EVIDENCE-BASED CLINICAL PRACTICE

Evidence-Based Medicine in Primary Care: An Overview

John P. Geyman, MD

Editor's Note: This article is the first in a series of articles that during the next 2 years will sequentially address various evidence-based approaches to the diagnosis and management of common clinical problems in primary care. Future articles will deal with clinical efficacy and effectiveness, clinical practice guidelines, quality-of-life and outcomes analysis, patient preferences, meta-analysis, cost-effectiveness analysis, decision analysis, technology assessment, and related subjects. This Journal will also welcome papers that report studies of cost-and-outcome assessment relevant to primary care practice. We hope that this new feature, Evidence-Based Clinical Practice, will be useful to clinicians seeking to base their practice more on evidence-based approaches in their quest for improved patient care and a more fulfilling style of practice.

Case 1-1
A 2-month old infant was brought into a rural island clinic at 11 PM with a temperature of 104°F (rectal). The child had been in good health from birth at full term until 2 days previously, when there was onset of intermittent fever to 104°F. There was no vomiting or lethargy. Heart rate, blood pressure, and respiratory rate were within normal limits. There was no rash and the neck was supple. The parents were observant and commented intelligently about the infant's condition. The family did not have health insurance. The last ferry to the mainland had left 1 hour earlier. The weather conditions were conducive for flying, but emergency transportation to a hospital would cost about $2000.

The physician doubted that the child had a life-threatening problem but could not be absolutely sure. He knew that the regional children's hospital 100 miles away had emergency hospital admission protocols for a sepsis work-up for infants younger than 3 months. He also knew that acute viral illness was the usual cause of illness and that most of these work-ups had negative findings for more serious problems. Though his reference books were current, he could not quantitate the risks and potential harms versus benefits of reexamination in the office 8 hours later versus emergency transportation to the hospital to work up for sepsis. The conscientious parents had the child flown to the mainland for care after talking to a pediatrician there who advised hospital admission (also without any estimates of harms versus benefits). The work-up was negative, the family acquired a sizable hospital bill, and the child was doing well without treatment 2 days later.

Introduction
The above case typifies a common problem faced almost daily by primary care physicians—how to quantify harms versus benefits and counsel patients and families about patient care options when needed evidence is either unavailable or unknown. Our prevailing system of medical education and usual process of continued learning in practice have not been based on rigorous periodic reassessment of evidence for or against particular management options. Our journals and textbooks, even if they can be accessed rapidly within the short time required for clinical decision making, are usually not helpful in quantifying harms versus benefits. The clinician usually relies on his or her clinical experience and judgment, perhaps buttressed by the advice of colleagues or consultants who practice the same way.

The recent rise of evidence-based medicine represents a major, but still untested, intellectual advance in the process of clinical decision making and patient care. The term has encountered varied reactions among physicians in both community and academic settings, ranging from skepticism or outright dismissal to enthusiastic acceptance.

Sackett and his colleagues have defined evidence-based medicine as the "conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients." Evidence-based practice requires the integration, patient by patient, of the physician's clinical expertise and judgment with the best avail-
able relevant external evidence. The process of evidence-based medicine is summarized in Table 1.

In Case 1-1 evidence-based approaches could have clarified harms versus benefits of hospital admission for a sepsis work-up and enabled better informed partnership decision making between the physician and the parents. The physician later undertook a brief literature search, which showed that the risk of bacterial meningitis and serious bacterial infection are about 0.5 percent (1 in 200) and 1.5 percent, respectively.3,4 A practice guideline, based upon meta-analysis, has been formulated for the management of infants with fever without source. This guideline provides solid evidence supporting close ambulatory follow-up of low-risk infants (white cell count 5-15,000/µL, band cell count fewer than 1500/µL; normal urinalysis findings; fewer than 5 white cells per high-power field in stool when diarrhea is present).4 Interestingly enough, a later study evaluated parent preferences for the care of febrile infants without apparent source. Parents were given a case scenario similar to Case 1-1 and advised of the risks, outcomes, and costs of close ambulatory follow-up versus hospitalization for lumbar puncture and sepsis work-up. About 80 percent of the parents chose the ambulatory option of less testing and treatment, often basing this choice on fewer painful tests and procedures, lesser chance of unnecessary antibiotics, and the assurance that reevaluation was available if their child failed to improve.5

