Chapter 9
Incorporating Evidence-Based Medicine into Your Daily Life

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Dr. Lane has been a practicing hospitalist at a busy community hospital for the past 5 years. While she felt up to date on current medical practices when she graduated residency, she feels her skills in delivering the best care possible in an evidence-based manner have deteriorated. She makes a conscious decision to rededicate herself to incorporating evidence-based medicine into her daily life. She is concerned, however, that it may be too difficult to stay up to date given the rate of medical advances. She decides to explore strategies to see how she can be able to accomplish this new goal. This chapter aims to provide the practicing hospitalist with tools to incorporate evidence-based medicine into daily practice in a way that is both efficient and meaningful.

The practice of medicine has changed significantly over the past century. From the mid 1950s, there has been an explosion of innovations and discoveries that have changed the landscape of medicine. With the development of new medications such as statins, immunosuppressants, and chemotherapeutic drugs, to the invention of everyday medical devices, it is easy to see how the practice of medicine today is rapidly evolving. All these innovations and advances have helped shaped our

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profession and allowed us to provide better care to our patients. However, this comes at a cost. The enormous amount of information that is generated daily makes it difficult for the practicing hospitalist to stay up to date. In 2013 alone, over 700,000 completed references were added to MEDLINE [1]. Today's hospitalists have an ethical duty to remain current with medical evidence that impacts our patient population. However, this can be a daunting task and without a systematic approach this will be unrealistic. Having the skill set to effectively and efficiently use evidence-based medicine to provide the best care to our patients is necessary to be a quality hospitalist.

What Is Evidence-Based Medicine?

Evidence-based medicine (EBM) is a term coined in 1996 by a group of clinicians from the McMaster University in Ontario, Canada. Dr. David Sackett, who was part of the original team and a pioneer of EBM, described it as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available external clinical evidence from systematic research." [2] Furthermore, he went on to state that "evidence-based medicine is the integration of best research evidence with clinical expertise and patient values" [3] (Fig. 9.1). Based on his definition, it is clear to see that EBM is not a prescribed approach to medicine, rather it is a means to provide the tools necessary to adequately answer a clinical question.

Fig. 9.1 Components of evidence-based medicine

Why Is Evidence-Based Medicine Important to Every Day Practice?

EBM is a crucial piece to providing appropriate care to patients. It offers a way for hospitalists to overcome inherent biases, maintain knowledge base with relevant medical information, and de-emphasizes the practice of medicine that is purely based on unsystematic clinical experiences. It also promotes consistency of treatment modalities, establishes national standards of patient care, and allows the hospitalist to provide the best care at the lowest cost. Finding a way to incorporate EBM into your daily life may seem daunting at first; however, strategies can be taken to incorporate this process into your daily practice without a great deal of effort.

The Evidence-Based Medicine Search Model

EBM is an analytical process which involves five steps known as the 5 A's: Ask, Acquire, Appraise, Apply, and Assess [4]. Using the following steps, you can use EBM to guide your clinical care and augment your ability to treat your patients more effectively and cost-efficiently. The following steps will guide you on this process.

Step 1: **Ask a Clinically Relevant Question**

The first step of the EBM search is developing an *answerable* question that is *relevant* to your patient [5]. Formulating the right question facilitates the literature search, and narrows down the results. A common tool used to assist clinicians in formulating this question is **PICO**—a mnemonic which stands for **P**opulation, **I**ntervention, **C**omparison, and **O**utcome [6]. With the use of PICO, you can quickly identify the different components of the question and rephrase it in a manner that it is clear and easily searchable.

P I C O [7]

P*opulation*: Refers to the *most important characteristics* of the group of patients being evaluated. Think of it as the terms you use to describe your patients when writing a note or speaking to a colleague. Some of these characteristics include age, sex, comorbidities, and the active condition at hand.
I*ntervention*: Refers to the intervention, prognostic factors, or exposures being considered. Examples include initiation of a new medication, or use of particular test (i.e., colonoscopy).
C*omparison*: Refers to the main alternatives being considered. Examples include comparing the effect of one drug versus another one, comparing the benefit of two different diagnostic tests, or comparing the effect of medical versus surgical

management. This step is considered optional as not all interventions need or have an available alternative.
***O**utcome*: Refers to what you hope to accomplish, measure, or affect. For example, are you looking to cure an illness? Relieve symptoms? Improve function? Remember that your outcome needs to be a specific measure pertinent to your patient.

