding relevance include the histories of the patients selected for the study, the age of the patients, the type of intervention (if any), the length of the study, as well as the gender and race or ethnicity of patients. The patients included in a study should resemble the patient you are treating in as many factors as possible. The greater the similarity, the more relevant the results will be for your patient.

Step 9: Select Action

Once you feel you have gathered sufficient information, you will decide what course of action to take. The action chosen depends on the question asked. For example, if the question of your EBP search related to diagnosis, then the action might be to perform the diagnostic procedure. If the question related to the selection of treatment, then the action might be to implement treatment. It might also be that you choose to take no action, other than monitoring, depending on the situation. It could be the action you select is to stop treatment due to discovering potential adverse effects or interactions. The action you select could involve patient education if your question had been related to that topic.

Determining when you have sufficient information on which to act is a matter of the severity of the patient's condition, the status of your knowledge on the topic up to this point, and the patient's needs and preferences. For example, Mr. Martinez has elevated cholesterol, but no urgent health problems. He has risk factors for heart disease, but does not currently have heart disease. His situation gives you time to search for various treatment options, to look for literature on nutrition, exercise, drug therapies, surgical interventions, and so on. At this step in the process, you would need to discuss with Mr. Martinez the types of treatments available. Patient compliance is essential in whichever treatment is selected, especially if the treatment involves lifestyle change or adherence to a drug regimen. Including the patient in the selection of action is imperative for a patient-centered approach to health care. Together with the patient, you should select the action that fits the health situation, can be achieved with available resources, and matches the patient's values.

You will need to be able to explain to your patient what you found in your review of evidence-based resources. It can help your patient decide which course of action to take, and it can influence the patient's adherence. You will need to communicate with the patient at his or her level of understanding. Effective patient communication is a skill you will be taught in your degree program. Another useful skill at this stage in the EBP process is *motivational interviewing*. It is a practice that incorporates effective patient communication with engagement of the patient in choosing a course of action. The specifics of motivational interviewing are beyond the scope of this text, but we encourage you to learn it and use it in your clinical practice, much as you learn any other clinical skill.

Step 10: Implement and Evaluate

The final step is to implement the action you and your patient have selected and to evaluate its effectiveness. It is important to ensure adequate patient education and to schedule a follow-up visit. Measures of effectiveness can include **objective** and **subjective data;** that is, information you observe or measure (objective) as well as the patient's perceptions (subjective). You must consider several questions at this point. What was the goal of the action taken? Is the outcome what was expected? Is the effect of the action adequate to meet the patient's needs? Are there any adverse effects? Is the patient compliant? Is the patient experiencing an outcome that matters? Is the cost acceptable to the patient?

At this stage in the EBP process, it is advisable to compare your patient's results with the results reported in the literature. The outcome your patient experiences should be communicated to

others, whether it matches the stated outcomes in the literature or contradicts them. The growth of knowledge in health care depends on communication of real experiences with patients. Healthcare research is often designed to eliminate the many confounding factors that exist with real patients. This is done in order to ensure that the outcome being measured does not result from some other variable. However, the steps taken in a study to create validity take away the many variables you deal with in everyday clinical practice. The patients you see will usually be more complex than those included in the research you read.

Communication of the results you observe with your patients might simply be tracking within your own clinic and sharing with your colleagues. This process can provide data to support the standard of care your clinic has chosen. Communication of results could mean writing a case review for a journal, participating in a clinical trial, or even performing a study of your own. The anecdotal results of clinicians in day-to-day practice provide the foundation for many discoveries in health care. The EBP process is not complete until some form of communication of results has taken place and you have reflected on how the results apply to future decisions.

Categories of Evidence-Based Practice

We have mentioned that there are several categories in which we group EBP sources, including: epidemiology, prevention, diagnosis, treatment, prognosis, harm, and patient education. The categories we use in this text are commonly used in health profession literature and databases. The purpose of using categories for medical information is twofold: (1) to give you vocabulary to assist with formulating search terms and (2) to make it easier to discuss and explain the EBP process. However, studies often examine more than one of these topics and can be difficult to place squarely into a category. This occurrence does not indicate a flaw in the literature, but rather the nature of categorization systems. We create categories to organize information and to enable communication.

