CPOE, bedside technology, and patient safety: A roundtable discussion

Am J Health-Syst Pharm. 2003; 60:1219-28

Neuenschwander: Let me tell you how this roundtable discussion came about. I had a number of conversations with pharmacists at the June meeting about computerized prescriber order entry (CPOE). It occurred to me that, with Leapfrog pressing so hard for CPOE, hospitals are almost feeling guilty or embarrassed for not having CPOE or not being ready to have it. And yet when I would talk to pharmacists, I began to hear a common theme: We all believe that CPOE is important, but it is far more complicated than we expected.

The medication-use process begins with prescribing, then pharmacy review, then dispensing and distribution, and ends with the actual medication administration and charting. Among these steps, I believe that the middle one—dispensing and distribution—has the most mature technologies. Overall, I think the technological applications in the medication-use process are still in their adolescence. They're gangly, and they look more mature than they are. The limits are not so much with the mechanical technologies themselves as with the human interface with the technologies. Do people know how to use these things really well? We are learning that sometimes you should automate, sometimes you should not. Manual systems are sometimes better.

It seems to me that the next mature category is bedside technology (i.e., drug administration and documentation). The least mature and developed is CPOE. In addition, CPOE is more complex than bedside at the point of care. That is saying a lot because bedside technology is very complex. CPOE may seem a simple problem at first, because people understand the issues of doctors' handwriting, transcription errors, hard-to-read orders, etc. Now we know that handwriting is only one small part of physician order entry. It appeared to me that Leapfrog had imagined that physician order entry was further along and simpler to employ.

VanEeckhout: I agree. Leapfrog seemed to think that one could buy CPOE in a shrink-wrapped box, plug it in, and make it work.

Rough: The evidence supporting the push for CPOE has been generated primarily from two organizations that developed and implemented home-built CPOE systems. They are Brigham and Women's Hospital in Boston, Massachusetts, and the Latter-Day Saints Hospital in Salt Lake City, Utah. To my knowledge there are no published data available on the impact of a commercially available CPOE system on patient safety.

Neuenschwander: I heard a presentation by Vanderbilt. They said it took them six years and $6 million to implement the CPOE system, and they talked about the complexities of the whole process. The cost of purchasing the technology was about one fourth of the costs of implementation and utilization.

However, in my opinion, bedside-scanning technology is ready to roll. Perhaps it's not perfectly ready, but it is more ready than CPOE. One thing that has held up bedside scanning is that we haven't had the bar codes on the medication packaging, so there was no incentive for hospitals to carry out automation at bedside. Now FDA's position on bar coding may just be a tipping point. In the marketplace, vendors and many users are taking notice. That's going to make the difference. Now the vendors are

Proceedings of a roundtable discussion held on December 10, 2002, during the ASHP Midyear Clinical Meeting, Atlanta, GA. Participating in the discussion were Mark Neuenschwander, President, The Neuenschwander Company, Bellevue, WA; Steven S. Rough, M.S., Director of Pharmacy, University of Wisconsin Hospital and Clinics, Madison; Shabir M. Somani, Director of Pharmacy Services, University of Washington Academic Medical Center, Seattle, and Associate Professor and Vice-Chair, Department of Pharmacy, University of Washington, Seattle; John VanEeckhout, Pharm.D., Vice President, Clinical Services, Child Health Corporation of America, Shawnee Mission, KS; and Billy W. Woodward, Executive Director, Department of Pharmacy, Scott & White Health System, Temple, TX.

The views presented here are those of the participants and do not necessarily represent those of their affiliated organizations.

rushing to take advantage of the pending FDA ruling.

Somani: I think there is going to be a bigger rush because the barriers to bedside technology are much lower than those for CPOE. Bar coding is more confined than CPOE, since the latter poses more organization-wide challenges.

Rough: I don't blame the Institute of Medicine (IOM) report for making stronger recommendation for CPOE than for bedside scanning, because when the report came out, commercially available CPOE systems were as or more sophisticated than point-of-care systems. There were no commercially available point-of-care medication-scanning systems in November 1999. Furthermore, literature supporting the safety benefits of bedside scanning was not available at that time.