The purpose of this article and others to follow in this series is to explore the dimensions and clinical relevance of evidence-based medicine in everyday primary care practice. More specifically, this series will do the following:

1. Introduce readers to the varied problems in the prevailing system of clinical decision making which have led to evidence-based medicine as a new paradigm.
2. Enable clinicians in primary care to read the literature more critically and develop new skills of self-learning.
3. Set forth some of the basic principles of evidence-based medicine, including introductory consideration of relative quality of evidence related to costs and outcomes.
5. Provide readers with concrete and practical approaches to integrate progressively the process of evidence-based medicine into their everyday clinical work.

**Case 1-2**

A 50-year-old man came to a rural island clinic on a weekend with a finger injury sustained the previous evening while mooring a boat. He had been in good general health and was enrolled in a large health maintenance organization (HMO) in a metropolitan area 100 miles away. At examination he had a mallet-finger injury involving the long finger of his right (dominant) hand, with loss of extension of the tip. Radiographs did not show any associated fracture.

The physician was aware of the controversy regarding conservative treatment of this injury using a splint compared with surgical repair, but had no accessible evidence to assess the merits of the two approaches critically. A telephone call to the orthopedic surgeon on call at the urban hospital associated with the HMO resulted in an unequivocal recommendation for conservative treatment ("They usually do fine, and a few may need later surgery."). The patient was not entirely happy with this advice and requested a second opinion. Another telephone call was made to the orthopedic surgeon on call at the nearest mainland hospital. His recommendation was equally unequivocal: "Almost all of my patients have failed splinting treatment and needed surgery." The patient opted for surgery at considerably more expense.

**Some Dimensions of the Problem**

**Rapid Access to Relevant Information**

Case 1-2 represents only two dimensions of a multifaceted problem facing primary care physicians during their everyday encounters with patients who have common medical problems. The biggest problem, of course, is to obtain relevant evidence to assist in clinical decision making at the time of the visit. Sometimes this information is available but not readily accessible. A rapid computer search could have been useful, but the physician lacked the time or expertise to accomplish such a search. The percentage of physicians in ac-

### Table 1. Process of Evidence-Based Medicine.

<table>
<thead>
<tr>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Select specific clinical questions from patient's problem(s)</td>
</tr>
<tr>
<td>2. Search the literature or databases for relevant clinical information</td>
</tr>
<tr>
<td>3. Appraise the evidence for validity and usefulness to the patient and practice</td>
</tr>
<tr>
<td>4. Implement useful findings in everyday practice</td>
</tr>
</tbody>
</table>

Adapted from Rosenberg et al.3
tive practice who use computers for clinical data retrieval, although increasing, is still comparatively limited; for example, the American Academy of Family Physicians has found that only 26 percent of US family physicians who have office computers use them for MEDLINE searches.6

Without convenient access to appropriate electronic databases, retrieval of relevant and useful information in a timely manner has become almost impossible. Most textbooks are becoming dated as they are published, and few are grounded in evidence-based practice in today's terms. There are now about 25,000 medical journals in print, and the doubling time of biomedical knowledge, which is currently 19 years, results in a fourfold increase within a clinician's career.7 A physician often feels fortunate to find one or two useful articles in a single journal issue.