Assigning Levels of Evidence

Another means of categorizing medical information is to assign the level of evidence to a given resource. Several systems have been developed for designating evidence levels. It is common to refer to these systems as **evidence pyramids**.

Recent research has supported the concept of an evidence pyramid, which is a visual representation and system for categorizing healthcare information according to level of evidence. In most systems the top of the pyramid represents the highest level of evidence, those resources that are considered to be the most trustworthy. A team of researchers led by John Ioannidis has conducted meta-analytic studies in which they have examined the frequency with which well-published research findings have been positively refuted. In describing Ioannidis's research, Freedman[21] reported that 80% of nonrandomized studies (which rank low on the evidence pyramid) turn out to be wrong. Moving up the evidence pyramid, randomized control trials are shown to be wrong approximately 25% of the time. Near the top of the pyramid, large, high-quality randomized control trials are shown to be erroneous nearly 10% of the time. The higher a study appears on the pyramid, the less likely it is to be discredited by later research. There is no guarantee, of course, but Ioannidis's research has demonstrated the utility of the evidence pyramid.

The peak of the pyramid includes systematic reviews and meta-analyses that summarize well-designed randomized control trials. A Cochrane Review is this type of resource. The next level includes critically appraised synthesis or synopsis resources, also known as evidence-based reviews, critically appraised topics (CAP), or patient-oriented evidence that matters (**POEMs**). Sources such as DynaMed, Physician's Information and Education Resource (PIER), and BMJ Point of Care generally provide this level of evidence. It is not unusual for medical information providers to offer various levels of evidence.

The next level includes randomized control trials (RCTs). This level is sometimes subdivided by the size of the study and the levels of blinding. Large size, longitudinal, multicenter, double- or

triple-blind studies are generally ranked highest in this group. In the next level, beneath RCTs, are cohort studies. These are then followed in the hierarchy by case-control studies, case series, and case reports. The remaining levels of the pyramid include textbooks, literature review articles (which differ from systematic reviews), laboratory research, and expert opinion pieces.

A number of different evidence hierarchy systems are available. We do not claim any one system to be the definitive system. You might find it useful to perform an Internet search on the term "evidence pyramid" and look at several of the results. The utility of this concept is that it gives you another means for appraising a resource. It is less important that you correctly identify the layer into which a given resource should be placed, but more important that you recognize if a resource is near the top, near the middle, or near the bottom of the hierarchy. See **Figure 1–6** for an example evidence hierarchy.

Some medical information providers give a rating scheme with the resources they provide, making it easier for you to ascertain the level of evidence. Often this information is referred to as the *strength* of a recommendation. For example, the USPSTF provides a grading system for its recommendations. The current USPSTF recommendation on screening men for lipid disorders is to screen men older than 35 years.[22] This recommendation is rated as a "Grade A recommendation," which means that "There is high certainty that the net benefit is substantial." The USPSTF defines high certainty as follows:

> *The available evidence usually includes consistent results from well-designed, well-conducted studies in representative primary care populations. These studies assess the effects of the preventive service on health outcomes. This conclusion is therefore unlikely to be strongly affected by the results of future studies.*[23]

This definition does not clearly indicate if a USPSTF Grade A recommendation comes from a meta-analysis, systematic review, RCT, or so on, but it does help you determine that information assigned this grade belongs in the upper section of the pyramid.

