

Becoming a Medical Information Master: Feeling Good About *Not* Knowing Everything

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The body of knowledge in medicine is growing at a phenomenal pace. Clinicians rely on many sources of medical information—journal articles and reviews, textbooks, colleagues, continuing medical education conferences, videotapes and audiotapes, and pharmaceutical representatives—although they probably have had little formal training in assessing the clinical usefulness of the information obtained from each source. Excellent reader guides on how to evaluate clinical trials and review articles have been published, but these tech-

niques are time-consuming and are rarely employed by busy clinicians. In this paper, we present a “user-friendly” method of managing new information in a practical and time-efficient manner. This approach allows clinicians to disregard most of the available medical information and focus on patient-oriented evidence that truly matters.

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*The professionally sponsored literature for medical practitioners acts as though each practitioner in each American community were supposed to be his own scholarly and scientific institute, screening, sifting, evaluating, assessing, and translating into practical terms the output of medical research that is reported in the periodical literature. This . . . is one aspect of the myth of the medical practitioner as a lone decision maker who makes up his own mind about things in his own office without being influenced by organized arrangements. The practitioner, of course, is quite unable to live up to this myth.*¹

*We produce “scientific illiterates” who are filled like an overstuffed sofa with the products of science, but who are not scientific in their approach to clinical questions or new technologies.*²

As a result of their broad focus and the continuing influx of new information, primary care clinicians find it frus-

trating and difficult to remain up to date with the current aspects of patient management. Even if they focus only on common problems, the increasing constraints of a busy practice quickly minimize any available time for this task. Guilt accumulates in direct proportion to the growing stack of unopened journals.

This information management problem is particularly acute when we are faced with new drugs, techniques, and tests. Consider the following scenario: a 52-year-old man is in your office for his 6-month hypertension check. In his hand, he carries a newspaper clipping outlining the new prostate-specific antigen (PSA) assay for the early detection of prostate cancer. He asks whether you could order the test for him, “just so that he knows.”

Although it is not your normal practice to use this as a screening test, the easiest answer might be to order it. The patient wants it and is willing to pay for it, so why not? The second option would be to refuse to order the test, a choice that carries the uncomfortable possibility of litigation. A third approach would be to stall.

Many sources of information are available that would answer your questions about the test. Short for time, you place a call to your urology colleague, who tells you that, based on her review of the medical literature, she recommends screening PSA for all her patients over

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50. With this information, you feel much more comfortable implementing this policy into your own practice.

However, on the way home you pop in the latest *Audio Digest* tape on cancer prevention, and the lecturer tells you that, although prostate cancer is relatively common in older men, it is frequently not found until autopsy, and very few men actually *die* of the disease. He therefore suggests that routine screening for prostate cancer, whether by digital prostate examination or by PSA determination, is unwarranted.

Now you have a problem. You have two conflicting sources of information, two different sets of evidence. On one hand, a urologist in your community is screening for prostate cancer. On the other hand, what is the use of identifying prostate cancer earlier with the PSA if few men die from it?

You are caught in a “specialist Ping-Pong,” bouncing between different answers to the same question, not sure of “the truth.” You want to know whether your patient would be better off with or without the PSA test.

In a sense, you progressed from too little information to too much in one quick step, a common dilemma among many primary care clinicians. Faced with limited time, how can we recognize “the truth” as it relates to this patient and, for that matter, all of our patients? This heightened information availability does not mean that we are more informed. Instead, we may develop a condition known as “information anxiety”—the frustration that occurs when there is a great deal of information, but it does not tell us what we need to know.

Information is not *knowledge*. Knowledge comes from the interpretation of information (Figure 1). While we are constantly bombarded with *data* and *information*, what we want is *knowledge* and *wisdom*, ie, the ability to understand and apply the facts.

For example, a recent study tells us that 37 of 112 men with a PSA >4 ng/mL were subsequently found to have prostate cancer (data), leading to a positive predictive value of 33% (information). What we actually want to discern from these pieces of information is whether men are better off in some way as a result of the test (knowledge) and whether our patient will benefit if we order the test for him at this particular time (wisdom).

