



*“The time will never be better for pharmacists to establish systems that further the rational and safe use of medication. There will never be a better time to implement what we have been advocating for the past 30 years.”*

=====**Neil M. Davis**=====

*(2000)*

*At the time he received this award, Neil M. Davis was editor-in-chief of Hospital Pharmacy and Professor Emeritus of Temple University School of Pharmacy, Philadelphia, PA. He was formerly director of pharmacy service at Temple University Hospital and Thomas Jefferson University Hospital.*

## **Initiatives for Reducing Medication Errors: The Time Is Now**

**I**t has been a long time coming, but finally the nation has awakened to what we as health-system pharmacists have long known: that there is a serious problem with medication errors and that action must be taken to reduce the problem.

In 1961, Barker and McConnell<sup>1</sup> conducted a study in a hospital showing that one out of every six doses of medication was given in error. This study was picked up as a cover story by *Look* magazine, the *People* of the 1960s.<sup>2</sup> As a result, many practicing pharmacists and ASHP began to focus more attention on medication errors. Federal grants were awarded to study unit dose dispensing and medication errors. With this

grant money, Barker, Heller, Tester, and Black published studies that led the way to the development of unit dose dispensing and pharmacy i.v. admixture programs, the value of which for error reduction was reinforced by publications by Hynniman, Schultz, Schneider, Guernsey, Flynn, Schnell, Shannon, Kuyper, Cohen, and others. Pharmacists were the first health care professionals to be interested in this issue. There was no real interest in the medication error problem by physicians, their professional organizations, or their journals. Nursing organizations in the 1960s and 1970s seemed satisfied to advocate the weeding out or retraining of nurses who made errors.

In the 1980s and 1990s, things started to happen that brought the medication error issue and the broader problem of medical errors to the forefront. Barker and his associates published additional science-based medication error studies. A national medication error-reporting program was begun by the Institute for Safe Medication Practices. The roots of this reporting program extended back to March 1975, when the first installment in the monthly feature “Medication Error Report Analysis,” by Michael Cohen, appeared in *Hospital Pharmacy*. More and more time was devoted to the subject of medication errors at ASHP meetings and by the ASHP Board of Directors. Newspapers started to run accounts of fatal medication errors. Investigative reporters published series of articles about medication errors. The national television news magazines *Dateline NBC*, *60 Minutes*, and *20/20* did features on the subject. Serious medication errors at Boston’s Dana Farber Cancer Institute were pivotal events.

As soon as dollar figures and unnecessary-death figures are assigned to a problem, you get everyone’s attention. This occurred when research findings concerning projected dollar costs and human lives lost were applied to medical and medication errors and published in major medical journals. Johnson and Bootman<sup>3</sup> reported in the *Archives of Internal Medicine* that the cost of adverse drug events in the ambulatory care setting was \$76 billion annually. Physician-authored studies on errors were published in medical journals and projected that 45,000–98,000 people die in hospitals each year as a result of errors.<sup>4–6</sup> An article in *The Lancet* estimated that, among the ambulatory care and inpatient populations, medication errors result in 7000 deaths annually.<sup>7</sup> The National Academy of Sciences commissioned the Institute of Medicine to study the problem, which led to 1999’s landmark report, “To Err Is Human: Building a Safer Health System.”<sup>8</sup>

Awareness of the problem started with Kenneth Barker in 1961. Today, physicians, the President, Congress, many state legislative bodies, Fortune 500 companies, and the public have gotten involved. We have the opportunity, now that the nation’s spotlight is on medical errors, to do some of the things pharmacists have been advocating for the past 40 years. I will discuss three areas: bar coding of pharmaceutical dosage forms, computer order entry by physicians, and pharmacists’ clinical activities.

## Bar coding

Bar coding (i.e., linear bar codes, two-dimensional bar codes, and other machine-readable codes) was discussed as a useful tool in medication error prevention in a 1985 article.<sup>9</sup> Nold and Williams<sup>10</sup> discussed the subject in detail and noted that the first patent on bar-code symbology was issued 51 years ago. Twenty-seven years ago,

the U.S. Supermarket Ad Hoc Committee on Universal Product Coding formulated an industrial standard for bar coding, the Universal Product Code Standard. You see the results of this endeavor every time you go through the checkout line in the supermarket.