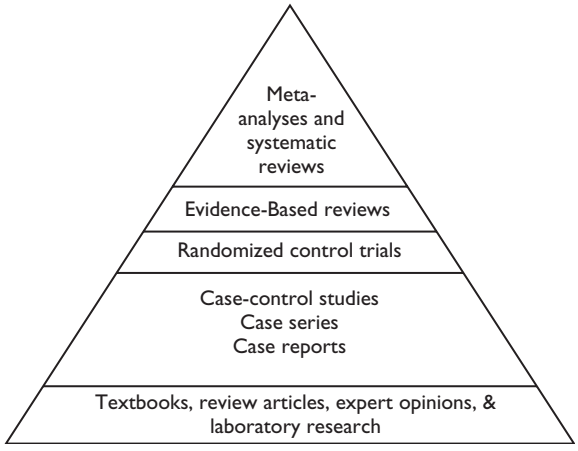

Figure 1–6 Evidence Hierarchy

EBP and Your Time

Engaging in EBP can feel time consuming. And, in the beginning, well . . . it is. It takes time to learn the skills of EBP. It takes time to develop your fund of knowledge. It takes time to learn what is contained in various resources. However, eventually EBP becomes a habit. And as it does, it will cease feeling like a cost to your time and more like a natural part of clinical practice. The perspectives we offered earlier about prospective, concurrent, and retrospective EBP will help with the time cost. Another strategy that will help reduce the time cost is collaborating with other clinicians. As we mentioned earlier, a team approach can be of benefit. It might also help if you expect it to take several years of practice until EBP starts to feel natural to you.

CASE STUDY: WRITING FOCUSED CLINICAL QUESTIONS

We return now to Mr. Martinez in order to bring together some of the concepts addressed in this chapter. In this case study, you will write a set of focused clinical questions following the procedure outlined earlier in the chapter. We also will give you several examples of focused clinical questions and explain how we would approach the case.

The Case of Mr. Martinez

Before beginning the case study, we need to explain some of the concepts the case involves. Mr. Martinez has four evident health problems: (1) overweight, (2) dyslipidemia, (3) hypertension, and (4) tobacco abuse. We will give you some information on each of these topics, but this is a good point to have some biology, physiology, and/or pathophysiology textbooks at hand.

Mr. Martinez, a 45-year-old male of Hispanic descent, visits his primary care provider for a routine employment-screening physical. He has been hired as a home construction site manager for a local company that requires a medical release in order for him to start his job. Mr. Martinez appears to be well, although overweight (height: 70 inches, weight: 202 pounds, waist: 38 inches). He has no health complaints. When asked about his family history, he reports that his father died recently at the age of 65 from a heart attack. Further questioning reveals that Mr. Martinez is quite concerned about his own heart health. He has a wife and two teenage sons. He does not want his family to lose him at a young age. Lab tests reveal that he has abnormal lipid levels: total cholesterol = 222 mg/dL, HDL = 30 mg/dL, LDL = 160 mg/dL, triglycerides = 160 mg/dL. He also admits to smoking one pack of cigarettes per day for the last 25 years. On physical exam he is found to have a heartbeat with regular rate and rhythm, without murmurs, rubs, or gallops. His pulse is 78 beats per minute, his blood pressure is 136/88 mm Hg. His lungs are clear to auscultation bilaterally.

Overweight

The term **overweight** is defined by the CDC based on **Body Mass Index** (**BMI**). The calculation of BMI for adults older than 20 years of age uses one of two formulas: weight (kg)/[height (m)]^2 or (weight (lb)/[height (in)]^2) × 703.[24] The first formula uses metric measures and the second one uses standard measures. The calculation for Mr. Martinez's BMI would be as follows:

$$\left(\frac{202}{70^2}\right) \times 703 = 20.98$$

Mr. Martinez's BMI falls within the CDC category of overweight. The BMI categories defined by the CDC are shown in **Table 1–1**.

Dyslipidemia

Dyslipidemia is high levels of total cholesterol and triglycerides in the presence of low levels of HDL (high density lipoproteins). A common generalization is to divide cholesterol into two types: so-called "bad" cholesterol (LDL) and "good" cholesterol (HDL). This is an oversimplification, but it works for our purposes here. According to the Friedwald formula, total cholesterol (TC) is the sum of HDL, LDL, and VLDL (very low density lipoproteins).[25] VLDL can be estimated by taking one-fifth of triglycerides.[26] Mr. Martinez's triglycerides were 160 mg/dL, giving a VLDL number of 32 mg/dL. His LDL value was 160 mg/dL, and his triglyceride value was 160 mg/dL. Thus, his TC calculation is:

$$30_{HDL} + 160_{LDL} + 32_{VLDL} = 222_{TC}$$

Table 1–2 presents the ATP-III (Adult Treatment Panel III)[27] reference ranges for TC, LDL, and triglycerides. Based on this information, his TC is *borderline high*, his LDL level is *high*; and his triglycerides are *borderline high*.

