Evidence-Based Medicine, the Research-Practice Gap, and Biases in Medical and Surgical Decision Making in Dermatology

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The objectives of this article are to promote a better understanding of a group of biases that influence therapeutic decision making by physicians/dermatologists and to raise the awareness that these biases contribute to a research-practice gap that has an impact on physicians and treatment solutions. The literature included a wide range of peer-reviewed articles dealing with biases in decision making, evidence-based medicine, randomized controlled clinical trials, and the research-practice gap. Bias against new therapies, bias in favor of indirect harm or omission, and bias against change when multiple new choices are offered may unconsciously affect therapeutic decision making. Although there is no comprehensive understanding or theory as to how choices are made by physicians, recognition of certain cognition patterns and their associated biases will help narrow the research-practice gap and optimize decision making regarding therapeutic choices. *Arch Dermatol. 2010;146(10):1161-1164*

The question concerning what governs medical and surgical decision making is of great interest from many points of view. For example, not only patients, physicians, and physician educators but also policy makers, health insurers, hospital administrators, and drug and device manufacturers have a vital but somewhat different interest regarding how decisions are made, especially decisions about therapies. A short list of factors that are important in governing the physician's selection of medical and surgical therapies include (1) training, (2) experience, (3) evidence (randomized clinical trials [RCTs], case-control studies, series, results in animal models, and in vitro findings), (4) rules of thumb (also called heuristics), (5) algorithms and clinical practice guidelines, and (6) biases.

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While training is certainly key, specific therapeutic information that is learned by physicians in the training years is quickly outdated. Experience, while also of great import, is by today's standards insufficient without the insights afforded by information that is derived from a larger database. Evidence, especially the results of RCTs, is currently considered to be the "gold standard" in guiding therapeutic choice.

The perceived importance of evidence is captured in the phrase *evidence-based medicine*, and the failure of physicians to apply the results of the latest research-generated evidence is known as *the research-practice gap*. This gap is thought to be attributable in part to the inadequacy or nongeneralizability of the information obtained from RCTs. Indeed, as much as a physician would like his or her decisions to be data driven or evidence based, even when being guided by evidence generated by RCTs, the chance of obtaining the expected therapeutic response with the average level of risk is lower than would be expected.[1]

Primary among the reasons that even the best RCTs are often not usable to guide therapeutic choices involves the very select populations studied in RCTs. Studies have documented the selection biases that often result in internally valid studies that are not generalizable to a broad practice population.[2] For example, Zarin et al[3] found that 55% of patients in a psychiatric practice research network would not have been

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eligible for their therapy, based on the selection criteria of key RCTs of the therapy. Recognition that RCTs, which are performed most often for drug registration, not only use limited populations but also have many other shortcomings, eg, inadequate follow-up periods and nonrelevant outcomes, has led to a demand for so-called comparative effectiveness research, which is based on outcomes such as functional status, quality of life, disability, and death in typical patient populations.[4-6] Therefore, not only is the evidence that evidence-based medicine is dependent on of limited generalizability, but also the sheer number of decisions to be made and the ultimate singularity of each patient preclude our ever having all of the key or specific evidence-based information that is needed to make most decisions for most patients. Rules of thumb, practice guidelines, and algorithms have been developed in part to help guide us in the application of evidence to decision making, but they cannot overcome a deficit in patient-specific information.

Although not generally acknowledged, bias is an important factor in medical decision making. Bias has been defined as a preference or inclination, especially one that inhibits impartial judgment, and as a prejudice, usually in the sense of having a preference for one particular point of view or ideological perspective. Clearly, inhibiting impartial judgment or being guided by ideology (rather than fact) is inconsistent with aspirations toward the soundest application of evidence-based medicine. Furthermore, recognizing predictable errors is considered to be a key step in learning sound clinical judgment and a prerequisite for improving medical decision making.[7]

Bias in decision making has been studied extensively, although the studies usually do not deal specifically with medical decision making. A brief review of the relevant literature produces a partial but fairly long list of recognized biases, such as availability bias, omission bias, preference for indirect harm bias, bias in medical evidence evaluation bias, bias against beneficial therapies, multiple alternatives bias, projection bias, sunk cost bias, regret bias, diagnostic bias, framing effect, confirmation bias, action bias, and gambler's fallacy.

Certainly, the availability bias is one that is easily recognized by today's dermatologist. For example, if dermatologists have a laser in their office, they would be much more inclined (biased) toward laser treatment solutions than might be the case when a laser is not readily available. Another of these biases that might have a special resonance for dermatologists is the action bias. Dermatologists are very aware of this bias and see its effects when general physicians attempt to treat rashes and as a result produce a contact dermatitis or a drug eruption. With that in mind, dermatologists in the past developed the anecdotal admonition, "Don't just do something—stand there!"

The balance of this discussion will focus on a group of interlocking biases—medical evidence evaluation bias, bias against beneficial therapies, preference for indirect harm bias, omission bias, and multiple alternatives bias—all of which seem to "work" in an almost unconscious or silent fashion.