Rapid access to available electronic databases requires new skills and expertise. Given constant time constraints in a clinician's schedule, the physician is often frustrated in attempting to do a literature search. The database of the National Library of Medicine, MEDLINE, has some 6 million references from 4000 journals, with about 400,000 new entries each year.8 When rigorous evidence-based criteria are used to screen for clinically credible and useful information in the six most important medical journals, fewer than one article per issue has been judged to be of immediate clinical value.9 For example, one study of MEDLINE search patterns showed a low yield of useful information after an average search time of more than 20 minutes,10 while another showed that less than 1 percent of retrieved citations led to a new or changed clinical decision.11

Global Judgment by Experts

A pervasive problem to primary care physicians attempting to appraise clinical information revolves around conflicting recommendations by experts, sometimes within the same specialty and often across specialty lines and representing various agencies. Many, if not most, of the clinical guidelines that have been promulgated in recent years are based on global subjective judgments by experts rather than rigorous criteria for analysis of evidence. Berg12 has elucidated this lack of rigor well after considerable experience in evaluating clinical guidelines. Slawson and his colleagues13 have observed the dilemma of “specialist ping-pong” in circumstances of conflicting data and recommendations by specialists; resolution of this problem requires an evidence-based search for data related to outcomes. Part of this problem is due to the different patient populations seen by specialists and primary care physicians. A classic example was reported in 1980 by Ellenberg and Nelson,14 who found widely disparate results of studies of nonfebrile seizures among children who had previous febrile seizures; rates ranged from 1.5-4.6 percent in population-based studies to 2.6-76.9 percent in seizure clinic studies.

Gap Between Evidence and Clinical Practice

Another complex dimension is translating solid scientific evidence into actual clinical practice. Clinicians need to become aware of new evidence and then to appraise the quality of that evidence, which might result in acceptance, skepticism, or rejection of the evidence. If accepted, many sequential barriers in the process of patient care can block its implementation. Even in the case of clinical guidelines that are solidly based on scientific evidence, frequently a mismatch exists between the circumstances of clinical trials upon which the guidelines are based and actual clinical situations in which clinicians encounter patients with a given clinical problem.

Geographic Variations

During the last 15 years, many studies have reflected the extreme practice variations from one part of the country to another, and even within a given state. Wennberg15 found, for example, 20-fold differences in utilization rates for carotid endarterectomy in 16 large communities in 4 states. Within single states, he found the odds of tonsillectomy during childhood ranging from 8 percent in one Vermont community to 70 percent in another, while in Maine the range for hysterectomy varied from 20 percent to over 70 percent.15,16 A study of procedure rates for Medicare patients in 13 large metropolitan areas of the country showed variations of more than 300 percent for more than one half of the procedures.17 Recently another study found a fourfold variation in adjusted odds ratios for the likelihood of warfarin use for patients with atrial fibrillation in the South compared with the Midwest.18 All of these examples stretch the bounds of clinical credibility way beyond any reasonable variations that might be de-
Per capita health care spending in 1991 US dollars on the basis of gross domestic product purchasing power parity

<table>
<thead>
<tr>
<th>Country</th>
<th>Female life expectancy at birth (years)</th>
<th>Male life expectancy at birth (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey</td>
<td>68.4</td>
<td>78.5</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>64.1</td>
<td>73.0</td>
</tr>
<tr>
<td>Japan</td>
<td>75.9</td>
<td>81.9</td>
</tr>
<tr>
<td>Germany</td>
<td>72.6</td>
<td>79.0</td>
</tr>
<tr>
<td>Australia</td>
<td>73.9</td>
<td>80.0</td>
</tr>
<tr>
<td>France</td>
<td>72.7</td>
<td>80.9</td>
</tr>
<tr>
<td>Canada</td>
<td>73.8</td>
<td>80.4</td>
</tr>
<tr>
<td>United States</td>
<td>72.0</td>
<td>78.8</td>
</tr>
</tbody>
</table>

Figure 1. Per capita expenditure for health care versus life expectancy by country.


fended based upon clinical, demographic, or other geographic differences. These large practice variations call into question scientific truth in each instance; shifting to a more evidence-based style of practice would have to narrow these variations.