The next factor to consider is Mr. Martinez's HDL, or "good cholesterol," level. The reference ranges

Table 1–1 CDC BMI Categories

BMI	Weight Status
Below 18.5	Underweight
18.5–24.9	Normal
25.0–29.9	Overweight
30.0 and above	Obese

Table 1–2 ATP-III Total Cholesterol, LDL, and Triglyceride Reference Ranges

Total Cholesterol (mg/dL)	LDL (mg/dL)	Triglycerides (mg/dL)
< 200 Desirable 200–239 Borderline high 240 High	< 100 Optimal 100–129 Near optimal/ above optimal 130–159 Borderline high 160–189 High 190 Very high	< 150 Normal 150–199 Borderline high 200–499 High 500 Very high

Table 1–3 ATP-III HDL Reference Ranges

HDL (mg/dL)	
< 40	Low
≥ 60	High

for HDL are shown in **Table 1–3**.[27] With an HDL level of 30 mg/dL, Mr. Martinez falls into the *low* category. In this case, "low" is a bad outcome, because it means he has a low level of good cholesterol.

Hypertension

Hypertension, simply put, is high blood pressure. The Seventh Report of the Joint National Committee (JNC) on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure[28] defines hypertension as a blood pressure greater than or equal to 140 mm Hg systolic or greater than or equal to 90 mm Hg diastolic. Also, by definition, a patient who is currently using antihypertensive medication has hypertension. The JNC's recommended practice for diagnosing a patient with hypertension is to average several blood pressure measures.[28] It is considered hypertension if that average meets the definition. Mr. Martinez's blood pressure was 136 mm Hg systolic and 88 mm Hg diastolic. With only one measure available to us, however, we cannot determine if he has hypertension. More than likely our next step in his case would be to schedule a follow-up appointment and take another blood pressure reading.

Tobacco Abuse

Mr. Martinez reported that he smokes one pack of cigarettes per day. A patient who smokes 20 cigarettes per day for a year is said to have a "1 pack year" history of smoking.[29] With a 25-year history of smoking 20 cigarettes per day (20 is the number contained in a pack of cigarettes), Mr. Martinez has a 25 pack–year history of smoking.

Case Study Steps

1. On your own, complete steps 1 through 3 of the EBP process. Write down the information you need, the purpose of your query, and your focused clinical question(s). You might have more than one purpose and more than one question for each purpose.
2. Next, work with a group of two to three others and repeat what you just did.
3. Check your work. In the case study summary, you will find a list of focused clinical questions that we came up with regarding the case of Mr. Martinez. The list is not all-inclusive, but it does provide examples for you to compare with your own. We also provide our responses to steps one and two in the EBP process.

Case Study Summary

Step 1 in the EBP process is to recognize a need for information. As we considered the case of Mr. Martinez, we recognized that we had several

information needs. Perhaps you had some of the same needs. It is likely that you also came up with different needs than ours or from your classmates.

We needed to know more about the common occupational health concerns for home construction sites. We also did not know which smoking cessation and weight loss strategies are most effective. Additionally, we realized that there have recently been conflicting reports regarding cholesterol-reducing medications and that we need to consider which option is best or whether a behavioral treatment option might be better. There are limitless possibilities to the questions we could ask, but for step 1 what is important is identifying the areas in which we need information. The answer will differ, depending on the practitioner's specialty and experience.

Step 2 in the EBP process is determining the purpose of the evidence search. This can be derived from the reason for the visit, the patient's signs and symptoms, or a request made by the patient. Mr. Martinez was seen for an employment-screening physical exam. Thus, the initial question is whether he is able to perform the job of construction site manager without danger to himself or others.

For this reason, we might center our query on this aspect of the case. As responsible primary care providers, with Mr. Martinez's four health problems we might wish to explore other questions, such as smoking cessation treatment or weight loss. Prevention of heart disease is also high on our list, not only because of his presenting signs but also because Mr. Martinez said he is concerned about heart disease.