Neuenschwander: It's a given that we would like to apply automation accurately, skillfully, and efficiently. However, I have a number of questions. Is it expedient to automate all the steps in the medication-use process? If so, what about priorities? Can you automate all at once? If you cannot do it all at once, which would you do first? I believe pharmacists' voices must be heard on these issues rather than everyone relying on the advice of Leapfrog. Interestingly, many hospitals are being pressured to implement CPOE.

Somani: I think some people in pharmacy favored CPOE by looking at what it was going to do for us rather than looking at what it was going to do for patients. Fortunately, we're starting to change our thinking.

Neuenschwander: I would also like to hear your perspective on what CPOE will do to the role of the pharmacist. I have neighbors who are fine physicians and surgeons and bright people, and one of them said to me recently, "Why do we need a pharmacist?" It was a sincere question; it wasn't an arrogant question. He wondered, if the physician can enter the order into the computer, can't the computer sort all of that information out? It's a thought that perhaps we could discuss later.

CPOE selection and implementation

Somani: We signed with a commercial vendor for a CPOE system in July 2002. We are currently in the design phase and anticipate putting in a new pharmacy computer system in May 2003. Next fall, we'll phase in the implementation of CPOE. It will be a two- to three-year implementation phase for the three institutions we have. We currently have Pyxis Rx on the units with patients' profiles at all institutions. We have also used Pyxis for the past five to six years.

Neuenschwander: Are most of the medications pulled from automated medication cabinets?

Somani: Yes, except for compounded and high-risk medications. We currently do not have bedside bar-code technology but are looking into systems that can meet our needs. A big challenge we may face is implementation exhaustion.

Rough: We are planning a pilot implementation of CPOE in May 2003, but this date may be changed. Our Information Systems (IS) department unilaterally selected the vendor. There was no involvement of any clinical department in the decision. There is one physician in the IS department. The choice was primarily based on costs and current contracts. We have this vendor's infrastructure throughout the hospital, so it seemed to be the logical choice. To integrate systems from any other vendor within three years would have been next to impossible.

Neuenschwander: Just for clarification, was the demand for CPOE driven by the Board, the CEO, or IS?

Rough: We have been talking about it for years. Both CPOE and bar coding were on the pharmacy department's strategic plan since early 1990s. Pharmacy supported the effort, but could not by itself influence any particular movement; it was more the CEO telling IS that a system would be implemented. It wasn't a matter of what we were going to do but when we were going to do it. The timeframe was set by our CEO and CIO. So we're planning a pilot phase soon, to be followed by a two-way interface with our pharmacy software.

It seems that we have implemented almost every patient safety technology one can think of. Our pharmacy computer system interfaces with all of our automated systems, including robotics—we were the second hospital in the country to have the McKesson RobotRx in 1993. We use the robot for filling all scheduled medication doses, about 50% of all inpatient doses dispensed. We have AcuDose RX automated dispensing cabinets, also from McKesson. We've had those for three years on all inpatient units for storing primarily narcotics and as-needed medications. All first doses are filled with the first-dose manual dispensing process.

We're licensed for over 450 beds. Our average daily census is about 360. We also have a product called Narcstation from McKesson, an automated dispensing and inventory tracking system for narcotics in the central pharmacy. We also have bulk packaging technology from McKesson. We use that to put bar codes on about 1000 unit doses per hour. All of these automated dispensing systems use the same software package and interface with our pharmacy software. We only have to maintain one database of drug product information in addition to the pharmacy software, which makes maintenance easier.

In December 2001, we started pilot testing the bedside-scanning technology with AcuScan, now called Admin-Rx. It has been very successful. The bedside point-of-care medication scanning and hand-held wireless technology are live on 19 of our 26 inpatient units. The trauma-and-life-

support unit and the pediatric units will be the last to implement these technologies in summer 2003. We administer close to 10,000 doses per day, and 75% of these are administered via our Admin-Rx system.

