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COVER IMPRESSIONS

About our cover artist

On Freedom's Wing (2001) ■ Rick Kelley

Perhaps his most important piece ever, *On Freedom's Wing* was wildlife artist Rick Kelley's response to the tragic events of September 11, 2001. The striking image consists of a snowcapped mountain landscape bearing a bold resemblance to the American flag. Two bald eagles gracefully soar through the upper atmosphere, symbolizing the inherent strength of the American people and their devotion to freedom.

Last September, Kelley's seemingly simple search to buy an American flag to display on his house became an exhaustive ordeal—all stores were sold out. Kelley's wife Shawn suggested that he paint his own flag. Taking her suggestion, he went to his easel and poured out *On Freedom's Wing*. "Usually I have in my mind what I am going to paint before I start, but with this piece, everything seemed to come automatically. It was like something divine was guiding my hand as I was painting," said Kelley. He further recalls, "I remember when I had applied the last brushstroke to the flag in the mountain…I knew I had truly created something special."

After completing the painting, Kelley immediately decided to donate 10% of all proceeds to the American Red Cross Liberty Disaster Relief Fund.

Minnesota Congressman Jim Ramstad was very moved by the patriotic spirit of *On Freedom's Wing*, and he proudly displays a print in his Washington, D.C., office.

In March of this year, Kelley had the honor of bestowing former President George Bush with a master edition signed canvas of *On Freedom's Wing*. Kelley hopes to be granted the opportunity to present *On Freedom's Wing* to President George W. Bush as well in the near future.

Born in 1956 in St. Paul, Minnesota, Kelley began his quest to be an artist out of a love for nature at the early age of 10. He continued to paint mostly wildlife themes throughout his grade school and high school years. After graduation, he took advantage of his father's transfer of the family to Montana, using the western state's beauty as a backdrop and inspiration for his work.

"Usually I have in my mind what I am going to paint before I start, but with this piece everything seemed to come automatically. It was like something divine was guiding my hand as I was painting."

After studying at Eastern Montana University, he set out on his own, and less than 10 years later, in 1980, he began painting professionally full time. Today, he publishes his own work through the company he and his wife established, Kelley Fine Art Publishing. It is this venue that allows him the opportunity to paint with passion—producing images that convey the splendor and dignity of nature.

Kelley's wildlife and African art is a visual journal of his life's travels and experiences. An avid outdoorsman, each of his paintings evokes a fond memory of the wildlife he has observed. His approach is to capture the essence of each animal; whether it is the serenity of the loon, the majesty of the bald eagle, or the stealth of the gray wolf. This method, coupled with proportionately correct images, has made Kelley a nationally recognized and critically acclaimed wildlife artist.

Be sure to visit his Web site at www.kelleyfineart.com to see *On Freedom's Wing* and the second painting of the triptych, *Liberty's Flight*. In this work, Kelley has subtly embedded an image of the Statue of Liberty in the rocky surface of a mountainside. A portion of the proceeds is being donated to the Todd M. Beamer Foundation.

Rick Kelley and his family reside in Chanhassen, Minnesota.

Sheila Macho
JMCP Contributing Editor

COVER CREDIT

Rick Kelley, *On Freedom's Wing*, oil on canvas. Chanhassen, Minnesota. Copyright 2001.

SOURCES

Interview with the artist and www.kelleyfineart.com.

CONTEMPORARY SUBJECT

Quality Improvement Opportunities in Health Care—Making It Easy to Do It Right

BRENT JAMES, MD, MStat

What has been accomplished is only an earnest of what shall be done in the future. Upon our heels a fresh perfection must tread, born of us, fated to excel us. We have but served and but seen a beginning.

—Sir William Osler, commenting on the contributions he had made to medical professionalism[1, p.237]

At the turn of the last century, William Osler, Harvey Cushing, and other clinical leaders redefined the caring professions and their role in modern society They restructured hospital organization, established scientific research as the foundation for clinical practice, formalized and standardized clinical education, and set and enforced high ethical and personal performance standards among those who would claim to be physicians or nurses.[2] Their era marked a major turning point in health care delivery.

Prior to 1900, seeking a physician's help for a serious illness did little to change a patient's final result,[3] but since that time, Americans' life expectancy has almost doubled. A child born in the United States in 1998 can expect to live almost 78 years, while 100 years ago, half of all Americans died before the age of 49.[4]

Early advances in life expectancy derived mostly from public health. Sanitation, clean water, safe food, increasingly effective immunization against epidemic infectious disease, and other similar preventive measures drove massive declines in mortality. The last 30 years have seen an increasing role for disease treatment as a source of life expectancy. For example, since 1970, age-adjusted mortality from heart disease and stroke, the first and third most common causes of death in the United States, have fallen by 56% and 70%, respectively.[4,5] Continuing advances in pharmaceuticals, genomics, and other clinical sciences presage even better clinical tools to prevent, detect, arrest, and reverse disease. Current health care is demonstrably the best that the world has ever seen.

Despite those impressive accomplishments, current clinical performance still falls far short of its theoretic potential. The Institute of Medicine's (IOM's) Roundtable on Quality catalogued a startlingly broad array of failures in applying extant knowledge to routine care.[6] Other reports extended that list.[7] For example, Schuster et al. found that across all care delivery settings, only 52% of eligible adults older than 65 years received recommended yearly influenza vaccination, and only 28% received indicated pneumococcal vaccination. Overall, just 50% of Americans receive appropriate preventive care, 70% of patients suffering acute disease receive indicated acute care, 30% receive contraindicated therapies, 60% of those treated for chronic conditions received recommended care, and 20% received contraindicated treatments.[8] More recently, the IOM's Committee on Quality of Health Care in America described the wide scope of care-related injuries patients suffer in U.S. hospitals[9] and, in a second report, *Crossing the Quality Chasm: A New Health System for the 21st Century*, called for massive redesign of the health care delivery system to address system-wide failures of execution.[10]

For example, Allison et al. recently compared treatment and outcomes for acute myocardial infarction across U.S. major teaching, minor teaching, and nonteaching hospitals.[11] They tracked myocardial reperfusion on admission, use of aspirin during hospitalization, and prescription of angiotensin-converting enzyme (ACE) inhibitors and beta-blockers at discharge as key treatment factors, and 30-day, 60-day, 90-day, and 2-year mortality as major outcomes. The study concluded that "admission to a teaching hospital was associated with better quality of care . . . and lower mortality," and traced most of the mortality difference to more appropriate use of beta-blockers and ACE inhibitors in teaching hospitals. That made the actual rates of appropriate administration of those drugs even more striking: Major teaching hospitals prescribed beta-blockers at discharge to "ideal candidates" only 48.8% of the time. They prescribed ACE inhibitors to "ideal candidates" only 63.7% of the time. That was still sufficient to significantly outperform nonteaching hospitals, which achieved only 36.4% and 58.0%, respectively, on the same measures.