In the third step of the EBP process, the objective is to write focused clinical questions. A focused clinical question includes the following six elements: Problem, Patient/Population, Action, Alternative Action, Results, and Evidence. Here we will focus on the first two elements of a focused clinical question:

- P (Problem) = a specific condition of interest
- P (Patient/Population) = patient/population risk factors; patient/population demographics

Mr. Martinez has four conditions: (1) overweight, (2) dyslipidemia, (3) hypertension, and (4) tobacco abuse. As a construction site manager, how might any of these conditions affect his safety and the safety of others? These conditions would be a primary concern to his potential employer. We would construct a focused clinical question related to this concept as shown in **Figure 1–7**.

We will not literally search for this question, verbatim, but we will use it to establish search terms. For the time being, we will set aside the issue of search terms, because it takes us into steps 4 and 5. This exercise is designed to go through steps 1, 2, and 3.

Looking at our question, it occurred to us that there might be another important factor—the environment. Does Mr. Martinez work in a place that is cold, wet, dusty, noisy, and so on? When gathering his history, it would be important to ask these questions. The answers to these questions will help narrow the evidence search and improve our chances of identifying his occupational environment risk factors.

We also would have asked him if he had any existing health conditions such as ringing in his ears, blurry vision, asthma, allergies, orthopedic injuries, arthritis, and so on. Mr. Martinez had none of these conditions. In some instances, we might collect information about the work environment from the employer. Some employers provide that information with the screening physical examination form.

In the question formulated in Figure 1–7, overweight was a risk factor for occupational health conditions. It is also a risk factor for heart disease. So, if we had a question about prevention of heart disease, overweight would again appear as a risk factor. However, if we had a question about

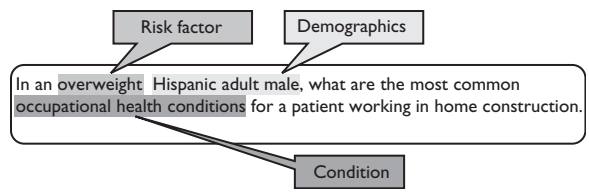

Figure 1–7 Clinical Question

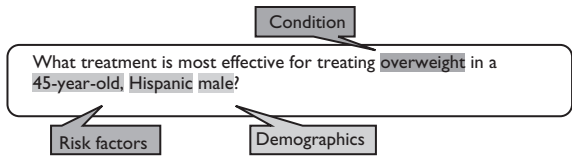

Figure 1–8 Focused Clinical Question

weight loss treatments, overweight becomes the condition. His risk factors for overweight include Hispanic race/ethnicity and age older than 40. **Figure 1–8** shows how we constructed a focused clinical question on weight loss.

One issue remains with this question, however. Which treatments are we considering? At this point, the question is too broad. It would be difficult to locate studies that compare all treatments. This is not always the case, but our prior experience with this area of investigation has already shown this to be the case. There is little research comparing nutritional and exercise interventions, as opposed to something like cholesterol-lowering medications, which have a significant, high-level body of research literature.

Thus, it would be necessary to have a list of treatments we are considering and to include them in the question, or to write several questions. We were interested in nutrition and exercise interventions. Specifically, we wanted to know which nutritional and exercise interventions are effective, whether one is better than the other, and if combining the two is more effective than either one of them individually. This leads to several questions:

- Which nutritional action or intervention is effective for treating overweight in a 45-year-old Hispanic male?
- Which exercise intervention is effective for treating overweight in a 45-year-old Hispanic male?

Then, depending on the answers to the above questions:

- Between [the successful nutritional and exercise interventions], which is most effective for a 45-year-old Hispanic male: nutrition alone, exercise alone, or a combination of the two?

Inside the brackets would be the names of the interventions of interest. It is not unusual to have a single information need lead to multiple focused clinical questions.

Lastly, the process of identifying focused clinical questions is both reflective and iterative. By that, we mean new questions emerge as you reflect on questions you have written. New questions will also emerge as you go through the EBP process. It might take several iterations of the process for you to identify all of your questions. This is one reason it helps to write your questions down. Spending a little time looking at your questions will often cause you to recognize other questions or important additional aspects to your questions, much as we recognized the need to include specific treatments in our focused clinical questions or the need to know about his work environment.