Woodward: We have Pyxis cabinets in all the units throughout the primary medicine units. We were one of the first to use Pyxis in the Southwest. We now have the Pyxis profiles system. We use an automated retrieval system, which uses PIC to light. We cover most as-needed and controlled drugs with Pyxis machines and fill cassettes for scheduled doses. The good thing about the system is that it times and prioritizes the orders.

We have a little more than 500 licensed beds, but we operate at a capacity of about 380. Both CPOE and bar coding were in the strategic plan long before the IOM report. Of course, nobody really paid much attention to these goals until the IOM report. However, the enthusiasm for prioritizing CPOE over bar-code scanning has recently faded, even among physicians. At our institution, CPOE is no longer our highest technological priority, and bar-code scanning at the bedside has become first priority.

We're experiencing some of the same things as Steve said. We have McKesson Horizon Meds Manager software, which is a Windows-based product that performs a lot of clinical functions. Because we mostly have Siemens systems, I'm under a lot of pressure, because of the need for bar-code scanning and CPOE, to change my whole pharmacy IS system, which is very disturbing.

I sense that people around the country are getting the same type of corporate pressure. We all went through the "best of breed" idea. Now IS departments are realizing the importance of integrating systems and having a common platform for all in-house systems. One doesn't want to head down the CPOE road alone because when you inevitably encounter problems, the finger will point at you for running a renegade system that is incompatible with the rest of the organization.

I still believe CPOE has to be our ultimate objective. However, I'd like to wait for the commercial products to mature a little more, and I'd also like to have a choice. I'm very concerned that we seem to be selecting CPOE systems without any due diligence, not because I'm against any particular system but because we are not asking the right tough questions. I am not even sure that we really know what those tough questions should be, because there aren't many CPOE-related studies in the literature. There is no widely accepted template that defines the essential elements of a good CPOE system. Consequently, we're seeing things all over the map in the name of CPOE. Although a lot of systems are being implemented around the country, we have not heard many success stories about CPOE. Everybody seems to be talking about how difficult it is to get these systems up and running.

Rough: Unfortunatley, I think pharmacy directors may have less say in what information technology systems—not from a management perspective but an IS perspective—are implemented in an organization, largely because of costs and system integration. You may not be able to afford the system that pharmacists, nurses, and physicians favor because of the prohibitive cost of revamping the whole infrastructure. From our experience, we did not fight the decision to choose Siemens to be our CPOE vendor, but we quickly organized a multidisciplinary team and developed core patient-safety principles as guidelines for the CPOE system. We took the guidelines to the pharmacy and therapeutics committee who endorsed the guidelines so that these core patient-safety criteria were deemed necessary by the medical staff to be programmed into the system before its implementation.

Neuenschwander: And the pharmacy department initiated that?

Rough: Absolutely. Our multidisciplinary medication-safety committee meets regularly. Last year, we developed best-practice criteria for CPOE from patient-safety perspectives. It is our way to have a say in the process by getting our medical staff involved in patient-safety guidelines.

Woodward: That's exactly what we collectively need to do. If we do not, IS, nonpharmacy personnel, and vendors are going to drive CPOE system selection and implementation. I'm not comfortable with that at all.

Neuenschwander: As an observer of technologies and a consultant, it is interesting to me how many decisions about automation in health care have been vendor driven, rather than vision based.

Woodward: It sets us up for failure or significant problems if, as a profession, we are not actively involved in critical design decisions. In that sense, bedside technology actually moves up the list. We are putting together an RFP right now. Again, Siemens is at the top of the list. We've conducted site visits, and what I have seen is fairly good. If we look at priorities in automation, I think dispensing devices are clearly within pharmacists' purview, bedside technology second, and CPOE a distant third. Further, you do not get many chances to fail. If you fail or have a bad experience, you almost have to outlive that. The turnaround time is at least three to five years before you regain the trust of hospital administrators and physicians.

Neuenschwander: That's a common theme I'm hearing from pharmacists. They say I have one chance in the short run, and I want to get it right. Interesting. John, you represent children's hospitals. What are your thoughts?