The present gap between the good that health care professionals *do* achieve for patients, and the benefits we *can* and *should* achieve for patients, arises from the collision of 2 potent factors. The first factor is a set of core, subconscious beliefs about how care is best delivered and how professionals should interact. The second is the rapidly increasing complexity of evidence-based best clinical practice.

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The Craft of Medicine

While many complementary principles fully define clinical professionalism,[12,13] 3 core ideas lie at their heart and distinguish the healing professions from others who claim professional status.

First, health professionals honor a fiduciary trust that places patients' health care needs before any other end or goal.

Second, health professionals use and maintain a shared base of knowledge that is not comprehensively available to those who seek their help. (Beyond applying specialized clinical knowledge in order to practice, health professionals also commit to transmit their knowledge to others who are entering their profession, extending their profession through time; and to improve their shared knowledge while it is under their control. Hence the triumvirate that defines any good academic clinical program, of practice, teaching, and research.)

Finally, acting on behalf of patients as a group (that is, society), health professionals hold one another accountable for clinical performance. No other group can perform that critical function, because no other group is in a position to accurately judge how well a professional meets commitments to fiduciary patient trust and properly knows and applies the profession's specialized knowledge (which leads to the original definition of professional autonomy, which functions at a professional group, not an individual, level[13]).

As they rebuilt the health care licensing, education, and delivery system at the turn of the last century, Osler, Cushing, and their colleagues implemented the continuing principles that define the health professions in terms of professional craftsmanship. The fundamental idea was this: An individual physician, placing his patients' health care needs before any other end or goal, drawing upon a vast body of clinical knowledge gained through formal education and ongoing practice experience, could devise a unique diagnostic and treatment regimen for each particular patient. The profession's promise was that this approach would produce the best possible health care result for each patient, and for society as a whole.

Under such an understanding of professional role, the physician-patient relationship is hermetic and sacrosanct. Nothing can be allowed to intrude between physicians and their understanding of a particular patient's disease, diagnostic and therapeutic needs, resources, local circumstances, preferences, and values. Most important, under the craft of medicine, care is defined, one patient at a time, as unique, individual cases with unique, individual solutions.

Clinicians transfer learning between patients through subjective recall of previous, similar cases. Within the craft of medicine, skilled clinical craftsmen define their own preferred understanding and approach. The health care delivery system is expected to adapt and accommodate, creating an environment within which each such skilled professional craftsman can use "what works for me."

Osler et al. further sought to insulate physicians from the financial demands that accompany clinical practice and might pervert physicians' fiduciary trust to patients. They created hospitals in which a separate group took responsibility for facility maintenance and financial performance, which eventually evolved into a second chasm that separates hospital administration and medical staff today.

Health Care Delivery and Complexity

One hallmark of the craft of medicine is variation in clinical practice, with failures in execution and outcomes that become obvious upon careful measurement across groups of patients. Wennberg's *Dartmouth Atlas of Health Care*, updated roughly every 2 years, summarizes a massive literature demonstrating large variations in clinical practice based on geographic location, and documents ongoing significant variation within the federal Medicare program.[14] Wennberg concludes that "geography is destiny"—the single largest determinant of the clinical treatment that will be selected for many medical conditions is geographic location, reflecting the views and beliefs of local clinicians acting within the craft of medicine. A more recent review found 2-fold differences in total Medicare health care costs across regions but no resultant differences in health outcomes.[15] Chassin links the health system's current gap in quality performance directly to variation in clinical practice, citing the mechanisms of underuse, overuse, and misuse of clinical treatments.[7]

In 1992, James and Horn drew a convenience sample containing 90 major peer-reviewed articles on variation in clinical practice.[16] They reviewed each study's discussion section and catalogued more than 70 different possible sources of variation hypothesized by the studies' authors. The 3 most common causes of variation, in order of frequency of citation, related to knowledge and information flow are: (1) the complexity of clinical practice, (2) a lack of valid information identifying best care across a range of choices, and (3) physicians' continued reliance upon subjective recall in making clinical judgments.

Lack of Valid Clinical Information

In 1979, Williamson et al. identified common treatment choices within 3 subspecialties of internal medicine, asked prominent internists to use their clinical expertise to identify best practices in each instance, then sought documented, best practice in the peer-reviewed medical literature. Using observational studies as a minimum evidence standard, Williamson's team was able to find published evidence for best practice less than 10% of the time.[17] In 1985, the U.S. Office of Technology Assessment asked experts to estimate how often the evidence base identified best practice for common treatment choices. Consensus opinion put the figure at less than 20%.[18] In 1991, the National Institute of Health's Office of Medical Applications of Research reviewed how often structured scientific literature searches had "made a substantive contribution" to assessments of best medical treatment performed at the request of the Health Care Financing Administration. They found that the peer-reviewed scientific literature contributed significantly in less than 20% of the assessments performed.[19]

Sackett described the formal use of clinical science to guide routine clinical practice as evidence-based medicine.[20] Arguing in

support of evidence-based medicine, Ellis et al.'s companion paper asked a fundamentally different question about the evidence base than that posed in the studies listed above: In a London teaching hospital's internal medicine service, house officers could identify direct evidence of efficacy for 53% of the treatments they applied to patients. For another 29% of treatments, the team agreed that there was convincing nonexperimental evidence.[21] Evidence to support selection of the best choice for a particular patient, among competing treatment alternatives, is much more limited.

Complexity

In counterpoint, Chassin found that the evidence base represented by randomized controlled trials is increasing exponentially. More than half of the randomized controlled trials performed since 1954, the date of the first such trial, were completed between 1990 and 1995. During 1995 alone, more than 10,000 new randomized controlled trials were reported in the peer-reviewed literature.[7] Because the breadth and depth of medical science is also expanding (e.g., secondary to new pharmaceuticals and human genomics), it is difficult to assess the growth rate of the evidence base for existing clinical practices.