CHAPTER SUMMARY

Historically, decisions in health care have been based on custom or authority. Evidence-based practice (EBP) has begun to change this custom. EBP is the process of combining the best available research evidence with your knowledge and skill to make collaborative, patient- and population-centered decisions within the context of a given healthcare situation. Clinicians today appraise the trustworthiness of information rather than relying strictly on the authority of the information source. Furthermore, clinicians today strive to make choices that result in outcomes that matter, such as reduced morbidity, mortality, and cost.

It takes time and experience to develop the skills to practice EBP effectively. Clinicians practice EBP prospectively, concurrently, and retrospectively. Each clinician develops his or her own EBP process based on the type of practice and patients seen. Clinicians apply EBP to choose diagnostic tools, treatment procedures, and patient education strategies. EBP is needed when a clinic chooses a standard of care, when a pharmaceutical representative offers free samples, or when an insurance company requires a letter from a provider to justify coverage of a requested treatment. Medical information used in the practice of EBP includes

not only research on diagnosis and treatment, but also epidemiologic research and studies on harm, prevention, and prognosis.

Meanwhile, the information available to clinicians is expanding at an incredible rate. It is increasingly important that providers can identify valid information. For this reason, information services have emerged that offer pre-appraised evidence-based resources, though often for a fee. The skills of EBP can enable a clinician to differentiate valid information from opinion. They can also improve a clinician's ability to sift through voluminous pages of results and quickly locate relevant information.

The process of EBP begins with your recognition of an information need. It requires self-awareness, humility, and a commitment to lifelong learning. Recognizing a need for information leads you to establishing a purpose for an evidence query and formulation of one or more focused clinical questions. These questions guide the selection of target resources and provide your search terms. As you search, you organize your findings and appraise the trustworthiness and relevance of the information you encounter. Based on this appraisal, you and your patient select and implement a course of action. Then you evaluate the effectiveness of the action you have taken and communicate the outcome.

EBP is more efficient and effective when practiced in teams. Each clinician brings different knowledge, skills, and experiences to the group. This means each clinical team member has different strengths to contribute to the hunt for the best available evidence. Some clinics employ EBP as a part of their operations by holding EBP meetings or running their own journal clubs.

Evidence sources can be categorized according to their level, or strength. Evidence pyramids offer a system for categorizing a source's level of evidence. Some information providers, such as the U.S. Preventive Services Task Force, assign the evidence level of the recommendations they publish. No system for levels of evidence has been identified as the best one. When a resource uses an evidence rating system you will need to read its procedures and definitions.

Lastly, regardless of the source, you will need to regularly appraise information. You will need to consider not only the trustworthiness of the information, but also the limitations of the clinical situation as well as the needs and preferences of the patient and the patient's family. You are not likely to have time, nor a need, to perform an evidence search with every patient. However, you will need to continuously update your knowledge and question your assumptions about health care. Utilizing EBP will help you remain current and make the best choices with your patients.

EXERCISE

Review the following case. Look up any terms or concepts in the case that are unfamiliar and then complete steps 1 through 3 of the EBP process. Write your focused clinical questions. Think about the search terms you might use and where you might begin to look for answers.

> Ms. Hooper is a 24-year-old Caucasian woman who presents to the emergency room with acute neck pain following an automobile accident. Her vehicle was struck from behind by another vehicle. She does not know how fast the other vehicle was moving when it struck her car. Her friends drove her to the emergency room. She was able to walk into the hospital and sit upright while waiting to be examined. On physical exam, you find no neurologic deficits. She is alert with a Glasgow Coma Score (GCS) score of 15. She is able to actively rotate her neck 45 degrees to the left and to the right, though it does hurt to do so. However, she does not have midline cervical spine tenderness. A blood test shows no alcohol or other drugs in her system. She has no other serious injuries. She does have a minor contusion above her left eyebrow and bruising across her shoulder and abdomen from the seatbelt. She reports no other health problems. She is taking oral contraceptive pills. Ms. Hooper does not have health insurance and you need to determine if she requires c-spine imaging to rule out a c-spine fracture.

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