Here is an example of how to use the PICO model to formulate a question.

Mrs. Brown is a fifty-two-year old woman with a history of hypertension who is admitted to the hospital with newly diagnosed insulin-dependent diabetes and uncontrolled hyperglycemia. During rounds you note that her blood pressure is 185/95 despite being on maximum doses of her home antihypertensive regimen. You wish to start a new medication and want to know if drug X is more effective that drug Y in controlling her blood pressure.

Now, let's identify the PICO components in this scenario.

P Middle-aged woman with insulin-dependent diabetes and hypertension
I Drug X
C Drug Y
O Control of blood pressure

The next step is to frame the question based on the PICO model:

In middle-aged female patients with insulin-dependent diabetes and hypertension, is drug X more effective than drug Y in controlling blood pressure?

Now that the question has been created, the next step of the evidence base search model is to find the answer in the literature.

Step 2: **Acquire the Data**

This step refers to the actual review of the literature. For most clinicians, this is the most intimidating and time-consuming step of EBM due to the sheer volume of literature available. EBM models facilitate the search by providing a framework which quickly guides the user to the best study type available to answer a particular clinical question.

In order to become proficient with this step it is important that you familiarize yourself with the sources of information, types of study designs available and the evidence pyramid, as well as the best study designs for the type of question asked.

Source of Information
The first classification to discuss is the difference between primary and secondary sources of information. Primary sources are the cornerstone of the literature and refer to the original studies. Randomized-controlled trials, cohort studies and case-control studies are examples of primary sources. Secondary sources refer to publications that have already been reviewed by experts and present the information pertinent to a specific question in a synthesized format. Examples of secondary sources include systematic reviews and meta-analysis.

Type of Study Design and the Evidence Pyramid

The second subset to review is the types of studies available. As you review this, it is helpful to use the *pyramid of evidence*—a graphic representation of how information is graded based on their level of quality, with the top of the pyramid representing the highest quality of evidence (Fig. 9.2).

In the evidence pyramid, the top portion is composed of systematic reviews, critically appraised topics (CATs) and critically appraised individual articles (CAIAs). These levels of the pyramid are considered "filtered information" as another party has already reviewed the literature, filtered out poor quality studies, and synthesized the information into more meaningful conclusions or recommendations. Systematic reviews are considered the most refined and sought after reviews of the literature and typically lead to the development of medical guidelines and national standards. Meta-analysis is a part of a systematic review and refers to the statistical technique used to combine the results of multiple studies in order to calculate the combined treatment effect. One of the most well-known databases for systematic reviews is the Cochrane Database of Systematic Review (http://www.cochrane.org/) created in 1993 and published by the International Cochrane Collaboration.

Following the hierarchy of evidence, the other two levels of filtered information are critically appraised topics (CATs) and critically appraised individual articles (CAIAs). CATs are a synthesis of the all published evidence on a specific question, think of it as a mini systematic review. CATs can be found in ACP Journal Club, DynaMed, and PIER. CAIAs on the other hand, are summaries of an individual study and they can be found in programs such as EvidenceUpdates and Bandolier.