This progression from a lower to a higher level of information requires a good bit of thinking, sorting out the significant from the irrelevant, considering and weighing all the available evidence, and applying it to the matter at hand. This brain time is the hard part of the information game, and an aspect we often leave to others. It may be difficult to base patient management decisions on your own information processing (which may lead you to practice differently from your specialist colleagues), especially if you are uncertain of your ability to

Wisdom

The appropriate *application* of knowledge to a particular situation based on intuition gained from experience.
(*This particular man will benefit with an improved quality of life from PSA screening at this time*)



Knowledge

An orderly *synthesis* of information through the process of deep and extensive learning and understanding.
(*Men undergoing PSA screening are less likely to die of prostate cancer*)



Information

That which leads to understanding.
The *meaning* we assign to facts.
(*The positive predictive value of the screening PSA is 33%*)



Data

Facts, which, by themselves, have no meaning
(*Thirty-seven of 112 men with an elevated PSA > 4.0 have prostate cancer*)

Figure 1. Progression from data to wisdom, using prostate-specific antigen (PSA) screening as an example (see text for explanation).

critically evaluate new information. More important, the weighing and sorting of the barrage of new information requires a good bit of confidence.

Despite these difficulties, it is possible to take an active and confident approach in order to gain mastery of the information deluge, and, in so doing, to provide the best care for your patients. This paper addresses three issues of importance to clinicians desiring to improve their skills at keeping up with new information: (1) the medical information jungle and why most of the literature is incidental medical chatter that can be harmful; (2) a method of evaluating the usefulness of new information; and (3) a simple but active approach that will allow clinicians to become medical information masters.

The Information Jungle

The statistics are astonishing. The National Library of Medicine's database, MEDLINE, contains 6 million references from 4000 journals. About 400,000 new entries are added each year. The current MEDLINE lists 19,304 articles on “prostatic neoplasms,” 231 of which deal specifically with some aspect of PSA. To keep ahead of this torrent of information by reading everything of possible importance to medicine, one would need to read 6000 articles each day.⁵

In addition, family physicians receive many unsolicited medical magazines (the so-called throwaways). At

least eight newsletters are marketed to family physicians, and several computer programs are available that provide summaries of current articles. *The New England Journal of Medicine* has its own television show. Local newspaper reporters have read the *Journal of the American Medical Association* before you have, and your patients are bringing in articles hot off the press. There are literally thousands of local, regional, and national meetings at which information is communicated. To top it all off, as you are reading this article, there is probably a pharmaceutical representative sitting patiently in your waiting room.

As we watch this flood of information go by, it is difficult to identify which information, knowledge, and wisdom we really need and then to incorporate the appropriate elements into practice. Although some clinicians may feel comfortable with their ability to process new information, many do not.

A number of studies have shown that there is an unacceptable lag time between publication of credible science that should change medical practice and its actual adoption by practitioners.⁶⁻⁹ For example, Fineberg⁸ identified 28 papers that evaluated the effect of various "landmark" trials on medical practice. Only 2 of the 28 papers found that the landmark trials had an immediate (ie, within 1 to 2 years) effect on medical practice.

On the surface, the solution seems easy: find a way to get the information out, and people will change their ways of doing things. However, even with appropriate information, clinicians are reluctant to change their management behavior. Looking at the treatment of hypertension, Evans and colleagues¹⁰ found that the strongest predictor of the clinician's knowledge of hypertension was the clinician's year of graduation. Many of the practitioners in this study showed no evidence of new learning despite their continuing medical information activities, journal subscriptions, or exposure to pharmaceutical representatives.

Two additional problems remain. The first is that the knowledge needed to make a decision often does not exist. We will not know, for example, for the next 20 years or so whether patients will really be better off because of PSA screening. Instead, we must settle for intermediate outcomes that we hope represent the actual desired outcome.