VanEeckhout: We are a business alliance representing 41 freestanding children's hospitals across the United States. Our own hospitals have im-

plemented several patient-safety technologies and continue to widen their application. Every hospital has a different level of technological sophistication. We have two hospitals that were relatively early adopters of robotic technology and bedside scanning. But for pediatrics, it's problematic to implement robotic and bedside scanning unless you have developed a strategy to standardize all doses. Even then, you're not going to get a huge percentage of those doses into the robot. We have several other hospitals that actually are using Bridge for bedside medication administration with an interface to their pharmacy systems. A few other hospitals have adopted CPOE first, and they are working through the process. Then we've got a number of people who are still waiting for the technology on the marketplace to mature further to meet their needs.

A number of products from different vendors, such as McKesson, Cerner, and a smattering of others, are used. Most facilities would prefer to have integrated systems because they believe that each interface becomes a potential failure point.

Our biggest challenge in bedside scanning and bar coding is the lack of standardized doses for pediatric patients since these doses are calculated on the basis of weight. It is enormously difficult to get the medical staff to agree to some sort of standardization.

Neuenschwander: The standards are internal to the organization?

VanEeckhout: Yes, each organization would need to create a list of doses that are standardized in conjuction with its medical staff committee. The standardization process would apply to drugs with wide therapeutic indices. Dose standardization is not an option for drugs that are very toxic or have narrow therapeutic indices. There are three ways to approach dose standardization. One is exact unit dose. This has caused a lot of problems because doses must be prepared exactly as written for every patient. If a nurse drops, for example, the syringes, the pharmacist has to prepare them again and send them back to the floor. An hour later, the doctor may change the dose, and the pharmacist will have to throw the original syringes away and prepare them again. This process has a high waste factor associated with it.

The second approach is to use unit of use. Unit of use is a standard unit dose cup or tablet as manufactured that probably contains a partial dose for a pediatric patient. The third approach is standardized dosing, in which medical staff must agree to some specific doses that will cover a therapeutically available range. That is most amenable to the bar coding and packaging processes with the robotic systems.

Neuenschwander: So in this standardization, the unit of use becomes the dose administered, correct?

Rough: That's critical. I believe that the Institute for Safe Medication Practices (ISMP) and ASHP surveys have pointed out that close to 40% of doses that come from hospital pharmacies in this country are not dispensed in the dose actually administered to the patient; nurses are manipulating those doses. It is a very common practice for pediatric pharmacies to dispense multidose products and expect nurses to give the appropriate amount. In such cases, bar-code scanning technology provides minimal safety benefit because grievous, wrong-dose errors may still occur. At our medical center, we dispense the exact unit dose for all scheduled medications except narcotics, which are stored in dispensing cabinets. Safe systems require extensive resources and are almost always expensive to maintain.

VanEeckhout: For controlled substances, we're basically using the unit of use because of the record-keeping issues. Because of the record issues you do force the wasting function for partial doses using a Pyxis or an Omnicell device, but it still begs the question: What does the patient really get?

Somani: We do have some bedside charting technology at our hospital. We have nurses charting and documentation using Eclipsys, but that system does not interface with the pharmacy's system.

Barriers to adopting CPOE

Neuenschwander: Obviously, it is easy to require physicians to use CPOE in the Department of Veterans Affairs or the Department of Defense. At the other end of the spectrum, some facilities' physicians just refuse to use it. My question is, if you adopt a CPOE system, what are the barriers to getting physicians to use it? Another question is, if you adopt a bedside scanning system, what are the barriers to getting nurses to use it?

Somani: I believe that CPOE will not completely eliminate errors. It takes longer for a physician to write an order electronically than to write it on paper. What is the incentive for physicians to use CPOE? If we can offer electronic documentation and real-time retrieval of all information at the same time, it will be easier to get physicians to use CPOE. If the process of entering orders is too slow or presents too many alerts and hurdles, physicians are less likely to use it; they will instead just give verbal orders and let somebody else enter the order for them.

Rough: I think another barrier is cultural. I believe the probability of successfully implementing CPOE is directly proportional to the percentage of orders written by medical residents. If you can get a few attending physicians championing CPOE, compliance is more likely. But even at the sites that have successfully implemented, over 25% of orders are verbal.