Cost Containment in an Era of Limits

National spending for health care services in the United States continues to rise at a rate well beyond the index of inflation. Despite many concerted efforts to rein in health care costs, the proportion of the gross domestic product expended for health care has grown from 5 percent in 1960 to 12 percent in 1990 to 15 percent today. This amount of spending represents one seventh of the national economy. For a family of 4 with a median family income of $30,000, health care spending has grown to about one third of that income, or $2500 per person.

Cost containment has become a driving force in health care reform and has ignited a vigorous national debate about alternative ways of structuring and financing health care services, managed care, value received (ie, outcomes), and comparative benefits to the individual patient versus population served. It makes logical and political sense to take an evidence-based approach to evaluating the need for various health care services and procedures based on analysis of costs and outcomes.

Genesis of Evidence-Based Medicine

Many forces appear to be driving the wide application of evidence-based medicine: the need for cost containment felt by the payers of health care services (principally the government and insurance industry); advances in medical informatics providing increased access to electronic databases, as well as the capacity to monitor practice patterns and outcomes; and continued pressure by patients and industry to apply the latest therapies. In addition to cost, access and quality add further momentum to efforts to reform the health care system. As costs have escalated, so has the number of uninsured, now totaling about 40 million people. Although the US health care system is touted by many to offer the highest quality of care in the world, outcome statistics for many reasons have often not demonstrated the best outcomes. Figure 1, for example, compares life expectancy...
and per capita health care spending in eight coun-
tries; although US health care spending is about
three times that of the United Kingdom, longevity
is not better.\textsuperscript{22,23}

The term evidence-based medicine has elicited
some confusion and misconceptions among many
physicians. Sackett and his colleagues\textsuperscript{24} have ob-
served the following common misconceptions
raised by physicians in their work with evidence-

1. It's what we've always done. Because much of
medical practice has been based on traditional
medical education and global subjective judgment
without broad access to electronic databases, this
view is clearly not well founded.

2. It will replace clinical judgment. Even if good
external evidence is available, it might not be rele-
vant to the care of an individual patient. More of-
ten, external evidence is either insufficient or lack-
ing. Clinical expertise and judgment remain
essential in everyday clinical decision making.

3. I don't have time for it. Lack of time remains a
major barrier, but continued advances in medical
informatics may well decrease this problem in the
future. Additionally, the physician can now readily
access predigested evidence-based analyses of
common clinical problems through more efficient
reading patterns.

4. It will lead to cookbook medicine. The process of
evidence-based medicine requires that physicians
assess the quality and relevance of whatever cur-
cent evidence can be found. In an individual cli-
nical situation, the physician always needs to apply
the evidence only as it is appropriate to the pa-
tient's needs and preferences.

In their excellent, recently published book Evidence-
Based Medicine: How to Practice & Teach EBM,
Sackett and his coauthors\textsuperscript{24} propose the following
rationale for applying evidence-based medicine in
medical education and clinical practice:

1. Increasingly available new evidence can and
should lead to major changes in patient care.
2. Practicing physicians often fail to obtain avail-
able relevant evidence.
3. Medical knowledge and clinical performance
deteriorate with time.
4. Traditional continuing medical education
(CME) is inefficient and generally does not
improve clinical performance.
5. Evidence-based medicine can keep the physi-
cian up-to-date.

<table>
<thead>
<tr>
<th>COMPONENTS</th>
<th>PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical epidemiologic studies</td>
<td>Practice guidelines</td>
</tr>
<tr>
<td>Meta-analysis</td>
<td>Pathways of care</td>
</tr>
<tr>
<td>Clinical trials</td>
<td>Performance measures</td>
</tr>
<tr>
<td>Cost-effectiveness analysis</td>
<td>Process-based</td>
</tr>
<tr>
<td>Decision analysis</td>
<td>Outcomes-based</td>
</tr>
</tbody>
</table>

Figure 2. Components and products of evidence-based medicine.