In 2000, the National Institute of Health's MEDLINE service added more than 8,000 articles to its reference database each week, representing about 40% of all peer-reviewed biomedical articles published worldwide.[22] The rapid expansion of new medical knowledge highlights a more significant challenge: Eddy argues that even the current evidence base, despite its limitations, is so large and complex that clinicians operating within the traditional craft of medicine cannot properly apply it consistently during routine patient care.[23] Shaneyfelt estimates that to remain current in their specialty, a general internist would need to read 20 articles per day, 365 days per year—"an impossible task." He found that 3 to 4 years after board certification, both generalist and subspecialist internists begin to show significant declines in general medical knowledge and that 14 to 15 years postcertification, more than two thirds of practicing internists could not pass the American Board of Internal Medicine's qualifying examination.[24]

Other investigations have called the root premise of the craft of medicine into question. In 1956, Miller estimated that the human mind can evaluate a maximum of 9 factors at one time.[25] Obviously, the effect of a disease process on a patient's anatomy and physiology, the many diagnostic and therapeutic alternatives that are commonly available, the likely outcomes of each choice, and the patient's personal resources and preferences will grossly exceed that limit in all but the simplest cases. How is a skilled clinical craftsman to choose?

Reliance on Subjective Judgment

Under the craft of medicine, skilled craftsman clinicians routinely rely upon subjective recall— their personal "clinical experience"—as the foundation for the recommendations they make to patients. But such subjective recall is significantly biased.[26,27] When forced to rely upon clinical experience, clinicians consistently overestimate their successes and underestimate their failures, or overreact to striking failures. Clinicians may also read the scientific literature selectively, ignoring obvious failings in studies that support the practices they favor, and magnifying minor problems in other, better studies that contradict their desired result.[26] Chassin described the resulting practice style as "enthusiasm for unproven methods"[28] and linked it to fee-for-service payment and pleasure arising from technical expertise.[7] Eddy describes the same phenomenon through a commonly accepted practice rubric, "if it might help, do it,"[29-31] which defines clinical quality as "spare no expense."

As long ago as 1982, Wennberg used the term "clinical uncertainty" to describe the combined effect of complexity, lack of valid scientific knowledge, and reliance on subjective judgment and linked it to the massive practice variation that typifies the craft of medicine.[32] The problem of clinical uncertainty still hounds health care delivery today.[33]

Solving the Complexity Problem: Profession-based Practice

In response to clinical uncertainty and daunting evidence of a true chasm between actual care delivery performance versus best care delivery performance, the clinical professions are changing. That change is widespread and foundational, bringing together many complementary methods, including evidence-based medicine, clinical quality improvement, and evidence-based and consensus-based best practice—guidelines developed by subspecialty medical societies.[34] The change is more in the manner in which clinicians understand and implement core professional values than in changes in the values themselves. At its heart, American care delivery is shifting from craft-based to "profession-based" clinical practice.

While addressing a wide array of related health systems issues, the Institute of Medicine's recent call for major reform in health care delivery, *Crossing the Quality Chasm: A New Health System for the 21st Century*,[10] is a primer for profession-based practice. Profession-based practice addresses health care's inherent complexity and uncertainty through shared professional activity. The idea is this: Rather than focusing on patients one at a time, as lone professional craftsmen, a group of clinical colleagues come together to identify high-priority care delivery processes that apply to large populations of patients with similar needs. Working as a multidisciplinary professional team, they design an evidence-based best care guideline. They weave the resulting guideline into front-line care delivery flow, creating a common baseline with standardized staffing, training, supplies, physical layout, and other shared factors that define the care delivery environment. Finally, they add process management methods (i.e., quality improvement) to measure patient results and to systematically improve the guideline and their shared care environment, while leaving individual

clinicians free to vary from the common baseline based upon their professional judgment of unique patient needs.[35-37] Profession-based practice aims to learn from and reduce (inappropriate) variation arising among clinicians while retaining (appropriate) variation arising from patients.

Profession-based practice is sometimes called "mass customization." It blends the best of 2 worlds, harvesting the efficiencies and error reduction that come from standardization and simplification, while respecting the fact that no 2 patients are ever quite the same, so that clinical judgment continues to play a significant role. Some also describe it as "make it easy to do it right." In an increasingly complex clinical care delivery environment, structure care delivery systems so that the evidence-based best practice is the default course—automatic, requiring no extra thought or work. That frees the clinical enterprise's most valuable resource—the creative thought of highly trained professionals—to focus on those areas of special need and adjust care to each individual patient.

Experience from other fields, and early experience from within health care itself, suggest that such an approach can reduce error rates and improve patient outcomes while generating efficiencies that reduce the cost, complexity, and burden of health care delivery.[38] For example, clinical leaders at Intermountain Health Care (a system of 22 hospitals plus more than 90 outpatient clinics, located in Utah, Idaho, and Nevada) identified appropriate discharge medications for patients hospitalized with heart disease as a high-priority area for clinical management and improvement. They developed an evidenced-based best practice guideline that contained indications and contraindications for 5 such medications: antiplatelet therapy (usually aspirin) for patients with ischemic heart disease; HMG-CoA reductase inhibitors (statins) for patients with ischemic heart disease; ACE or ARB inhibitors for patients with congestive heart failure or left ventricular systolic dysfunction; beta-blocker therapy for patients with a history of myocardial infarction; and warfarin for patients suffering from chronic atrial fibrillation.

They blended the guideline into the flow of clinical care by including it within a standardized packet of nursing discharge forms: As part of their routine discharge process, nurses complete a simple check sheet, detailing indications and contraindications for each medication. If a patient meets indications for any of the medications and has no contraindications, the nurse places a corresponding order on the discharge medications sheet. Physicians must countersign the order, and so still retain full control of final clinical decisions.

Figure 1 shows appropriate use rates for beta-blockers at discharge among ideal candidates (patients who had indications but no contraindications), as the guideline was implemented. Table 1 details performance across all 5 medications.

Follow-up studies showed that, once started at an initial hospital discharge, the vast majority of patients continued to receive appropriate medications in an outpatient setting. All-cause, one-year mortality rates for such patients fell significantly (from 22.7% to 17.8% for patients with congestive heart failure, and from 4.5% to 3.5% for patients with ischemic heart disease), representing a decrease of more than 450 deaths per year. All-cause rates for rehospitalization within one year also fell significantly, from 46.5 to 38.5% for congestive heart failure, and from 20.4 to 17.7% for ischemic heart disease, representing a total of almost 900 fewer hospitalizations per year.