Bar-code scanners are faster than the human eye and more accurate, making less than one error per million scans. These devices do not become fatigued or distracted. Those who are not health care professionals may be surprised to learn that bar-code technology is not widely used in health care facilities. Why are we not using this technology to reduce errors and increase productivity? Where have pharmacists been on this issue? Our professional organizations? Group purchasing organizations? USP, FDA, Congress? Where have the public interest groups been? The pharmacy journals and investigative reporters? Why have they all not fought harder during the past 20 years to ensure that this technology is used for the public good?

There is some potentially good news. The National Coordinating Council for Medication Error Reporting and Prevention, a multidisciplinary group, is holding a two-day invitational meeting in August 2000 in an effort to develop a white paper on bar coding. I do not want to lend the impression that bar coding of pharmaceutical products by the industry is a simple task. To this date, there is no agreement on pharmaceutical standards for the bar-code format, content, or symbology, although "system 128" is now in use. Should a bar code identify only the product, or should it also identify the lot number and expiration date? Once a standard is definitely decided upon, it will cost the pharmaceutical industry for label design, regulatory submissions, testing, production line changes, and in some cases an increase in package and container size.

There may be incentives for manufacturers to introduce bar coding where there is competition for sales, such as with generic products and large-volume injections. Even though there may be a competitive advantage in being first to offer bar-coded large-volume injections and i.v. additives, there is no enthusiasm for bar coding in the industry. Most members of the Pharmaceutical Research and Manufacturers of America see minimal demand for bar-coded products from customers, group purchasing organizations, and professional organizations.

Nevertheless, bar-coded pharmaceutical products are an essential component of medication error prevention and documentation. Without this enhancement, we cannot move forward with our many plans for quality assurance and automation. If bar-coded products were generally available, the move to adopt advanced medication error prevention systems would be dramatically facilitated. The availability of bar-coded products would also open the door to better utilization of pharmacy technicians and its corollary, more time for pharmacists to devote to clinical activities. Bar-code readers will soon be integrated into home computers, expanding the potential usefulness of bar coding of pharmaceuticals.

For reasons of safety, quality, and cost, it is the pharmaceutical industry that must bar code pharmaceuticals, not individual health care facilities or contract packagers. Only the pharmaceutical manufacturers have the good manufacturing practices in place to guarantee consistent accuracy of the bar codes. We have not been successful

in moving the pharmaceutical industry toward providing this needed feature. We must dramatically step up our efforts to speed the process of establishing standards and mandating the universal use of bar codes. When bar-coded products are made available, we must buy them.

I recommend that, for safety reasons, Congress or FDA mandate the bar coding of all pharmaceutical products. It might take as long as one year to establish bar-code standards for format, content, and symbology and two to three years for the entire pharmaceutical industry to test and implement these standards.

## **Physician computer order entry**

The first hospital in the United States was opened in Philadelphia in 1752. At that hospital, physicians indicated which drugs, diagnostic tests, diets, and nursing care they wanted for their patients by writing orders by hand in a medical record. Quills and blotters have been replaced by ballpoint pens over the past 250 years, but orders are still written by hand. Everyone knows that such orders are a major problem that at best leads to delays in starting therapy and at worst causes error. One study found that 17% of physicians had completely illegible handwriting and that another 17% had only poor to fair handwriting.<sup>11</sup> Illegible handwriting increases the time needed to train personnel, wastes the time of those who must decipher what was written, and makes it difficult and sometimes impossible, at a future date, to ascertain what happened to patients during their hospitalization.

With hand-written drug orders, it often takes two to eight hours from the time a physician writes an order to the time it arrives in the pharmacy—assuming it gets there at all. However, when a physician enters an order into the computer, it is instantaneously transmitted to the pharmacy, the radiology department, the laboratory. Decreasing the response time for orders can reduce suffering and morbidity and can shorten the time a patient stays in the hospital. It can prevent tens of millions of telephone calls each year from nursing to pharmacy asking why a patient's medications have not been delivered. It can even save lives.