Conceptual Components and Outcomes of Evidence-Based Medicine

With the growth of clinical research during the
last 30 years, together with the new emphasis on
cost and outcome assessment and the increased
use of randomized clinical trials and meta-analy-
sis, evidence-based medicine is being hailed as a
new paradigm of medical education and prac-
tice.\textsuperscript{25} Rooted in clinical epidemiology, evidence-
based medicine has the potential to inform and
guide clinical decision-making not only for the
care of individual patients but also for cost-effec-
tiveness analysis and health policy for populations
being served. The application of evidence-based
medicine can thereby help to formulate clinical
practice guidelines as summaries of rigorously ap-
praised evidence, pathways of care, and both
process-based and outcomes-based performance
measures of clinical practice. Figure 2 illustrates
the conceptual framework that will underpin this
and later presentations in this series. Within the
context of everyday patient care, Figure 3 repre-
sents the essential components for making evi-
dence-based clinical decisions in partnership with
the patient or family.\textsuperscript{26}

Meta-analysis is a powerful tool with both
strengths and limitations.\textsuperscript{27} Properly applied, it
can sort out what we know, what we do not know,
and what we need to know.

Practice guidelines have proliferated in recent
years, as promulgated by specialty organizations,
governmental agencies, and other groups. They
have been of variable quality and value, depending
largely upon the scientific rigor of the process by
which they were developed. Many, especially ear-
lier, practice guidelines were produced without an
explicit review process through global subjective
judgment of an appointed panel of so-called ex-
erts. These guidelines are often flawed and not
widely accepted. To an increasing extent, more
guidelines are becoming available that are evi-
Research evidence

Figure 3. A model for evidence-based clinical decisions.

Reprinted, with permission, from Haynes RB, Sackett DL, Gray JM, Cook DJ, Guyatt GH. Transferring evidence from research into practice: 1. The role of clinical care research evidence in clinical decisions. ACP J Club 1996;125(3):A14-6.

dence-based. The most desirable evidence, if and when available, will include evidence of outcomes and patient preferences, as summarized in Table 2.16(pp30-3)

For the purpose of resource allocation decisions within health care in an era of limits, Eddy16(pp252-65) has proposed the following 11 principles based on an underlying premise that resources for population-based health care are truly limited financially:

1. Financial resources to provide health care to a population are limited.
2. It is valid and important to consider financial costs of interventions.
3. Because of financial constraints, priorities must be set.
4. It is not possible to cover from shared resources every treatment that might have some benefit.
5. Objective of health care is to maximize health of population served within available resources.
6. Priority of a treatment should not depend on whether the particular individuals are our personal patients.
7. Priority setting requires estimates of benefits, harms, and costs.
8. Empirical evidence should take priority in assessing benefits, harms, and costs.
9. A treatment must meet 3 criteria before being promoted for use:
   a. Compared with no treatment, treatment is effective in improving health outcomes.
   b. Compared with no treatment, benefits outweigh harms of outcomes.
   c. Compared with next best alternative treatment, treatment is good use of resources for population served (principle 5).
10. Patient preferences should be sought as much as possible in making judgments of benefits, harms, and costs of a treatment.
11. In determining whether a treatment satisfies principle 9, a burden of proof is on those promoting its use.

These principles might seem all too obvious and unassailable, but there are many examples where they have not been followed. Electronic fetal monitoring, for example, became widely applied with major impacts on perinatal care without meeting any of the criteria of principle 9.

Present Status of Evidence-Based Practice

Sources for Evidence-Based Medicine

A steadily advancing wave of interest in evidence-based medicine is starting to influence medical education and clinical practice. Some books and journals are taking an evidence-based approach, as are some CME programs. An increasing number of clinical practice guidelines are being developed through rigorous analysis and appraisal methods. The Agency for Health Care Policy and Research (AHCPR), having already created 19 practice guidelines, is establishing a group of evidence-based practice centers around the country to develop guidelines on a contractual basis.28 It is also creating a national guideline clearinghouse on the Internet to become available in the fall of 1998.29

A recent study of the use of practice guidelines by HMOs showed that 80 percent used guidelines developed by the HMO, whereas an equal number adapted them from external sources30; in many instances these guidelines are increasingly evidence based.