TABLE 1 Appropriate Use of Discharge Medications for Ideal Patients*

	Baseline (January-June 1999)	Intervention (March-October 2000)
aspirin	65%	98%
statins	68%	91%
ACE/ARB inhibitors	63%	95%
beta-blockers	57%	97%
warfarin	10%	92%

** Patients who met indications, no contraindications, before and after implementation of an evidence-based best care guideline integrated into the flow of care; baseline rates were comparable to or exceeded national benchmarks.*

Summary

The American health care system's shift to profession-based practice is happening on a very wide scale, at a fundamental level, under a variety of different names and initiatives. It embodies a massive force, as the health professions respond to the burgeoning complexity that confronts all aspects of health care delivery. It also represents a profound redefinition of what it means to be a caring professional: The principles that define our professions will remain the same, but the way in which we implement those principles are changing to reflect a new reality, requiring new knowledge and new methods.

Such change carries significant implications for the practice of pharmacy. For example, the single largest area of preventable injuries faced by patients in American hospitals involves the appropriate selection and delivery of medications (adverse drug events). Pharmacists can move beyond their traditional roles, move out of the pharmacy, and contribute to multidisciplinary care teams as they identify, measure, and manage critical medication delivery processes.

New pharmaceuticals have been identified as a major contributor to exploding health care costs. While federal regulation requires that every new medication receive careful scientific study to establish clinical efficacy, evidence directly comparing new to existing medications is usually lacking. Pharmacists help patients, physicians, and health care policy makers understand the cost-effectiveness of new products relative to existing choices.

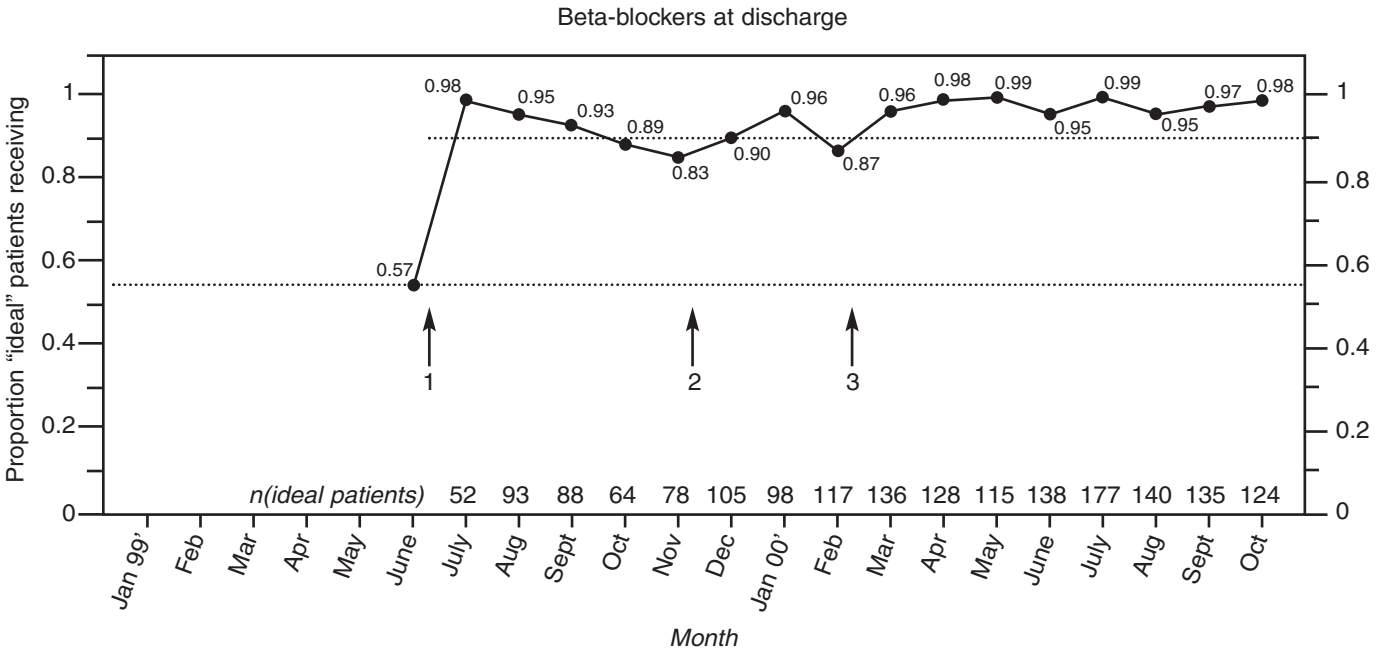
FIGURE 1 Discharge Medications for Patients with Heart Disease

Aim: Improve to more than 90% the proportion of CV patients, without specific contraindications, receiving appropriate discharge medications:

o Post MI	beta-blocker
o CHF / LV systolic dysfunction	ACE inhibitor
o Ischemic heart disease	aspirin + HMG-CoA reductase inhibitor (statin)
o Chronic atrial fibrillation	warfarin

Outcomes measure(s): Among "ideal" patients (those who met indications, but had no drug-specific contraindications), proportion discharged on the indicated medication.

Sampling scheme: Baseline rates established through random sample chart review of all eligible patients, January-June 1999. All eligible patients tracked and recorded using manual data sheets, completed by a nurse at the time of discharge, from July 1999 on. Manual data collection sheets were compared to cases identified by examining ICD-9 diagnosis and procedure codes in hospital case-mix files, to insure that no eligible patients were missed.



Interventions:
1. Introduction of a standing order set, containing indication and contraindication check-off boxes for cardiac medications, placed in chart by nurses, with physician override. Tear-off copy for data collection.
2. Three additional hospitals added to original intervention site.
3. Repeat inservice of nurses, with introduction of regular performance feedback.

Many pharmaceutical companies now advertise direct to consumers, recommending that patients "ask their physician" whether a new drug might be beneficial. Yet the process of establishing the level of potential benefit that a new medication offers to a particular patient is hugely complex, extending well beyond the capacity of most practicing physicians. Questions of side effects, lifestyle changes required for appropriate use, alternative treatment strategies, and costs complicate the question even further. Pharmacists can help patients understand the total impact that a new medication might have on their life. Pharmacists can help physicians as they advise patients.

At the end of his career, speaking at the dedication of the Phipps Clinic in England, Sir William Osler reflected on the similar, massive change that had defined his own professional life:[1, p.241]

> *I am sorry for you, young men of this generation. You will do great things. You will have great victories, and standing on our shoulders, you will see far, but you can never have our sensations. To have lived through a revolution, to have seen a new birth of science, a new dispensation of health, reorganized medical schools, remodeled hospitals, a new outlook for humanity, is not given to every generation.*

We live in interesting times. Those who succeed in the health care delivery system of the 21st century will be those who can best understand, harness, and direct the forces that are remodeling our professional landscape.