The computer can be used to alert the prescriber to allergies, drug–drug interactions, drug–laboratory test interactions, unwanted duplicative therapy, overdoses, underdoses, contraindications, drugs of choice, and incorrect routes of administration. Computer order entry helps capture patient charges. Legible orders enable administration to document charges more easily. The problem of lost medical records is at least partially solved.

In the early 1980s, some physician computer order-entry systems were in use. At the 1000-bed Medical College of Virginia Hospitals in Richmond, it was reported that, of the 2500 orders received per day in the pharmacy, 98% were generated by physicians through computer terminals.<sup>12</sup> I would call this a very successful installation. Given all the advantages, why has it taken so long for physician order entry to take hold in hospitals? The energies of the government, the media, industry, and the health care professions should be marshaled to ensure that the development and installation of these systems increase dramatically.

For a long time, physicians did not actively support physician order-entry systems.

Although many were aware of the problems caused by hand-written documents, they did not want to change their comfortable and familiar way of writing orders. Also, years ago many physicians had no experience with computers and resisted using them. Physicians did not want to expose their lack of computer skills in a training session. Also, they reasoned, why should they do what they considered someone else's work? What was in it for them?

These objections have partially faded as more physicians have become computer literate. They now realize that there is something "in it for them." With a computer system, they can quickly locate their patients. They can enter orders from their offices and other remote areas. They can develop common order sets, which will save them time and ensure that orders are complete. There will be a list of active orders, which is much easier to use than a 100-page paper medical record. There will be fewer calls from pharmacists and nurses asking for clarification. Orders will be acted upon more promptly, possibly providing better outcomes. Patients will be less likely to complain that Physician Jones told them on his visit at 8 a.m. that he was going to start them on a new medication and here it is 3 p.m. and they have not received it. These same patients know that they can pick up their bedside phone in Philadelphia at 7 p.m. and order a computer from the state of Washington, 3000 miles away, and it can be delivered to their hospital bed by 11 a.m. the following morning.

Another issue has been that some physician computer order-entry systems offer no seamless connection with existing hospital pharmacy systems, thus creating a dual system. This can create many error-producing problems.

Implementing a physician computer order-entry program is by no means easy. It requires careful selection of a vendor, a tremendous amount of multidisciplinary planning, and a large outlay of capital. There must be a thorough analysis of how orders are currently entered, who enters them, when they are entered, and how they are transcribed, routed, fulfilled, and documented. The physician system must be integrated with the pharmacy, laboratory, radiology, admissions office, medical records, and business office computer systems. Security of data and patient privacy needs are prime considerations. Here is a list of some of the specific challenges that must be met:

- ▶ Address the need for a common medical record number for inpatients and outpatients.
- ▶ Provide a continuum of preventive care, hospital care, clinic care, home care, and hospice care.
- ▶ Decrease duplicative tasks.
- ▶ Choose a system that encourages physicians to use the system and that is physician friendly.
- ▶ Select physicians for the planning committee who are respected by other physicians and who are actively involved in writing orders.
- ▶ Learn from others through site visits and by hiring knowledgeable consultants.

- ▶ Determine which drug allergies and drug–drug interactions are significant enough to be presented to physicians electronically. (Overloading physicians with clinically insignificant alerts could result in their ignoring alerts.)
- ▶ Thoroughly test the system before it is introduced.
- ▶ Plan for turnover of key staff members involved in the project.
- ▶ Establish a constant (controlled) vocabulary.
- ▶ Establish cross-departmental consistency in pathways to make the system easier for users.
- ▶ Prepare for planned and unplanned downtime.
- ▶ Realize that, although a paperless system may be the long-range goal, initially more paper will be generated, necessitating more high-speed printers and paper shredders.
- ▶ Plan for or install wireless terminals.
- ▶ Learn how and why there are variations in the timing of supposedly standard dosage schedules on many specialty nursing units. Try to standardize where possible but realize that there are legitimate differences that must be addressed.
- ▶ Recognize and plan for implied orders, which are carried out but never written.
- ▶ Recognize and plan for at least three types of orders: new orders, modified existing orders, and discontinued orders. These orders can be one-time orders, continuous orders, as-needed orders, or orders for a future time.
- ▶ Realize that order set development requires up-front and continuous involvement from pharmacy and nursing.
- ▶ Ascertain, when developing order sets, how they are going to be updated when drug brands are changed.
- ▶ Realize that, with manual systems, nurses and pharmacists “clean up” orders when they are transcribed. The ball game is different with physician order-entry systems, since incomplete orders must be discontinued and new orders entered.
- ▶ Realize that, for the first time, the exact time when an order was entered will be known.
- ▶ Recognize that human error will continue to exist with a computer system and that there will still be a need for pharmacists to review physicians’ orders.
- ▶ Realize that, as with all new activities, there is a learning curve with