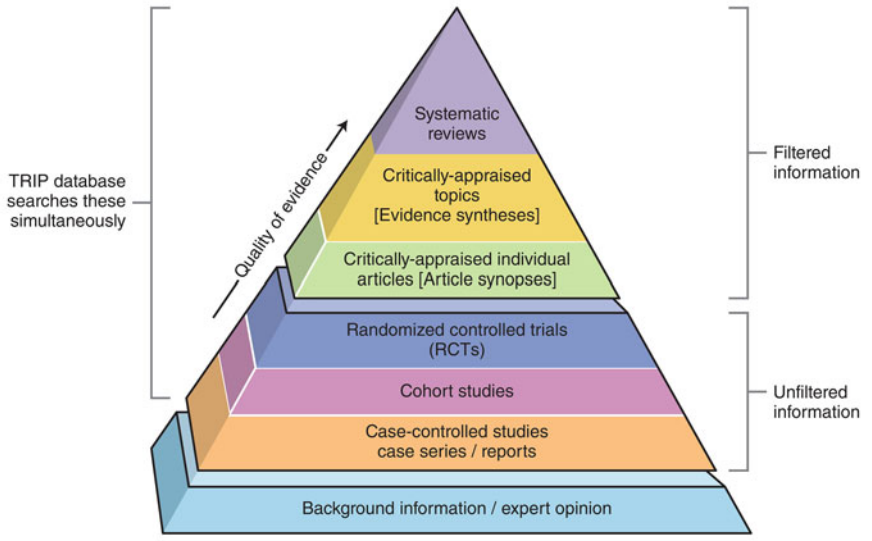

Fig. 9.2 Pyramid of evidence

For the busy hospitalist, using the levels of filtered information (systematic reviews, CATs, CAIAs) is the most time-efficient and effective way to incorporate EBM into your daily practice. These levels of filtered information have already been rigorously evaluated by both experts in the field as well as experts in statistical analysis, and generate sound recommendations based on the best current evidence.

Below filtered information on the evidence pyramid you find unfiltered information. Unfiltered studies include randomized-controlled trials (RCTs), cohort studies, and case-control studies/case series. As mentioned previously, these are the primary sources of all available data and they are particularly useful when systematic reviews and clinically appraised articles are lacking. Unfiltered studies can be found using well-known search engines such as MEDLINE and PubMED.

At the base of the pyramid of evidence, you will find background information and expert opinion. At this level the information is typically factually stated, such as in the case of the pathophysiology or epidemiology of an illness, or based on expert opinions. At this level the quality of the information can be low, and the recommendations are not typically backed up by research.

Systematic reviews represent the most evidence-based information and should be the starting point for your search; however, it is important to note that not all questions will be answered with the top level of the pyramid. Each level of the pyramid holds a particular value and it is important to know when to use it. When searching for the best source of evidence for a particular question, the type of question being asked (diagnosis, therapy, prognosis, or harm) typically dictates the best study design. See Table 9.1 for a summary of the best study designs.

Step 3: **Appraise the Literature**

Now that you have found the literature, the next step is to appraise it. Appraisal refers to assessing the validity of the study. Here you must review the study, analyze it, and decided if it is applicable to your patient [9]. This is a critical step in your evidence-based search as studies can be biased, poorly design, or not relatable to your search.

The type of in-depth appraisal depends on the study design. There are multiple worksheets online that can help you analyze a paper. For a detailed list of questions to ask, you can refer to Critical Appraisal Worksheets at http://www.dartmouth.edu/~library/biomed/guides/research/ebm-resources-materials.html

Table 9.1 Best study design for a particular question [8]

Type of question	Best study design
Diagnosis	Prospective, blind comparison to a gold standard or cross-section
Therapy	RCT
Prognosis	Cohort study > case-control > case series
Harm	Cohort > case-control > case series

Adapted from Dartmouth Biomedical Libraries: Evidence-Based Medicine Worksheets

Step 4: **Apply**

After you have reviewed the literature and analyzed the information, it is imperative that you go back to the patient and determine if the information is applicable. This step ensures that the best evidence obtained is aligned to your patient's preferences. In evidence-based practices, the patient is at the center of the model and is an active participant of the decision-making process.

Step 5: **Assess**

The final step is the assessment of your intervention. Did the intervention affect my patient? Was the effect beneficial to my patient? Was it harmful? Was it aligned to their desires? This is also a time of reflection of the individual steps and a learning opportunity for future searches.