DISCLOSURES

Editor's Note: This article was subjected to peer review in the same manner as all articles and editorials published in the *Journal of Managed Care Pharmacy*. This article is based upon a background paper, "Making It Easy to Do It Right," written by Dr. James as part of the "Framework Project" sponsored by the Foundation of Managed Care Pharmacy and produced by FMCP in its publication in 2002 titled, "Supporting Documents—Pharmacy's Framework for Drug Therapy Management in the 21st Century." This document may be ordered from the Foundation for Managed Care Pharmacy (http://www.fmcpnet.org/fmcp.cfm?c=resources#a2).

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Medical Errors, Adverse Medical Events, and PDRM

A MEDLINE search in August 2002 using the search term "PDRM" revealed 2 medical literature citations, one on the subject of ventilator-associated pneumonia and potentially drug-resistant microorganisms (PDRM)[1] and the other an overview of the contribution of systems to the "widespread problem of preventable drug-related morbidity.[2]" Expanding the search to the terms "drug-related morbidity" yielded 667 citations, including the widely referenced article on a cost-of-illness model for drug-related morbidity and mortality by Johnson and Bootman in 1995.[3]

As MacKinnon and Hepler describe in this issue of the *Journal,*[4] the distinction between drug-related morbidity (DRM) and *preventable* DRM (PDRM) is obviously of importance to managed care pharmacists since PDRM would, by definition, be reducible. Their research suggested that experts can agree on what constitutes a preventable drug-related adverse event. How does this research advance our work in making medication delivery systems and drug therapy management safer for its users? The results of the PDRM work to define a nomenclature and measurement system in a hospital health care system, among the elderly, will be described in an article in the November/December 2002 issue of *JMCP*. Their expert panel reached consensus on several clinical indicators of PDRM that included indicator no. 6, an emergency room (ER) visit or hospitalization due to hyperkalemia subsequent to the use of an ACE (angiotensin-converting enzyme) inhibitor without checking electrolytes and CBC at least every 6 months. By this measure, most of our elderly population on an ACE inhibitor could be at risk of PDRM.

The work by Morris and Cantrill in the United Kingdom to validate and apply the U.S.-derived PDRM indicators developed by MacKinnon and Hepler resulted in survival of just 19 (33%) of the 57 PDRM indicators in the U.K.[5] This result suggests that the U.S.-derived PDRM indicators are either (a) not durable under scrutiny for validity and relevance in general or (b) quality indicators in drug therapy management are significantly different in the U.K. compared to the U.S. In either case, the fact remains that these expert panels, small in the number of experts employed, 7 in the U.S. and 16 in the U.K, did not agree on 2 out of 3 PDRM indicators.

Already, much value has been derived from the distinction between medical error (ME) and adverse event (AE), the former referring to any event that represents a mistake versus the latter that is associated with an adverse outcome.[6] Whether an adverse outcome represents preventable "morbidity" is an important matter for investigators and those dedicated to quality improvement. Administering the wrong drug (aspirin) to a patient with a known aspirin allergy and prescribed acetaminophen represents an apparent medical error. This ME may have no adverse effect and therefore not represent an AE. Without an adverse effect, there is no opportunity for a *preventable* drug-related adverse event and no morbidity to be prevented. Had the patient suffered anaphylactic shock due to an aspirin allergy and died, the event would presumably represent an ME, an AE, a drug-related event, an adverse drug event, an adverse drug reaction, and preventable drug-related *mortality*, but not PDRM.

Fortunately for patients and users of the U.S. health care system, the focus of promoting patient safety and preventing medical error shifted years ago to systems and away from people.[7] More than 10 years ago, Reason summarized his work in the analysis of success and failure in complex work settings: "Rather than being the main instigators of an accident, operators tend to be the inheritors of system defects . . . . Their part is that of adding the final garnish to a lethal brew whose ingredients have already been long in the cooking."[8] In 1997-1998, the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) revised its policy on reporting medical errors to emphasize the investigation of sources of medical errors and self-correction versus the former policy of public notice and punishment through threat of downgrade of accreditation status.[9] More recently, JCAHO standards for medical error reporting, adopted in mid-2001, included further emphasis on process-oriented investigation by shifting the focus from external review and reporting to development of a system within each hospital (system) to report and analyze medical errors.[10]

Crossing the Quality Chasm—Incremental Change through Clinical Practice Guidelines (CPGs)

The explosion of data available on the Internet has magnified the challenge of filtering that data to derive information. Information is that precious commodity that, unlike data, supports action that is more likely to result in desired outcomes. In addition to the mountain of data available in the lay press, Internet, television, and radio, the U.S. National Library of Medicine reported an average 10,000 new lines (articles) referenced in MEDLINE each week at year-end 2001.[11] How can we possibly separate the reliable and useful information from the overwhelming amount of data available today?

We appear to be approaching a time when information technology has the potential to eliminate quality shortfalls in certain sectors of the U.S. health care system.[12] Yet, we still have a long way to go, particularly in the creation of an electronic medical record that will support fully informed decision making by health care providers and patients, at the point of care. Lurking behind the obvious challenges is the never-ending task of developing and maintaining clinical practice guidelines that can help reduce nonrandom, systematic variation in medical interventions and delivery of pharmacy services. Despite all of the challenges, the use of CPGs or clinical practice models (CPMs) is the foundation for *incremental change* that will permit improvements in systems to better protect patient safety and improve clinical and service outcomes.

Many in health care refer to "evidence-based medicine" as if this concept exists commonly in practice. It would be comforting and helpful if reliable information (evidence) was routinely reduced to useful guidelines and available in a readily accessible manner, at the point of care. Work published in September 2001 found that only 3 of 17 (18%) of the CPGs published by

the Agency for Healthcare Research and Quality were judged to still be valid.[13] Seven (41%) of the CPGs were found to require a major update to reflect new evidence, and 6 CPGs were judged to require a "minor update." In other words, at the time of the report in September 2001, three quarters of the AHRQ guidelines needed updating.

In fact, there are at least 8 threats to the reliability and usefulness of information contained in CPGs and CPMs. First, bias and conflict of interest can undermine validity and reliability (value) of the clinical "evidence." Second, experts may fail to use sufficient rigor when interpreting the results of clinical interventions. Third, valid and reliable clinical evidence may not be reduced to a practical and useful CPG. Fourth, experts may not disclose conflict of interest and potential bias when preparing CPGs. Fifth and sixth, a useful and practical CPG may not be disseminated adequately or may be unavailable at the point of care. Seventh, the communication of the guideline may be ineffective or become lost in the increasing level of "noise" in information communicated to physicians. Eighth, even if readily available at the point of care, the clinician may reject or otherwise choose to ignore the CPG and the information it contains. All 8 barriers may contribute to nonrandom variation in clinical practice.