a computer system. People will get faster, but in the beginning it will be slow.

- ▶ Avoid asking physicians for information that is retrievable elsewhere in the computer or that is not necessary.
- ▶ Make sure that everyone is adequately trained, and have expert users available 24 hours a day on nursing units when the system is introduced.
- ▶ Avoid overusing the system to enforce policy, as this will offend physicians. The computer should not be used as a policeman.
- ▶ Require strong and continuous administrative support.
- ▶ Address questions about patient privacy and access to medical records that may be raised by the system.

Many hospitals are in financial trouble. How will they pay for these expensive computer systems? The promise of reduced costs in the future as a result of physician order-entry systems will not help today. I recommend that Medicare and other third-party payers provide incentive reimbursement to hospitals that can show that 90% of their drug orders are directly entered by physicians via the computer before the orders are carried out. After three years, if the third-party payers can show that costs have been reduced, these dollar incentives could be adjusted.

## **Pharmacists' clinical practice contributions**

After studying the Institute of Medicine's *To Err Is Human*,<sup>8</sup> a first suggestion for improving the situation might be that there should be a person who has expert knowledge about drugs and drug therapy to review the entire drug selection and monitoring aspects of patient care. In a world where there were no such people as pharmacists, they would have to be invented. Perhaps, on that planet, they would be called medicationists. Well, our world does have drug experts. They are called pharmacists, so there is no need to create a new professional to fill that void.

In the past, more pharmacists should have been providing clinical services, more documentation should have been provided showing the costs and lives saved by pharmacists' prevention of medical error, and such documentation should have been published in the medical literature. Currently receiving much favorable press is a study showing that pharmacists' presence on an intensive care unit reduced the potential for adverse drug events by 66%. The authors concluded that "participation of a pharmacist on medical rounds can be a powerful means of decreasing the risk of adverse drug events."<sup>13</sup> An earlier study estimated that each preventable adverse drug event cost \$4685.<sup>14</sup>

With the increased clinical education being received by pharmacy students, pharmacists as a group are acquiring the knowledge required for meaningful involvement in clinical practice. The time needed for clinical activities can be gained from better utilization of pharmacy technicians, bar coding of pharmaceutical products, automa-

tion, and a well-designed, fully integrated physician order-entry system. For some facilities, all of this will still not be enough to substantially reduce the error problem, and more pharmacists will have to be hired. Institutions will have to attract and retain pharmacists by providing competitive salaries and good working conditions. Junior high school and high school students must be exposed to the benefits of pharmacy as a career choice to ensure that there is an adequate pool of bright and motivated students.

## **Conclusion**

What happened to health care that led to an unacceptable level of medication-related problems? First, health care professionals' knowledge about drugs did not keep up with the proliferation of new products. Insufficient knowledge causes professionals to make errors. Second, drug therapy became more intensive. Third, medication-use systems became more cumbersome. Pharmacists, whose job it is to make sure that drugs are used rationally and safely, increasingly found illegible or incomplete orders and the prescribing of overdoses, underdoses, wrong routes of administration, and drugs that were inappropriate or downright dangerous for any of a host of reasons. When they discovered these problems, they contacted physicians so that corrective action or clarification could occur.