The second problem with information management is that once we are aware of knowledge, we are hesitant to put it into practice.¹¹ Researchers of information diffusion in medicine have found that innovations in medical practice are widely adopted in a medical community only after they are first adopted by an "opinion leader,"¹²⁻¹⁴ an influential member who is trusted by others in the community.

Information scientists have found that physicians

obtain information from many sources and place greater credibility on some sources than on others. No matter where or from whom the information is obtained, though, for the most part, its roots can be traced to one source: medical journals.

Medical Chatter and Gossip

Journals are the major source of new medical information and function to serve the needs of both researchers and practitioners. However, the approach to this information by the members of these two groups is quite different. When researchers evaluate articles in their area of expertise, they are usually familiar with all of the research that has been published previously. Practitioners may not be so well versed in the knowledge of previous publications, and thus, in a sense, are picking up in the middle of a conversation. The situation is similar to sitting on a bench in the middle of a mall and listening to the bits and pieces of conversation as people walk by you. Reading a journal article is like hearing these conversations—you are getting only one piece of the entire conversation. In the case of medical journals, although you may be familiar with the topic, in most instances you have not heard the whole "conversation" that preceded the article at hand.

For example, a recent abstracting service¹⁵ summarized an article comparing the effectiveness of the administration of a beta-agonist by means of a nebulizer vs a metered-dose inhaler (with a spacer).¹⁶ The researchers found that administration by nebulizer was more effective. These results contrast with many other previously published studies that showed the two methods of administration to be equivalent.¹⁷⁻²⁰ Readers of this abstract who are unaware of the previous "conversation" may be misled.

Much of what is written in journals can be considered "medical chatter" among groups of researchers with the clinician listening in. Just as bits and pieces of chatter overheard in a mall can be dangerous if taken out of context (Bill did *what* with *whom*?), medical chatter can be misapplied to clinical situations, and, in the process, become just as potentially dangerous and inappropriate as gossip.

Some readers may argue that it is useful to read the medical chatter to identify future trends in medical practice, but consider some of the gossip derived from the medical literature that was initially applied to clinical practice and later rejected: drug therapy for asymptomatic ventricular arrhythmias; mammary artery ligation for coronary artery disease; the Sippy diet or ice water lavage for peptic ulcer; fluoride and saccharin as causes of cancer; the use of clonidine as an aid to smoking cessation;

and caffeine as a cause of pancreatic cancer. In all these instances, clinical practice was changed based on preliminary evidence that subsequently was not substantiated by clinical evaluation.

Sources of Medical Information

Some readers will point to these examples and exclaim, “*That’s* why I don’t read journals!” Medical journals are the primary means used to communicate new information, but unfortunately, not necessarily *knowledge*. In all these examples, the facts known to date were laid out on the table for all to see, but it was left up to each reader to interpret.

Although the facts are important, *knowledge* is what we would rather have, ie, what do these facts mean? The extraction of *knowledge* from *information* is an awesome task for which few clinicians are adequately prepared. Most clinicians, as a result, turn to other sources to find knowledge.^{21–27} Textbooks, colleagues, newsletters, review articles, unsolicited journals, pharmaceutical representatives, and specialists are extensively used by clinicians as a means of keeping up and obtaining answers to clinical questions.

The benefit of these sources is apparent: they are quick and easy to use, and the knowledge gained is often relevant. However, each source has limitations. For example, textbooks can be out of date. Colleagues may be no better informed than you, yet feel pressured to give you an answer; or they may be unknowingly biased by their own self-interest.²⁸ Abstracting services may give a rapid synopsis of an article but may fail to put the new information in context with the old. The biases of pharmaceutical representatives have already been noted.²⁹

Some authors have suggested that clinicians must critically evaluate new information for themselves.³⁰ Excellent reader guides on the evaluation of clinical trials have been published.^{31–40} These techniques, however, are time-consuming, oriented primarily to the critique of original research, and rarely employed by the busy clinician.^{16,41} How do we find some middle ground, some compromise between relying on other sources to do it for us and converting information into knowledge ourselves? A “user-friendly” approach to managing new information in a practical and time-efficient manner is necessary for this purpose.