An online survey of about 300 internal medicine and family practice physicians conducted by Harris Interactive in mid-2001 for the Henry J. Kaiser Family Foundation found that only 19% of these primary care physicians chose aspirin as the treatment of choice for the onset of stroke, 27% chose heparin, and about half opted for t-PA. According to clinical evidence, t-PA is the third-line choice for acute stroke, while aspirin is first-line and heparin is second-line. Some of the gap in the use of CPGs is attributable to physician resistance to "cookbook medicine." Alan Muney, MD, chief medical officer for Oxford Health Plans (Trumbull, Connecticut) commented, "The shameful truth is that not all doctors adhere to evidence-based medical guidelines."[14] "Shameful" might not be the best word to describe the failure by clinicians to use the available information since practicing clinicians point, fairly, to bias in the preparation of many CPGs and CPMs. There is also the matter of inadequate communication of the CPG to the practitioner. Amid an increasing barrage of data, practitioners could easily lose the significance of an otherwise important clinical guideline among the "noise" of data overload.

The matter of pseudo-evidence is also of serious concern and contributes to the problem of data overload and information underload. Calling data "evidence" does not make it so. Much of the literature contains expert opinion, not the results of randomized clinical trials. It has been said that one study, particularly a randomized, control group trial, is worth 1,000 expert opinions.

Information Technology to Cross the Quality Chasm

At year-end 1997, the Health Care Financing Administration, now the Centers for Medicare and Medicaid Services, proposed a maximum 2% medication error rate for Medicare and Medicaid hospitals, and nurses would be required "to review drug orders for accuracy of the entire system before prescription drugs are administered."[15] In 1998, a 15-month study of computerized physician-order entry at Brigham & Women's Hospital found that medication errors were reduced by 55% when physicians were required to enter all drug orders by computer.[16] While few would debate the need to improve quality by reducing medication error rates, there is debate about the magnitude of the problem.

More than 2 years later, General Motors Corp., IBM, AT&T, General Electric, Boeing, and 91 other employers collaborated to form the Leapfrog Group, to, as its name implies, leapfrog over the present (slow) pace of quality improvement in health care. The Leapfrog Group in 2001 defined 3 basic ways to improve safety and quality of health care for at least the hospital component of the health system. The Leapfrog Group urged managed care organizations (MCOs) to contract with only those hospitals that (1) implemented a computerized order entry system by 2004 and (2) provided an ICU staffed full-time by an internist with specialty training and certification in intensive care medicine. Third, the Leapfrog Group suggested that MCOs should practice evidence-based medicine by sending patients only to hospitals with high volume and favorable outcomes. As for the chasm between current practice and the 3 quality standards: only 3.3% of hospitals reported operational physician electronic order entry systems, only 10% of hospitals surveyed had intensive-care specialists overseeing care in the ICU at least 8 hours per day, and only 12% of 250 hospitals surveyed by the Leapfrog Group in late 2001 met the standard of performing at least 500 coronary artery bypass graft procedures per year.

At a meeting on July 26, 2002, called by the U.S. Food and Drug Administration (FDA), hospital groups and patient safety advocates such as the Institute for Safe Medication Practices (ISMP) asked the FDA to require prescription drug manufacturers to apply bar codes to all drug packages, particularly unit-dose packages. The promise is large for information technology (IT) to reduce the estimated 100,000 deaths annually and the estimated 770,000 medication errors that occur in U.S. hospitals each year.[17] Yet, there are several factors that should affect expectations of the promise of IT to cross the quality chasm in medication errors. First, there is the absence of a single bar code standard. Second, even if there were bar codes on individual drug doses (unit dose packages), only 10% to 15% of hospitals had bar code readers at patient bedsides in mid-2002. Third, drug manufacturers had been producing fewer drugs in unit-dose packages, due to the extra cost. Fourth, there is a question of the return-on-investment. Bar coding drugs and making bar code readers standard at hospital bedsides would cost $1.5 billion or more, and the FDA estimate of the 770,000 annual hospital medication errors that are preventable is a wide range, from 28% to 95%.[18]

Lucian Leape, MD, a retired surgeon and professor at the Harvard School of Public Health, found wide discrepancies in hospital medication error rates, attributing the discrepancies to the method of data reporting rather than actual variation in incidence and outcomes, highlighting the fact that people who report high medication error rates are punished for these data. Leape found an error rate of 0.2% (2 per 1,000 charts) for self-report methods, 0.7% for retrospective chart reviews, 3.8% for computer screening, 6.5% for daily chart reviews, and 10.0% for computer screening combined with daily chart review. He concluded, "If you are relying on incident reports, you are missing 95% of them."

So, it would seem that (a) everybody agrees that medical errors should not occur, (b) the scope of the problem is not well-defined quantitatively, and (c) we have solutions for reducing medication errors but determining the return-on-investment from these solutions will be difficult. Brent James, MD, a well-recognized leader and teacher in health care quality improvement, has observed for several years that the key to reducing systematic variation in health care delivery involves "making it easy to do it right." This perspective involves making key process steps routine and unavoidable, such as the application of IT to the hospital discharge process. A randomized trial of a computerized clinical-information system that generated preventive care reminders at the point of patient discharge increased significantly the use of subcutaneous heparin for patients at risk for venous thromboembolism, instructions to take aspirin for patients hospitalized for acute myocardial infarction, and the use of pneumococcal or influenza vaccine for eligible patients.[19] James observed that "studies of clinical errors have identified a series of human limitations that lead to predictable failures of the health care delivery system."[20] In this issue of the *Journal*, James elaborates on his perspectives of the quality chasm in health care.[21] His perspectives are important since his work on the Institute of Medicine "Chasm" report is almost incidental to his efforts over the last 20 years to improve health care delivery by teaching others the methods to apply analytical thinking and statistical tools to the study of the processes of care, measuring outcomes, and reducing nonrandom variation in clinical practice.

Benefit Maximums Versus Drug Benefit Needs for Medicare Beneficiaries

Annual dollar maximum limits for Medicare+Choice prescription drug benefits are common, an average $1,149 in 1997 and as low as $600 per year. By CY 2000, 38% of Medicare+Choice members with prescription drug benefits had an annual maximum of $750 or less. Data from the Kaiser Family Foundation also show that 13% of Medicare beneficiaries spent $2,000 or more on prescription drugs in CY 2001, accounting for 52% of total prescription drug spending for Medicare beneficiaries.[22] Spending of $1,000 or more was found among 28% of Medicare beneficiaries and accounted for 76% of total expenditures for prescription drugs. Yet, an amazing 17% of Medicare beneficiaries had no ($0) spending on prescription drugs in CY 2001. A previous study in the *Journal* reported that for 2 cohorts of patients in a Medicare+Choice population, one using only community pharmacy services and the other using only mail-service pharmacy, only 0.18% (26 members) and 0.01% (2 members) respectively, reached their maximum drug benefi, which ranged from $500 to $1,600 in 1998.[23] These data are difficult to reconcile.