MEDICAL EVIDENCE EVALUATION BIAS AND BIAS AGAINST BENEFICIAL THERAPIES

In their 2006 publication, "Failure to Adopt Beneficial Therapies Caused by Bias in Medical Evidence Evaluation," Aberegg et al[8] present compelling medically oriented studies that suggest the presence of a bias against new therapies. To set the stage for their studies, they cite the very rapid cessation of the use of hormone replacement therapy in response to studies suggesting that hormone replacement therapy increases the risk of certain cancers and other medical problems. Aberegg and colleagues point out that "some evidence does not seem to suffer from the general trend of underutilization. . . . clinical practice responded rapidly to reports of harms associated with hormone therapy."[8] They go on to ask the question, "Is the rate of adoption of beneficial therapies lower than the rate of abandonment of harmful ones?"[8] To study this question, they fabricated RTCs with results of equal medical weight showing in 1 set of 2 RTCs that a therapy being used was harmful. In the other 2 fabricated RTCs, they showed that a new therapy was beneficial. When physicians were shown these studies, which were constructed to have equal weights of evidence, and questioned as to how they would use this "evidence," many more physicians were willing to discontinue the harmful therapy (85%) than were willing to initiate a new beneficial therapy (35%). In discussing their results, the authors noted the medical dictum "do no harm" and the absence of a dictum such as "do not fail to do good" and concluded that their studies fit with a bias in evaluation of medical evidence such that when physicians are evaluating clinical trials they are less willing to adopt beneficial therapies than they are to abandon harmful therapies.

In their 2006 publication, Abdelmalek and Spencer[9] deal with the same issue in a dermatologic context. They note that dermatologic surgeons required very little evidence (a small series of patients) to adopt a policy of having patients discontinue perioperative systemic retinoid therapy for fear that it would worsen surgical scars. At the same time, a fairly robust body of knowledge (trials in animals and patients) indicating that pretreatment of the surgical site with topical retinoids would improve healing was not generally put into practice. Their publication stated that the "aforementioned nine case reports have established the avoidance of systemic retinoids in the perioperative period as the medical-legal standard of care in facial resurfacing."[9] They go on to say that there is little evidence that treatment with systemic retinoids causes scarring or abnormal healing and that in fact there are more documented cases in the medical literature that show normal wound healing than there are that show abnormal scarring in patients who use systemic retinoids in the perioperative period. Furthermore, wound healing studies in rabbits and diabetic rats found no adverse effect from perioperative retinoid therapy, and healing was normal or improved in transplant recipients undergoing Mohs surgery while tak-

ing systemic retinoids as well as in laser-treated patients taking systemic retinoids. By contrast, studies that have found favorable wound healing results after pretreatment with topical retinoids in animals and humans have mostly had no effect on clinical practice.

OMISSION BIAS AND PREFERENCE FOR INDIRECT HARM BIAS

Omission bias and preference for indirect harm bias are 2 additional biases that are clearly linked to the bias against beneficial therapies. The omission bias is well illustrated in studies of individuals' reactions to the following scenarios.[10] In 1 scenario, 2 tennis players are dining together the night before competing against one another for a championship. One player knows that his opponent is allergic to cayenne pepper but does not tell his opponent that cayenne pepper has been used in the food they are eating. In another scenario, the player sneaks cayenne pepper into his opponent's dish. When surveyed, 30% of the study participants thought that adding cayenne pepper was worse than not warning about the cayenne pepper. This result illustrates that emotionally we have a preference for causing harm by omission rather than by commission.

The omission bias can be seen as a form of the indirect harm bias, which is also is well documented[9] and illustrated in a liver transplantation paradigm. Exploring the idea that some individuals feel that a person who has damaged his own liver through alcoholism does not have the same right to receive a liver transplant as someone whose liver was damaged by another cause, researchers told participants that in compiling the ranking list for candidates to receive a liver for transplantation, they could add points to evaluation scores for nonalcoholics or subtract points from the scores of the alcoholics. By a count of 4 to 1, the participants preferred to act indirectly, ie, they preferred to add points to the scores of the nonalcoholic candidates rather than to affect the ranking of an alcoholic directly by subtracting points from the alcoholic's score. In a 2007 *New York Times* article entitled, "Is 'Do Unto Others' Written Into our Genes?"[11] there is an illustration of a train that is about to run over a large number of infants and children. This tragedy can be prevented in 1 of 2 ways. The first is to throw a single infant in front of the train to save the others, and the second is to pull a switch that will direct the train away from the larger number of infants and toward the single infant. Studies showing people's overwhelming preference for the indirect act of pulling a switch rather than for directly throwing an infant in front of a train is among the many examples used in this article suggesting the presence of a "subconscious morality" being written into our genetic code.