Determining the Usefulness of Medical Information

When we pick up a journal, attend a conference, or call a colleague, our goal is to spend the least amount of time

and energy finding the best information. The ultimate in useful information must have three attributes: it must be relevant to everyday practice, it must be correct, and it must require little work to obtain.⁴² These three factors can be conceptually related in the following manner:

$$\text{Usefulness of medical information} = \frac{(\text{relevance} \times \text{validity})}{\text{work}}$$

The relevance aspect of this equation starts with the concept of “applicability to practice” but then goes much further. In the blizzard of information swirling around us, it is easy to lose sight of our primary destination—how to help our patients live long, functional, satisfying, pain- and symptom-free lives. We have an incredible amount of information about disease: etiology, prevalence, pathophysiology, pharmacology. The problem is that little of the available information tells us how to accomplish our primary goal.

What we are looking for is patient-oriented evidence. This type of evidence evaluates the effectiveness of interventions that patients care about and that we, as clinicians, care about for our patients. It is not enough simply to find patient-oriented evidence, for what we are truly seeking is patient-oriented evidence *that matters* (POEM). Examples of POEM come from studies that evaluate outcomes that matter the most to our patients.

For example, an article about the PSA assay may report the sensitivity, specificity, and predictive value for identifying men with prostate cancer. The results may tell us how good the test is at correctly identifying men with an early stage of the disease, but this is just an intermediate outcome. It does not tell us what we want to know: whether the patient will be better off as a result of identifying the cancer earlier. A randomized trial evaluating the overall effect of this early detection on the mortality of prostate cancer *would* provide this information. A randomized trial demonstrating that men who underwent a screening PSA test enjoyed an improved quality and length of life would be an even better measure. A study of this sort would be a POEM.

POEMs are rare and scattered among the huge number of articles that can be labeled as disease-oriented evidence (DOE). Examples of DOE consist of information aimed at increasing our understanding of disease, that is, the etiology, prevalence, pathophysiology, pharmacology, prognosis, and so on. These studies are absolutely crucial to medicine, for without them, we would not have POEMs. We must understand how a disease “works” before we can diagnose, treat, or prevent it with any certainty.