Neuenschwander: The first thing Michael Cohen of ISMP says about verbal orders is "don't make verbal orders."

So, what you are saying is that we're trying to avoid verbal orders by implementing CPOE.

Rough: You need to give your pharmacists and nurses authority to enforce the hospital's verbal-order policy and discourage the use of verbal orders for physicians' convenience.

Somani: Some institutions have found that, with increasing verbal orders, physicians and nurses do not put this information into the system, and drugs have been given without any documentation of the order.

Rough: We see that all the time. We've seen nurses give doses for which no orders have been documented. It's worse in the intensive care unit. A nurse would scan a medication, the system would produce an alert, but the nurse would override it. The nurses and physicians probably have every intention to go back and document the order, but they forget to do it because of distractions from other responsibilities.

Shabir, you mentioned that alerts are one of the barriers to implementing CPOE. I think properly structured alerts in physician support systems can be valuable. A problem is that many commercial systems do not produce an alert until the physician has written multiple orders and then submits all orders. Then the alerts appear, and the physician must reenter the orders if they wish to comply with the alert. Vanderbilt's system is the only one I know of that gives alerts when physicians select each drug, not when the whole order is submitted. I think that is one reason why Vanderbilt's system is successful. The alert system was developed by a full-time physician and pharmacist who devised how to best insert these alerts to make the system more user-friendly.

Woodward: I hear complaints from nurses and physicians about systems that are isolated and not fully integrated. Although nurses understand the importance of bar-code verification systems, the idea of having to use one system for medication administration and another for routine documentation does not appeal to them. It is the same with physicians. If they must enter medication orders into one system but have to use a separate system for everything else, CPOE won't meet their needs. We want the system to do more than one task at a time because it's not practical for physicians to just enter medication orders or for nurses to document medication administration. The whole spectrum of care must be considered and addressed by these systems.

Somani: A comprehensive process of care rather than compartmentalized care.

Rough: But no vendor has a commercially available, off-the-shelf point-of-care medication-scanning system and a good nursing-documentation system on the same platform, so you are dealing with interfaces. I'm glad we are addressing medication administration first and nursing documentation second at UWHC. To do both simultaneously is particularly difficult because medication scanning alone presents many challenges.

Woodward: I'm not disagreeing with you, but nurses in our health system insist that they must have both pieces and thus far have rejected less comprehensive systems.

Neuenschwander: Here again, I think we are encountering our lack of understanding of how people work with machines. I was on an airplane going to a Health Information Management Systems Society meeting. Bill Gates was the keynote speaker; he sat two rows in front of me on the airplane. I could see him from where I was sitting. Next to him was an assistant from Microsoft typing away on a laptop. Bill Gates was writing his speech on a legal tablet! Bill Gates believes we're going to read *War and Peace* on palm pilots, but he was writing on paper. My point is this: When we implement new technologies, two tests have to be conducted. One, will the robot pick up a medication, put it where it's supposed to be, and read the bar code correctly? Next, how does it fit in the workflow of human activities in the pharmacy?

With bedside systems, the computerized devices might work flawlessly, but how will using them affect nurses' work? Will people carry the device? Do they *want* to carry it? Do they want to roll it around instead? Do they want a full screen or a small screen? Do they want a small screen to carry and a big screen elsewhere? We have to deal with these complexities. This is one area that has stalemated a lot of progress.

Rough: Very often people think they want what they don't have. However, with wireless technology, medication orders can come across with point-of-care scanning systems. Instead of comparing the pharmacy-generated medication administration record (MAR) on paper with the physician's order, the nurse can verify orders with a hand-held computer. The beauty of it is now nurses can take the hand-held device anywhere on the unit and verify orders. It substantially simplified their work.

VanEeckhout: In the pediatric setting, if you don't have standardized dosing, nurses have to manipulate everything, which adds many additional steps. Standardized dosing and unit dosing must be in place before CPOE and bar coding are implemented.