Survey data from 10,927 noninstitutionalized seniors in 8 geographically diverse states in 2001 showed that 35% of seniors with drug coverage under a Medigap policy, 25% of seniors enrolled in state pharmacy assistance programs, and 19% of seniors in Medicare HMOs spent at least $100 per month ($1,200 per year) on prescriptions in 2001.[24] Medicare HMOs were important sources of drug coverage for seniors in California (30%) and Colorado (24%) but were less important in other states, ranging from a low of 7% in Illinois to 14% in Pennsylvania.

In this issue, Cox and Henderson[25] report that 24% of the respondents in their survey of Medicare+Choice members (with limited prescription drug benefits) did not know if they had exceeded their annual drug benefit maximum in the preceding year (CY 2000), and 46% did not know (accurately) the dollar amount of their annual benefit maximum ("cap"). This study did not link the survey responses to the demographics and drug benefits of the Medicare+Choice members. This link would have helped answer questions that arise from efforts to interpret the survey results. And, the fact that 24% of Medicare+Choice members reported that they were not aware of whether or not they had exhausted their prescription drug benefits may not be surprising in the context of the statistic that 17% of Medicare beneficiaries had no ($0) expenditures for prescription drugs in CY 2001.

The study by Cox and Henderson also did not include analysis of the reported behaviors compared to actual experience, as measured by drug claims in the database. This assessment would have provided more insight into this important question of the effects of Medicare+Choice annual maximum benefits on the use of prescription drugs by type (e.g., generic drugs versus brand drugs, antihypertensives versus drugs for heartburn). Also left to other researchers is evaluation of the qualitative and quantitative time curve to exhaustion of benefits; i.e., the percentage of beneficiaries who exhaust benefits in 90 days, 120 days, etc. Readers should also note that the work by Cox and Henderson did not include Medicare+Choice annual maximum benefits applied quarterly (e.g., $1,000 annual maximum limited to $250 per calendar quarter), a common practice in Medicare+Choice plans since 2001.

Nevertheless, the study by Cox and Henderson does highlight a subject that should concern health plan administrators

and pharmacy benefit mangers, that is, the adequacy of pharmacy benefits and the potential consequences that could arise from gaps in treatment associated with financial barriers. A Kaiser Family Foundation study published in 2002 found that 30% of the nonelderly uninsured did not fill a prescription in the previous 12 months due to cost, compared to 12% of the nonelderly with insurance,[26] and 10% of the insured population reported needing a prescription in the previous 12 months but not getting it due to cost.[27] Overall, nearly one quarter of seniors, regardless of drug benefit coverage, either did not fill a prescription or skipped doses due to costs. More than one third of seniors without drug coverage either skipped doses or did not fill a prescription due to costs, twice the rate of seniors with drug benefit coverage.[24]

Perhaps the most important finding by Cox and Henderson is the apparent link between Medicare prescription drug benefit maximums and the use of prescription drug samples as a means to mitigate out-of-pocket expenditures. This practice is potentially self-defeating since (a) higher-cost drugs are more heavily sampled and (b) the availability of drug samples may affect physician prescribing practices and reduce the pressure to find lower-cost therapeutic alternatives. Other investigators may ask Medicare+Choice beneficiaries with drug benefit limits the important questions regarding the nature and usefulness of interactions with physicians in offering recommendations for generic drugs and other lower-cost therapeutic alternatives to help reduce out-of-pocket expenditures.

Crossing the Quality Chasm—Pharmacist Prescribing, Nontraditional Interventions, and Outcomes-based Pharmacist Reimbursement (OBPR)

Since 1996, pharmacists in Indiana have had the authority to manage the drug therapy of hospital patients, including prescribing drugs, when conducted via a protocol established with a physician and a hospital.[28] In California, AB 826 was enacted late in 2001 and became effective January 1, 2002. AB 826 included 2 key changes in California law: (1) pharmacists may perform clinical functions outside of a pharmacy or other licensed health facility (e.g., the patient's home, physician's office, or medical office building) and (2) pharmacists may select initial drug therapy. Prior law only allowed adjustment of drug therapy (e.g., dose) in outpatient settings. Pharmacist prescriptive authority is permitted only under appropriate protocols, and the pharmacist must notify the prescriber within 24 hours of initiating a drug regimen under this new authority.[29]

By 2002, 33 states granted prescriptive authority to pharmacists,[30] typically permitting pharmacists to work collaboratively with physicians to adjust drug therapy under protocol.[31] The collaborative practice agreement with a physician(s) may specify authority for the pharmacist to adjust the dose of prescribed drugs, or in many situations, select initial drug therapy as well. In 1999, Minnesota pharmacists could establish collaborative practice agreements with physicians allowing pharmacists to adjust drug therapy and administer the first dose in an emergency. The amendments to the pharmacy practice act also recognized the pharmacist's role in counseling, monitoring, and drug research.[32] In 2002, Maryland HB781 allowed a licensed physician and a licensed pharmacist to enter into a drug therapy management contract.[33] As defined in the Maryland bill, the contract is a voluntary written arrangement that is disease-state-specific and applies to one pharmacist, one physician, and one patient receiving care from the physician and pharmacist. Connecticut SB528, also enacted in 2002, allowed one or more licensed pharmacists employed by a hospital to enter into a written protocol-based collaborative drug therapy management agreement with one or more physicians to manage the drug therapy of individual patients receiving inpatient services in a hospital.[34]

The need for collaborative work among physicians and pharmacists to reduce medication errors is well-recognized in health systems devoted to quality improvement principles. These organizations are more likely to spawn solutions that recognize the strengths of pharmacists in knowledge of drug dosing and even drug selection. At the University of Wisconsin Hospitals and Clinics, pharmacists have (veto) authority over the prescribing of physicians, most of whom on the house staff are interns and residents. A trial program begun in the trauma unit in 1996 was expanded to a hospital-wide program in 2002, first for all anti-infective orders and later for other therapeutic categories.[35] Pharmacist oversight of drug orders at the University of Wisconsin Hospitals and Clinics is directed by the hospital's pharmacy and therapeutics committee and will be supplemented in the future by information technology, a computerized physician order entry system.