Until recently, though, DOEs were the only infor-

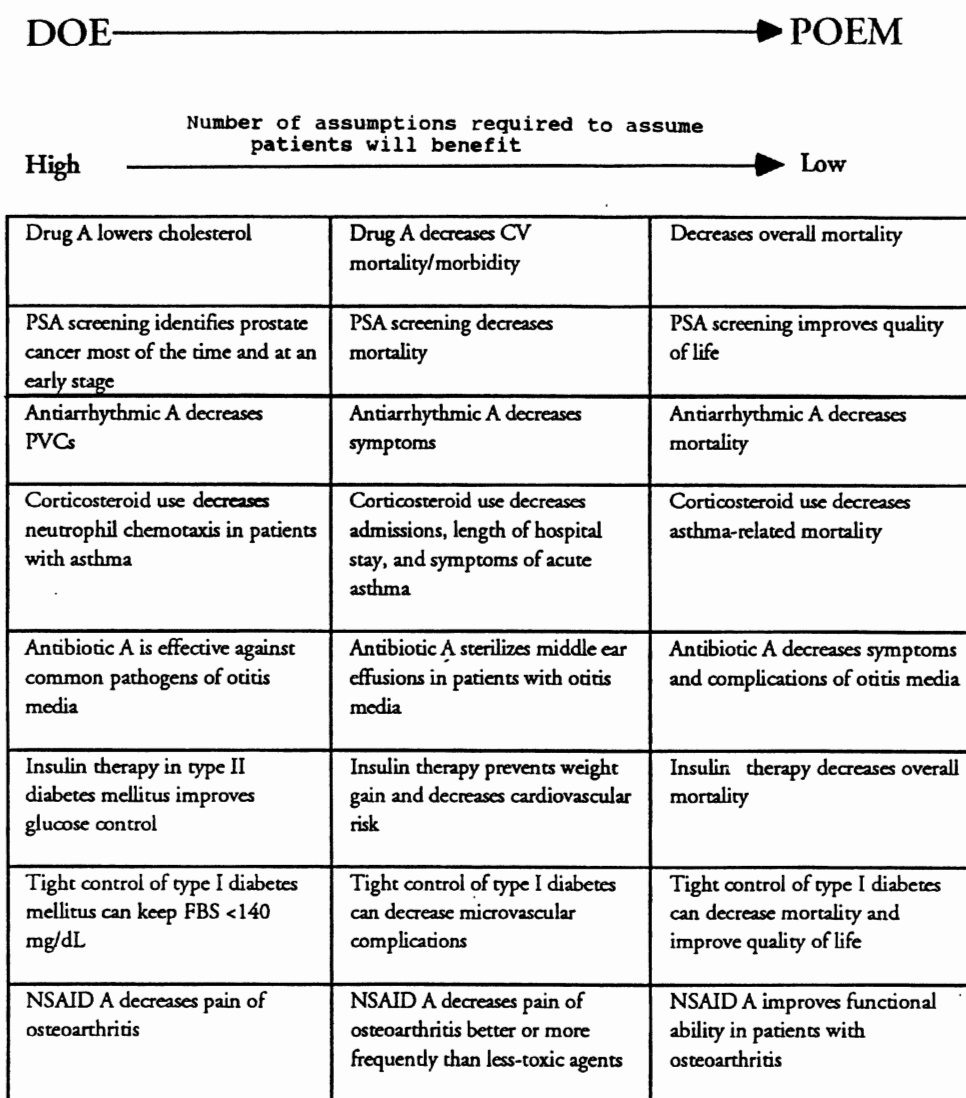


Figure 2. Examples of hypothetical disease-oriented evidence (DOE) and patient-oriented evidence that matters (POEM) studies. (Note that not all these POEM trials have been performed.) CV denotes cardiovascular; PSA, prostate-specific antigen; PVC, premature ventricular contraction; FBS, fasting blood sugar; NSAID, nonsteroidal anti-inflammatory drug.

mation we had about many of our patients' illnesses. We knew that, for example, two antiarrhythmics were shown to suppress ventricular arrhythmia and thus were believed to be beneficial for patients at risk for sudden death. However, the Cardiac Arrhythmia Suppression Trial (CAST) subsequently demonstrated that patients receiving these medications were more likely to die than were similar patients not taking them.⁴³ Many patients received these agents because the available evidence focused on the disease (ventricular arrhythmia) rather than the patient, and we prematurely assumed an overall benefit to the patient.

One way to distinguish a POEM from a DOE is to determine whether the information requires assuming or

knowing (Figure 2). If we identify a cancer earlier or suppress a patient's arrhythmia, it makes sense (ie, we *assume*) that the patient will live a longer, more productive life. On the other hand, until the anticipated outcome is verified by clinical trials, we do not *know* that it will actually occur. Counterintuitive as it might seem, the error is in assuming that treating the disease is in the best interest of the patient.

Once a POEM has been identified, frequency of contact with the problem in clinical practice must be considered. When clinicians read to "keep up," POEMs that clinicians can use to evaluate the diagnosis, treatment, or prognosis of an illness seen frequently in clinical practice are top priority. These common POEMs will