What pharmacists have not done sufficiently is document and publicize these clinical activities in the medical literature. In a way this is quite understandable. Publishing studies of colleagues' imperfections would seem not to be politically correct since (1) we must work with these colleagues on a daily basis and (2) pharmacists also make errors. Another problem is that documentation takes time—time that, shortsightedly, pharmacists did not perceive they had.

With a physician order-entry system, many of the drug-related problems routinely discovered by pharmacists could automatically be called to the attention of the prescriber at the order-entry point. Pharmacists should not fear that their knowledge base will be circumvented and surpassed by computers, since history tells us that today's problems will be replaced by different problems and that there will always be a need for knowledgeable professionals who are up-to-date.

The time will never be better for pharmacists to establish systems that further the rational and safe use of medication. There will never be a better time to implement what we have been advocating for the past 30 years. Never before have physicians, nurses, the media, the government, and the public been so well informed and so supportive. Let us actively fight for bar coding, physician computer order entry, pharmacists' clinical involvement, and all the other things that are needed to reduce medication errors.

## **Acknowledgments**

I am honored to receive this award. Thank you. For 40 years, I have sat where you are sitting and watched the bestowal of the Harvey A. K. Whitney Lecture Award. The contributions of these past recipients make me very proud to be counted as one of them.

I could not have accomplished what I have without the help of my colleagues and my family. I owe my start in pharmacy to my mentor, Herb Flack, director of the master's degree and residency programs at the Philadelphia College of Pharmacy and Thomas Jefferson University Hospital. When I was director of pharmacy services at Thomas Jefferson, my assistant director was Charles King. I was also fortunate to have Joe E. Smith as an assistant.

When I went to Temple University Hospital as director of pharmacy services, I found myself surrounded by intelligent, forward-thinking, hard-working associates, including Harry Berkowitz, Terry Owens, and Fred Sprissler. Two associates and friends I have worked with for over 30 years and to whom I owe much are Salvatore Turco and Michael Cohen. Many of you in the audience and others who are not here have also helped me in my career. Examples are Billy Woodward, Bill Smith, Andy Anderson, and Don Rucker. It further gives me pleasure to acknowledge my managing editor and administrative assistant, Evelyn Canizares, for all her help.

I must publicly thank my family for its support and patience. There is a connection between my son and the American Society of Health-System Pharmacists. About 26 years ago, my wife, Julie, and I took Matthew, who was eight years old at the time, to an ASHP convention in Anaheim, California. I thought it would be good for him to attend the Harvey A. K. Whitney Lecture Award ceremony so that he could see how a career of hard work can be rewarded. This eight-year-old enjoyed the reception, picked at dinner, and started to squirm during the introductory presentations. It was obvious that he would not sit still through the award lecture, so Julie took him back to the hotel room. On the way back, Matt asked his mom, "Does Dad really enjoy this stuff?"

There is also an ASHP connection with my daughter. Twenty-eight years ago, when Robin was 10, I was invited to be a faculty member on an ASHP-sponsored international study tour to Greece and Yugoslavia. During that trip, Robin became friendly with Sister Gonzales, the first nun she had ever met. The history and culture to which Robin was exposed and the warmth of Sister Gonzales made a lifelong impression on Robin. I would like to introduce Matthew; his fiancée, Annette; Robin; her husband, Steve Miller; and two of my three grandchildren, Melissa and Benjamin (Hayley, who is 20 months old, would have enjoyed being here but would not have been able to contain herself).

Lastly, I would like to thank my wife for her patience, wisdom, support, encouragement, and love. Julie has been by my side—or, some may say, ahead of me—for the past 41 years. Today is a doubly special day for Julie and me, as it is our 41st wedding anniversary.

---

---

(For the complete list of references cited, please see page 1492 of the *American Journal of Health-System Pharmacy*, Aug. 15, 2000.)

*Harvey A. K. Whitney Award Lectures (1950–2005)*

© 2006, ASHP Research and Education Foundation. All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, microfilming, and recording, or by any information storage and retrieval system, without written permission from the American Society of Health-System Pharmacists Research and Education Foundation.

[www.ashpfoundation.org](http://www.ashpfoundation.org)