There are two major types of electronic data-

Table 2. Hierarchy of Practice Guideline Development.

| 1. Global subjective judgment |
| 2. Evidence-based |
| 3. Outcomes-based |
| 4. Patient preference-based |

Source: Eddy16(pp10-7)
Figure 4. Usefulness equation.

to guide and make reading, attendance at CME conferences, or other CME approaches more efficient. Further critical appraisal of new information is aided by evaluating the usefulness of such information. Slawson and his colleagues have observed that patient-oriented evidence that matters (POEMs) in terms of demonstrated positive outcomes important to patients is far more useful than disease-oriented evidence (DOE) that represents intermediate outcomes without demonstrable positive outcomes to patients.

Table 3 displays four clinical illustrations of this important distinction. It is more useful for the clinician to know, for example, that a new therapy has been shown to decrease mortality, morbidity, or major complications of diabetes mellitus than whether that new therapy merely leads to better control as measured by hemoglobin A1c tests, an intermediate outcome.

Validity assessment can be approached individually or by using validity appraisals established by others. In either event, a clinical study being evaluated must be appraised for internal validity (are the results valid for patients in the study, eg, randomized?) and external validity (can the findings of the study be generalized to one's patient and practice?). Haynes and his colleagues have developed a “bare bones user's guide” for appraisal of the validity of clinical studies (Table 4).

The process used by the US Preventive Services Task Force serves as an excellent example of an explicitly rigorous application of an evidence-based appraisal of evidence for or against the use of screening and preventive procedures (Table 5).

It is becoming increasingly apparent that the major problem in practicing evidence-based medicine is finding relevant evidence in a timely way so that it can be integrated into clinical decision making in everyday practice. As more electronic databases become more complete and more user friendly, this problem should be alleviated. The Cochrane Library, for example, now has 159 completed systematic reviews on file, with 199 protocols for reviews in progress, and 5000 to 10,000 reviews projected by the year 2002. In addition, this library also has a Database of Abstracts of Reviews of Effectiveness (DARE).

**Getting Started Toward Evidence-Based Practice**

There are a number of practical, concrete steps
### Table 3. Examples of Hypothetical Disease-Oriented Evidence (DOE) and Patient-Oriented Evidence That Matters (POEM) Studies.

<table>
<thead>
<tr>
<th>DOE</th>
<th>POEM</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Assumptions Required to Assume Patients Will Benefit</strong></td>
<td><strong>Low</strong></td>
</tr>
<tr>
<td><strong>High</strong></td>
<td><strong>Low</strong></td>
</tr>
<tr>
<td>Drug A lowers cholesterol</td>
<td>Drug A decreases cardiovascular mortality/morbidity</td>
</tr>
<tr>
<td>PSA screening detects prostate cancer most of the time and at an early stage</td>
<td>PSA screening decreases mortality</td>
</tr>
<tr>
<td>Corticosteroid use decreases neutrophil chemotaxis in patients with asthma</td>
<td>Corticosteroid use decreases admissions, length of hospital stay, and symptoms of acute asthma</td>
</tr>
<tr>
<td>Tight control of type 1 diabetes mellitus can keep fasting blood glucose &lt;140 mg/dL</td>
<td>Tight control of type 1 diabetes can decrease microvascular complications</td>
</tr>
</tbody>
</table>

Note: not all these POEM trials have been performed. PSA - prostate-specific antigen. Adapted from Slawson et al.13

that a clinician can readily take to get started toward an evidence-based approach to practice. The following steps are recommended in this initial effort:

1. Subscribe to *Evidence-Based Medicine*, bi-monthly structured abstracts with evidence-based commentaries published by the American College of Physicians, Philadelphia (800-523-1546).
2. Increase reading of predigested information relevant to your practice from sources listed in Table 6.
3. Refocus reading habits along the lines suggested in Table 7.
4. Join or establish an evidence-based journal club in your area, with hospital staff, or in a group practice.
5. Meet with a librarian at your nearest health sciences library to arrange a tutorial or workshop in current search tools, such as MEDLINE.
6. Establish access through an office or home computer to the Internet and the Web sites listed in Table 6.
7. Reorient your CME to evidence-based courses as they become more available. Time is the major limitation faced by the busy primary care physician in the trenches of everyday life.