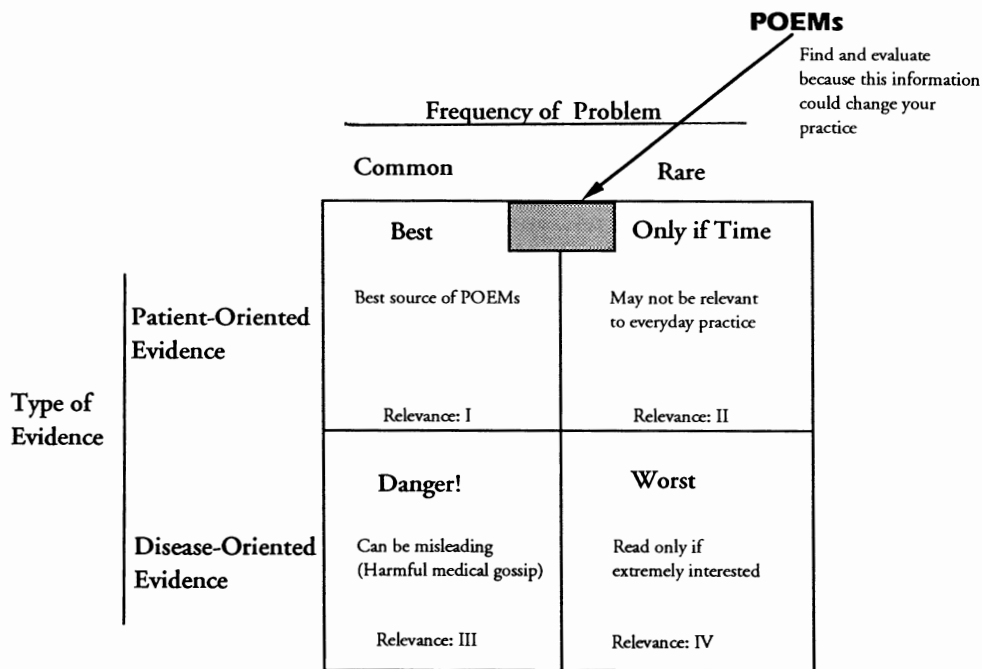


Figure 3. Information grid illustrating the relationship of the types of evidence and the frequency of the clinical dilemma to the relevance of the information. Relevance scale, I (high) to IV (low).

have the greatest impact on our patients and therefore the greatest *relevance*. Common POEMs should be sought and carefully scrutinized. The least relevant information is a DOE involving a rare or unusual disorder. Figure 3 illustrates the ranking from a common POEM (eg, PSA screening decreases the mortality and morbidity of prostate cancer) to an uncommon DOE (eg, the role of 21-hydroxylase deficiency in the development of congenital adrenal hyperplasia).

The *validity* of information defines to what extent the knowledge gained as a result represents the "truth." Well-designed clinical trials that minimize bias are more likely to provide valid conclusions. This is the foundation of the scientific method. The assessment of validity is time-consuming and may be difficult for clinicians without formal training in epidemiology. As previously mentioned, excellent guides for critical review of the medical literature, including useful checklists, are available.

Validity assessment can be done individually or in conjunction with others, or, with great care and caution, delegated to those with the appropriate training and available time. It is not enough to ask a colleague simply whether it is a "good article." A specialist may be no better at evaluating new information than you are. Rather, a source well versed in critical appraisal must be consulted. This source might be a colleague with expertise in epidemiology, local journal clubs that can spread the burden of finding and evaluating new information, or

published rigorous evaluations, such as the *ACP Journal Club* (a supplement to *Annals of Internal Medicine*). This month, *The Journal of Family Practice* begins providing a similar service for primary care.

The clinician's responsibility to manage new information has been identified as a competency that the "physician of the future" must embrace.⁴⁴⁻⁴⁶ As a result, when considering the implementation of common POEMs into everyday clinical practice, the clinician must be responsible for ascertaining that the validity issue has been appropriately addressed.

The negative attribute that we must consider when evaluating the usefulness of information is the *work*, or how much effort it takes to obtain the information. "Work" consists of factors such as how long it takes to obtain the information, how much it costs monetarily, and the mental energy required to track down the answer.