Somani: Talking about technology, I think we're often guilty of building the technology around the workflow without first making the workflow more efficient.

Rough: Alerts can be as big a problem with nurses at the point of care as they are to physicians entering orders into a CPOE system. I hear vendors talking about sound-alike drug warnings at the bedside with point-of-care technology. If you scan a bar code and it's the right bar code, why do you need a sound-alike drug warning? Vendors are learning that

nurses don't always want to look up drug information at the bedside or review all of these alerts. We are working with our vendor to give us the ability to require nurses to provide vital information and for the system to produce alerts only when it's absolutely necessary from a patient safety perspective.

VanEeckhout: Our organization has a million-dollar project that is looking at organizational transformation—what we need to do with the technology, how it will be incorporated into the workflow. Our organization is intently looking at that because we realize that if we don't leverage the technology, the $25 or $30 million the hospital will spend on technology will not be used efficiently.

Rough: I agree. Planning and workflow redesign is essential when you implement and use a new technology.

Comparison of CPOE and bedside scanning

Neuenschwander: We must consider not only the cost but more importantly the return value on investment—the cost justification based on return. How does the cost of CPOE compare with that of bedside scanning, and what is the value justification?

Rough: In terms of personnel, for implementing CPOE, we've added 13 dedicated full-time equivalents (FTEs) to the hospital's budget. Those are needed for planning and keeping up with implementation, including one pharmacist, one pharmacy technician, and a number of FTEs in the IS department. For point-of-care implementation, we've had one nurse project coordinator added, 0.75 pharmacist FTE that we absorbed into a manager's role. The project also requires about 1.4 technician FTEs for bar coding and maintaining the database. That was 2.4 total hospital FTEs added to the budget versus 13 FTEs for CPOE. Bedside scanning costs about one fifth of CPOE and needed no IS personnel involvement except setting up network connections; pharmacy can manage the entire database without extensive IS support. There is really no physician involvement, either.

A study published a few years ago estimated that a good CPOE system could intercept 93% of prescribing errors—a good pharmacist could intercept 94%. The study found that, in most facilities, a decentralized clinical pharmacist can be as useful as a CPOE system in intercepting potential adverse drug events. Decentralized clinical pharmacists are a more cost-effective and feasible solution to medication errors than commercially available CPOE systems now.

Neuenschwander: Does the 1:5 ratio in FTE expense sound reasonable to everyone?

Woodward: Intuitively, that sounds right.

Somani: I think the ratio may be even bigger than that.

VanEeckhout: When you have complex drug therapies like we have within pediatrics, I think the cost contrast between the implementation and maintenance of CPOE and bedside scanning would indeed be much more.

Neuenschwander: I feel that, compared with CPOE, the lower hanging fruit is bedside technology. I would further argue that bedside scanning helps accomplish some of the very same objectives we are trying to accomplish in CPOE. What we are trying to do with CPOE is help physicians make safe, accurate orders and enter those orders into the system safely and accurately, correct? However, the current system of MARs that a physician relies on may not accurately reflect everything a patient actually receives. I call it an estimated MAR, because nurses are not always capturing medication administration at the point of administration. Too often they are documenting the information by hand, down the hall, and from memory. The MAR is not always accurate or complete.

Rough: That's exactly what we found through direct observation from internal studies conducted before we implemented bedside scanning. Eight percent of all doses administered were not documented accurately on the MAR. That translates to over 120,000 doses a year on inpatient units that were given but not documented properly on the MAR.

Somani: CPOE involves more than just having the physician enter the orders. If you have all the information in front of you electronically, from medical history to MAR, you can make decisions so much more efficiently and effectively.

VanEeckhout: The available systems are still not sophisticated enough. We have hospitals in which CPOE amounts to physicians typing orders into a computer that are then printed in the pharmacy.

Somani: Then we may be paying for a very expensive word processor.

VanEeckhout: The other issue is, are we producing high-tech mistakes?