### Table 4. Bare-Bones Users’ Guides for Appraisal of the Validity of Medical Studies.

<table>
<thead>
<tr>
<th>Purpose of Study</th>
<th>Guides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Therapy</td>
<td>Conceived random allocation of patients to comparison groups</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Patients to whom you would want to apply the test in practice</td>
</tr>
<tr>
<td>Prognosis</td>
<td>Inception cohort early in the course of the disorder and initially free of the outcome of interest</td>
</tr>
<tr>
<td>Cause</td>
<td>Clearly defined comparison group or those at risk for, or having, the outcome of interest</td>
</tr>
<tr>
<td>Reviews</td>
<td>Explicit criteria for selecting articles and rating validity</td>
</tr>
<tr>
<td>Outcome measure of known or probable clinical importance</td>
<td>Few lost to follow-up compared with number of bad outcomes</td>
</tr>
<tr>
<td>Objective or reproducible diagnostic standard applied to all participants</td>
<td>Blinded assessment of test and diagnostic standards</td>
</tr>
<tr>
<td>Objective or reproducible assessment of clinically important outcomes</td>
<td>Few lost to follow-up compared with number of bad outcomes</td>
</tr>
<tr>
<td>Blinding of observers of outcome to exposure; blinding of observers of exposure to outcome</td>
<td>Comprehensive search for all relevant articles</td>
</tr>
</tbody>
</table>

Table 5. An Evidence-Based Approach to Guideline Development by the US Preventive Services Task Force: Rating the Quality of Evidence and Strength of Recommendations

<table>
<thead>
<tr>
<th>Quality of evidence</th>
<th>I</th>
<th>Evidence obtained from at least one properly designed randomized controlled trial</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>II.1</td>
<td>Evidence obtained from well-designed controlled trials without randomization</td>
</tr>
<tr>
<td></td>
<td>II.2</td>
<td>Evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than one center or research group</td>
</tr>
<tr>
<td></td>
<td>II.3</td>
<td>Evidence obtained from multiple time series with or without the intervention. Dramatic results in uncontrolled experiments (such as the results of the introduction of penicillin treatment in the 1940s) could also be regarded as this type of evidence</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>Opinions of respected authorities, based on clinical experience, descriptive studies or reports of expert committees</td>
</tr>
</tbody>
</table>

| Strength of recommendations | A.                     | There is good evidence to support the recommendation that the condition be specifically considered in a periodic health examination |
|                            | B.                     | There is fair evidence to support the recommendation that the condition be specifically considered in a periodic health examination |
|                            | C.                     | There is poor evidence regarding the inclusion of the condition in the periodic health examination, but recommendations may be made on other grounds |
|                            | D.                     | There is fair evidence to support the recommendation that the condition be excluded from consideration in a periodic health examination |
|                            | E.                     | There is good evidence to support the recommendation that the condition be excluded from consideration in a periodic health examination |

Adapted from Report of the US Preventive Services Task Force.14

In practice. Targeted reading of predigested evidence-based references, however, can make already-allocated reading time more efficient and productive. In addition, as electronic aids to practice become more widely available in more primary care settings, the barriers to evidence-based practice should diminish. As Becker3 recently observed, the availability of a palm-top computer with comprehensive, current clinical information is already on the immediate horizon.

Table 6. Some Sources of High-Quality Evidence.