Recent reports of prescriptive authority for pharmacists and clinical pharmacy interventions in nontraditional roles include a telephone clinic and protocol for eradication of *Helicobacter pylori* infection. The intervention was associated with favorable outcomes: (a) 100% patient compliance with HP eradication therapy, (b) symptom improvement in 33% of patients (but many patients were either asymptomatic or mildly symptomatic before initiating HP eradication therapy), (c) no drug-drug or drug-food interactions, (d) no reinitiation of acid-suppressive therapy at one-month post-treatment, (e) creation of a learning environment for doctor of pharmacy clerkship students in defining a new role for pharmacists in ambulatory care, and (f) pharmacy collaboration with the departments of surgery, medicine, and nursing.[36]

The entire process of quality improvement in health care is based upon *incremental change*. While the Leapfrog Group encourages us to think of dramatic, fundamental change, the reality is less cataclysmic. As with most industrial and engineering processes, improving the tools improves the quality of the product but only with changes in processes by which the

tools are used. In drug therapy management, we need the operators (pharmacists) of the tools to embrace clinical practice guidelines and the principles of continuous quality improvement. Compensating pharmacists at the lowest possible price does not foster this attention and commitment.

Farris, Kumbera, Halterman, and Fang in this issue of the *Journal*, describe a proprietary program developed around the concept of compensating pharmacists based upon measurable patient outcomes.[37] This is the holy grail of managed care pharmacy, compensation for clinical pharmacists based upon valued outcomes.

Statistical Significance Versus Practical Significance

Researchers know the value of sample size in demonstrating statistical significance between groups. Small sample size requires a large absolute difference between groups to demonstrate statistical significance. For example, the data used to obtain FDA approval of pravastatin for the indication of stroke involved a study of 9,014 patients with a history of myocardial infarction or unstable angina and total cholesterol levels of 155 to 271 mg per deciliter. The study found that the risk of stroke was 3.7% among patients given pravastatin versus 4.5% among patients given placebo over a follow-up period of 6 years, an absolute difference of 0.8% and relative risk reduction for stroke of 19%.[38]

Subsequent scrutiny of the study findings and the literature citations identified flaws. Of the 4 studies cited by the authors to support the reported reductions of 25% to 30% in the rate of stroke, the West of Scotland trial showed no reduction in the rate of stroke—the risk after 5 years of follow-up was reported as 1.6 percent for both the pravastatin and placebo groups (P=0.57), and a second cited study (the Air Force-Texas Coronary Atherosclerosis Prevention Study, or AFCAPS/ TexCAPS) did not list stroke as an individual end point. More to the point here, the 0.05 statistical difference reported by the authors using univariate analysis for pravastatin versus placebo was actually 0.10 upon application of multivariate analysis, arguably the more appropriate measure.[39] Aside from the statistical debate, in which a small absolute difference may or may not be statistically "significant," there is the very important matter of *practical significance*. The study results suggested that it would require 750 patients to be treated for one year to prevent one nonfatal stroke, or more than $750,000 in discounted drug cost, an unfavorable cost-effectiveness outcome and a very unfavorable cost outcome, compared to the risk reduction possible with aspirin.[40] Previous research and a meta-analysis of clinical studies found no association between cholesterol levels and risk of stroke.

In this issue of the *Journal*, Arocho, Solis, Wade, Goldberg, and Tang discuss the very important subject of underlying characteristics of groups that might explain differences in the dependent measure found in study results.[41] But within their analysis is the ever-present matter of practical versus statistical significance. As part of their findings of underlying differences among calcium channel blocker patients, they report 86% of amlodipine users had at least one professional service, compared to 84% of felodipine users (P<0.05), in a study involving 17,667 patients. They also report a statistically significant (P=0.0007) difference between average daily dose, 5.8 mg for amlodipine patients versus 5.93 mg for felodipine patients. They report average age but not median age and do not address the fact that 39.2% of amlodipine patients in their study were less than age 70 versus 33.9% of felodipine patients less than age 70. Readers should note that this study was funded by the manufacturer of amlodipine. Managed care pharmacists would be interested in the formulary status of these two drugs at the time that the drug and medical claims were incurred in the health plans employed in the study, a fact not disclosed by the authors. Nevertheless, the authors are correct in highlighting the importance of managed care pharmacists investigating the underlying differences in patient populations, particularly in drug-to-drug comparisons.

Prevalence and Costs of Atopic Dermatitis

Atopic dermatitis (AD), or eczema, is a chronic, relapsing inflammatory skin disease affecting about 10% of the Western population, with a prevalence estimate of 4% to 20%.[42] The high range of the prevalence estimate is in children, and 80% to 90% of AD cases are diagnosed by age 5.[43] The disease is physically distressing to the patient and often has an adverse effect on the quality of life.[44] Fivenson, Arnold, Kaniecki, Cohen, Frech, and Finlay, in this issue of the *Journal,* provide estimates of some of the direct and indirect costs of AD among patients identified in one health plan, expressed in 1997 dollars.[45] Readers might note that about two thirds of the patients were cared for only by a dermatologist, suggesting that these patients were the more severe cases of AD in that population. Combined with the small prevalence, approximately 1.3% of plan members, the data suggest that this patient population is more representative of the moderate-to-severe population of AD patients. Yet, only 3 patients were rated as "severe" by provider-assessment. Nearly two thirds of the patients in this cohort were younger than 16 years, and 19.5% were younger than 4 years. There was one inpatient visit and no emergency room visits among 3,576 patient-months in the study. The only inpatient visit occurred in a patient with a "mild" case of AD, according to provider-assessed severity.

Bias Management—The Path to Better Evidence

In this issue and on the *Journal* Web site (www.amcp.org) is a copy of the editorial policy, disclosure statement, and attestation required of all authors of articles published in *JMCP*, effective with the January/February 2002 issue. The detail is designed to obtain all disclosures necessary to permit readers to evaluate potential biases that may affect the objectives of the research, interpretation of data, conclusions, or other findings and to attribute to each listed author the specific contribution to the article.

Frederic R. Curtiss, *PhD, RPh, CEBS, Editor-in-Chief*

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Editor's Note:
Mark McCoy, PharmD, MBA, Associate Director, Health Outcomes, Pharmacia Corporation, Peapack, New Jersey, was coauthor of the article "Relationship of Clinical Factors to the Use of Cox-2 Selective NSAIDs Within an Arthritis Population in a Large HMO" that appeared in the July/August 2002 issue of *JMCP*.