MULTIPLE ALTERNATIVES BIAS

The Nobel Prize–winning economist Thomas C. Schelling says that he stumbled on the multiple alternatives bias when he went to a bookstore to purchase an encyclopedia for his children and found that the bookstore had 2 different brands of encyclopedias.[7] Because he was unprepared to decide between the two, he left without buying either. It was his first conscious recognition of the bias toward continuing with present circumstances when presented with multiple choices. A recent book highlights a nonmedical study supporting a similar tendency not to act when confronted with many choices. The so-called jam study[12] found that more jars of jam were sold when only a limited number of different types were offered for sale than when many jams were offered.

In their publication, "Medical Decision Making in Situations That Offer Multiple Alternatives," Redelmeier and Shafir[7] describe their studies involving the possibility that adding new medical options can increase the probability of maintaining the status quo. After describing studies in which only 21% of the students went to the library when they were offered a single alternative activity but in which more students (41%) went to the library when they were offered 2 alternative activities, they presented the results of their studies on medical options. In 1 study, family practitioners were presented with a situation in which a single, newly introduced arthritis drug was available for a 67-year-old man with osteoarthritis who was already scheduled for surgery. Of the 288 physicians surveyed, 48% chose to postpone the operation in order to try the new drug. By contrast, when there were 2 new drugs to try, only 28% chose to postpone the patient's operation. In Redelmeier and Shafir's studies of 352 neurologists and neurosurgeons, similar decision avoidance was detected when the physicians had to choose from 3 rather than 2 options.

In conclusion, this group of interlocking biases seems to operate invisibly, but, in fact, each represents a recognized and predictable thinking or cognitive bias that can affect medical and surgical therapeutic decision making. Thinking harder will not eliminate a cognitive bias. However, studies in nonmedical settings have shown that debiasing procedures can improve many types of decision making.[7] Perhaps the most clinically consequential outcome of this group of biases is the widening of the research-practice gap; ie, the biases against new therapies, the tendency to continue with the current therapy when faced with several new choices, and the actual preference for omission can all result in effective therapies being underused, often in favor of continuing with suboptimal therapies. While as yet there is no comprehensive understanding or theory as to how choices are made, we can hope that recognition of certain cognition patterns and associated biases will help physicians narrow the research-practice gap and optimize their therapeutic choices.

Accepted for Publication: July 15, 2010.
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Financial Disclosure: Dr Eaglstein is employed by Stiefel Laboratories Inc, a GSK company.

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PRACTICE GAPS

Identifying Biases

Physicians often do not implement the best evidence available when selecting therapy. In exploring this point, Eaglstein provides us with a valuable educational piece on a variety of biases that keep clinicians from instituting new therapies. He points out specific gaps that can result from these biases, including unnecessary recommendations that patients discontinue using retinoids in the perioperative period because of rare reports of altered wound healing. Data do not support these recommendations.

Eaglstein suggests that closing the gaps begins with education to better recognize biases. In residency training, the Accreditation Council for Graduate Medical Education is looking to stakeholders in dermatology to participate in the Milestone Project to define measurable markers of successful resident progress throughout training.[1] One competency area, practice-based learning and improvement, will propose milestones relating to the identification of biases encountered in the literature and in practice, including those mentioned by Eaglstein. Knowledge questions that identify biases corresponding to research-practice gap vignettes could be created as one measure of practice-based learning and improvement competency. In continuing medical education, a facilitator familiar with evidence and bias could lead discussion-based venues that would highlight various study results, use audience responses to identify research-practice gaps, and then openly explore the biases that may be guiding practice. Continuing medical education venues that educate dermatologists about established medications as well as new medications should continue and should critically review the best available evidence to guide treatment selection.

Several additional barriers that were not discussed may also explain why dermatologists do not prescribe newer drugs. When providers attempt to prescribe new therapies for patients, treatment cost, prior authorization, justification letters, and insurance tier confusion all take considerable time and can be challenging to navigate. Furthermore, Eaglstein's article presumes that physicians read their journals well enough to know the latest evidence from trials, which may not be true. It identifies training as an inadequate and quickly outdated reference for future clinical decision making. Unfortunately, for some physicians, information from training remains an important resource for treatment selection. There is no requirement that a number of continuing medical education hours are to be spent confirming or learning appropriate therapeutic selection.

The final type of impactful bias is the relevant financial relationships of the authors. Nearly half of the RCTs published in dermatology include investigators who disclose a relevant financial relationship.[2] When reading a peer-reviewed article in the *Archives* that claims a therapy's success, the reader should turn his or her attention to the authors' disclosure information, which is published with each article. Authors disclose relationships with industry that could potentially introduce bias into the results or conclusions that are presented in the article. Industry-sponsored studies are often of superior methodological design and more rigorous than other studies; however, such studies are more likely to report positive results than are those whose authors lack industry relationships. In his article, Eaglstein has declared his financial relationship with a pharmaceutical company; therefore, the reader is able to place his plea in context. Dermatologists are urged to think about how to eliminate biases against prescribing new therapies with the intention of improving patient care.

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Financial Disclosure: None reported.

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