The goal of using any information source is to find one with the highest usefulness score. Working too hard to establish validity will raise the work factor. On the other hand, a low work-factor source may also have low validity. The best source of information would provide highly relevant and valid information with minimal effort required to obtain it. Because sources such as this are rarely available, it is necessary to find a balance among the three factors.

Feeling Good About Not Knowing Everything

Studies evaluating the effect of research have shown that well-done clinical trials that should influence medical care fail to do so because the results are bogged down in the mire of clinically unimportant information.^{6-9,47,48} Clinicians are often so overwhelmed by the volume of DOE information that they fail to discover and act on the truly quality POEM information that is available. Because primary care clinicians are the protectors of their patients' best interests, they have a duty to act when POEMs are available.

The ventricular arrhythmia mortality data from the CAST trial showed that therapy based on DOE information was harmful. When quality POEM information is discovered, we must remain open to the possibility of abandoning a seemingly appropriate intervention based on DOE information. Likewise, we should avoid changing our practice standards based on the discovery of new DOE information. We are not suggesting that innovations should be withheld from clinical practice until they have been exhaustively studied. We do, however, believe that appropriate patient-oriented studies should be performed to validate hunches supported only by DOEs, since otherwise, more harm than good may result.³⁵

Understanding the interrelationship between relevance, validity, and the work factor can help information masters improve their management of medical information. Distinguishing between POEMs and DOEs will minimize the potential for misapplying harmful medical "gossip" (Figure 3). In addition, focusing attention on identifying POEMs will dramatically reduce the time necessary to remain up to date. Allowing oneself the luxury to ignore or deflect DOE information can do wonders for improving self-esteem and increasing free time without incurring a guilty conscience.

A warning: this approach to medical information management creates a two-edged sword. One edge allows clinicians to disregard most of the published medical literature (DOEs). The other edge, however, carries the responsibility to search out, evaluate, and, most important, implement new information that affects patients (POEMs).

So, back to our patient who wants the PSA test. Armed with the usefulness equation, we now recognize that the basis of the disagreement between our two sources is a different interpretation of DOE information. Our urology colleague recognizes that the PSA test will detect more disease at an earlier stage. Although we do not know for sure, we assume that people identified earlier in their disease live longer, and, therefore, we should screen all men in the risk group. However, our *Audio Digest* discussant acknowledges that very few men

die of prostate cancer anyway, and that the majority of new cases we discover may face unnecessary and potentially harmful therapy.

How are we to decide? We can only conclude that the information is currently incomplete and there is no right choice. We can either share this information with our patients and involve their input into the decision (a useful guide for patients has recently been published⁴⁹), or choose a direction, and remain open to the necessity of changing directions when better POEM information becomes available.

The Information Master

In the above scenario, the medical information system was used both to answer a question concerning a specific patient and to keep up with new developments that will affect clinicians' standards of practice and use of resources. Making decisions, such as whether to recommend routine screening for prostate cancer with the PSA test, will have a significant impact on the cost of medical care: "In a field filled with uncertainty and doubt, the difference between 'when in doubt, do it' and 'when in doubt, stop' could easily swing \$100 billion a year."⁴⁵ Primary care clinicians stationed on the front lines of health care management must recognize the power obtained from the appropriate management of information.

Clinicians gather information for four basic reasons: (1) to keep up with new developments in clinical medicine; (2) to answer a question related to a specific patient; (3) to review and reinforce previously learned information; and (4) for fun or to keep up with a specific area of interest. Depending on why the medical information system is used, different sources will have different usefulness scores and, accordingly, will be more appropriate in some situations than in others. In forthcoming articles, we will outline how to further employ the usefulness equation to identify appropriate sources based on information needs. Providing these additional tools will allow clinicians to become true medical information masters.

Knowledge is power.

—Sir Francis Bacon,
in *Meditationes Sacrae*, 1597

In a time of turbulence and change, it is more true than ever that knowledge is power.

—John Fitzgerald Kennedy
Address at the University
of California, Berkeley,
March 23, 1962

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