Tips to Incorporate EBM to Everyday Practice

1. ***Commit to the practice of EBM***
   In order to become proficient with EBM, you must invest the time and make it part of your daily work. Initially, it will be challenging and time consuming, but with practice it will become part of your daily routine and dramatically improve your skills as a hospitalist.
2. ***Understand the Language***
   A common limitation hindering physicians from practicing EBM is their discomfort with the research terminology. In order to be comfortable with EBM, it is important that you become familiar with the basic research terminology. Table 9.2 shows a list of the most commonly used research terms.
3. ***Learn how to formulate the right question***
   Remember the mneumonic **PICO** (Population, Intervention, Comparison, and Outcome) and use it with all your searches.
4. ***Understand the levels of evidence and the different study designs***
   Place a copy of the evidence pyramid and the table of best study designs on your work desktop or work table. Keep it as quick reference when searching the literature to save time and significantly limit your search results.
5. ***Actively engage your patient in the decision-making process***
   Knowing what your patient wants before you engage in the search will limit your search results. There is no need to look up a procedure or intervention if your patient is not interested in it.
6. ***Use EBM search engines and have it accessible at work***
   There are multiple online programs created to quickly and accurately answer medical questions, take advantage of them! Download the programs to your work computer so they are readily available. Examples include the TRIP Database (www.tripdatabase.com), Cochrane Library (www.cochrane.org/),

Table 9.2 Common research terminology [10]

Absolute risk reduction	The absolute arithmetic difference in rate of bad outcomes between experimental and control participants in a trial, calculated as Experimental Event Rate (EER)—Control Event Rate (CER) and accompanied by a 95 % CI
Case-control study	A study which involves identifying patients who have the outcome of interest (cases) and patients without the same outcome (controls), and looking back to see if they had the exposure of interest
Case series	A report on a series of patients with an outcome of interest. No control group is involved
Cohort study	Involves identification of two groups (cohorts) of patients, one which received the exposure of interest, and one which did not, and following these cohorts forward for the outcome of interest
Confidence interval	Quantifies the uncertainty in measurement. It is usually reported as a 95 % CI which is the range of values within which we can be 95 % sure that the true value for the whole population lies
Cross-sectional study	The observation of a defined population at a single point in time or time interval. Exposure and outcome are determined simultaneously
Intention-to-treat analysis	A method of analysis for randomized trials in which all patients randomly assigned to one of the treatments are analyzed together, regardless of whether or not they completed or received that treatment, in order to preserve randomization
Likelihood ratio	The likelihood that a given test result would be expected in a patient with the target disorder compared with the likelihood that this same result would be expected in a patient without the target disorder
Meta-analysis	A systematic review that uses quantitative methods to synthesize and summarize the results
Number needed to treat	The inverse of the absolute risk reduction and the number of patients that need to be treated to prevent one bad outcome. Calculated as the inverse of the absolute risk reduction NNT = 1/ARR
Odds ratio	The ratio of the odds of having the target disorder in the experimental group relative to the odds in favor of having the target disorder in the control group (in cohort studies or systematic reviews) or the odds in favor of being exposed in subjects with the target disorder divided by the odds in favor of being exposed in control subjects (without the target disorder)
Negative predictive value	Proportion of people with a negative test who are free of the target disorder
Positive predictive value	Proportion of people with a positive test who have the target disorder
Randomized-control trial	Participants are randomly allocated into an experimental group or a control group and followed over time for the variables/outcomes of interest
Relative risk reduction	The proportional reduction in rates of bad outcomes between experimental and control participants in a trial $\mathrm{RRR} = \frac{\mathrm{EER}-\mathrm{CER}}{\mathrm{CER}}$

(continued)

Table 9.2 (continued)

Sensitivity	Proportion of people with the target disorder who have a positive test result. It is used to assist in assessing and selecting a diagnostic test/sign/symptom
Specificity	Proportion of people without the target disorder who have a negative test. It is used to assist in assessing and selecting a diagnostic test/sign/symptom
Systematic review	A summary of the medical literature that uses explicit methods to perform a comprehensive literature search and critical appraisal of individual studies and that uses appropriate statistical techniques to combine these valid studies

ACP Journal Club (https://acpjc.acponline.org/), and Bandolier (http://www.medicine.ox.ac.uk/bandolier/).

7. ***Download apps to handheld devices***
   We all use our phones to look up medical information. Instead of quickly searching for an answer on non-reputable sources, use EBM smartphone apps. Some examples of useful apps include DynaMED Plus, ABX guide, Uptodate, and Medscape.
8. ***Participate in EBM seminars***
   A good number of medical conferences directed to hospitalists have workshops on EBM. Go to these seminars to refresh your knowledge and learn new skills.
9. ***Participate in local journal clubs***
   Journal clubs are an excellent way to get to know your colleagues, earn continuing medical education (CME) points, and practice your newly learned EBM skills.

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