<table>
<thead>
<tr>
<th>Source</th>
<th>Description or Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary (undigested sources)</td>
<td></td>
</tr>
<tr>
<td>MEDLINE</td>
<td>National Library of Medicine database with citations from about 4000 journals dating back to 1966</td>
</tr>
<tr>
<td>EMBASE</td>
<td>Derived from Excerpta Medica, with some citations in pharmaceutical literature not available in MEDLINE; since 1974</td>
</tr>
<tr>
<td>Secondary (predigested sources)</td>
<td></td>
</tr>
<tr>
<td>American College of Physicians</td>
<td>ACP Journal Club on CD-ROM</td>
</tr>
<tr>
<td>ACP Journal Club</td>
<td><a href="http://www.acponline.org">www.acponline.org</a></td>
</tr>
<tr>
<td>POEMs, formerly Journal of Family Practice Club</td>
<td>jfp.msueru</td>
</tr>
<tr>
<td>Best Evidence</td>
<td>CD-ROM started in 1997 with all first years of ACP Journal Club and all of Evidence-Based Medicine</td>
</tr>
<tr>
<td>Centre for Evidence-Based Medicine (CEBM)</td>
<td>cebm.jr2.ox.ac.uk</td>
</tr>
<tr>
<td>Cochrane Collaboration</td>
<td>hiru.mcmaster.ca/COCHRANE</td>
</tr>
<tr>
<td>Bandolier (full text)</td>
<td><a href="http://www.jr2.ox.ac.uk:80/Bandolier">www.jr2.ox.ac.uk:80/Bandolier</a></td>
</tr>
<tr>
<td>Agency for Health Care Policy and Research (AHCPR) Clinical Practice Guidelines</td>
<td>text.nlm.nih.gov/frts/dbaccess/ahcpr</td>
</tr>
<tr>
<td>Physicians’ Online (POL)</td>
<td>Free MEDLINE access, inexpensive Internet access if sign up <a href="http://www.po.com">www.po.com</a></td>
</tr>
</tbody>
</table>

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Table 7. Suggested Reading.

Articles

**Evidence-Based Medicine**


**Information Mastery**


**Critical Appraisal of Literature**

- Guyatt GH, Sackett DL, Cook DJ. Users' guides to the medical literature. II. How to use an article about therapy or prevention. A. Are the results of the study valid? Evidence-Based Medicine Working Group. JAMA 1993;270:2598-601.
- Jaeschke R, Guyatt GH, Sackett DL. Users' guides to the medical literature. IV. How to use an article about a diagnostic test. B. What are the results and will they help me in caring for my patients? The Evidence-Based Medicine Working Group. JAMA 1994;271:703-7.
- Richardson WS, Detsky AS. Users' guides to the medical literature. VII. How to use a clinical decision analysis. A. Are the results of the study valid? Evidence-Based Medicine Working Group. JAMA 1995;273:1292-5.
- Richardson WS, Detsky AS. Users' guides to the medical literature. VII. How to use a clinical decision analysis. B. What are the results and will they help me in caring for my patients? Evidence-Based Medicine Working Group. JAMA 1995;273:1610-3.
- Naylor CD, Guyatt GH. Users' guides to the medical literature. X. How to use an article reporting variations in the outcomes of health services. The Evidence-Based Medicine Working Group. JAMA 1996;275:554-8.
- Drummond MF, Richardson WS, O'Brien BJ, Levine M, Heyland D. Users' guides to the medical literature. XIII. How to use an article on economic analysis of clinical practice. A. Are the results of the study valid? Evidence-Based Medicine Working Group. JAMA 1997;277:1552-7.
- O'Brien BJ, Heyland D, Richardson WS, Levine M, Drummond MF. Users' guides to the medical literature. XIII. How to use an article on economic analysis of clinical practice. B. What are the results and will they help me in caring for my patients? Evidence-Based Medicine Working Group. JAMA 1997;277:1802-6.

**Internet Resources**


**Books**

References

26. Haynes RB, Sackett DL, Gray JA, Cook DJ, Guyatt GH. Transferring evidence from research into practice. 1. The role of clinical care research evidence in clinical decisions. ACP J Club 1996;125:A14-6[7].