Neuenschwander: Back to approximate MARs. In an ideal world, every administered dose is scanned, physicians know exactly what medication is given and when so that they can proceed on the basis of accurate documentation. If you are not capturing actual drug administration with scanning, is there a CPOE system that can compensate for that? No. If we are getting actual documentation closer to the point of administration, that helps tremendously. If we believe CPOE's value is facilitating a more accurate medication-ordering process, bedside scanning adds value to the medication-use process from the other end. That's why I say it's a very attractive low-hanging fruit.

Woodward: You also have to look at what you don't get done. To me, bar coding is a more logical choice to implement first because it is more durable and less expensive than CPOE and is less likely to derail further progress in technology implementations.

Rough: In the meantime, CPOE systems will mature. The sophistication required of bedside scanning technology to prevent serious errors is less than that required of CPOE systems with clinical decision support functions

Somani: For bar coding, the learning curve is not steep. Nursing doesn't have to learn that much. The biggest challenge I see is getting the bar code on the medication package.

Rough: The biggest challenges include doses that are compounded in the pharmacy such as i.v. and extemporaneous preparations. You have to rely on your pharmacy software vendor to put legible bar codes on all product labels.

Neuenschwander: How difficult it is to persuade nurses to use bar-code scanning at the bedside?

Somani: I don't think it would be too difficult to get nurses to use it if they knew its value in providing safer care.

Rough: A related issue is, can we perform quality assurance reviews? We periodically collect reports of non-bar-coded medication administration information from our computer system, and our nursing project manager reviews them. Once she discovers certain nurses are administering non-bar-coded drugs, she shares the result with their manager. Once nurses know you have the ability to audit their use of the system, they are more likely to comply with the system. In addition, as soon as a nurse gets a near-miss error alert from the system, he or she is sold on the benefits of using the system properly.

Neuenschwander: The Joint Commission frowns on nursing overrides in automatic drug-dispensing cabinets. Likewise, overriding the procedure of bedside bar-code scanning is wrong. Processes, procedures, and protocols have to be followed. The better systems catch work-arounds and make them more difficult to do in the first place.

Somani: Another point is that if the technology is not user-friendly, people tend to work around it. We sometimes forget that.

Rough: You had mentioned bedside scanning might be a lower-hanging fruit than CPOE. If you compare the safety features and double-checking mechanisms within prescribing and drug administration, you'll realize that more safety checks have been built into the prescribing process. Under prescribing, there are pharmacists reviewing the order, nurses checking the order, preprinted order sheet, hospital guidelines, etc. You have all these double check systems. Under medication administration, all you have is the nurse and the patient. We know that the vast majority of medication administration errors made by nurses do not get intercepted; they reach the patient. Some hospitals even maintain the MAR by hand; they don't even use a pharmacy-generated MAR.

Effects on pharmacy practice

Neuenschwander: What happens to the pharmacist's role in drug therapy review after CPOE becomes the norm? Does the pharmacist end up with a stronger medication specialist role in the process, or will the pharmacist be automated?

Somani: Some of the pharmacist's role may be replaced. When all i.v. solutions were made by a pharmacy rather than by Abbott and Baxter, there was a fear that pharmacists would lose their jobs by the availability of commercial i.v. products. I think as long as we continue demonstrating value, there will always be a need for pharmacists.

Neuenschwander: As clinicians, one of the pharmacist's roles is reviewing orders and consulting with physicians about drug therapy. Is that threatened by CPOE?

Somani: Not in the near future. The systems today are still very immature. We talked to people in one organization who said that 40% of all orders that come to the pharmacy through CPOE require no changes to be made by the pharmacist. The other 40% need minor tweaking, leaving 20% that need major modification. We still have a long way to go before we take the pharmacist out of this process.

Rough: CPOE systems usually aren't dispensing systems; they cannot generate your PIC list, your dispensing list, and your TPN list. Depending on the level of your system, you're not going to be able to take away pharmacy's distributive work, but hopefully we will get there. I heard reports of four-fold increases in the percentage of orders that required pharmacists' intervention because their CPOE system allowed incoherent orders to come through, like choosing a suspension instead of an i.v. solution. I do not believe the need for clinical pharmacists will be reduced by CPOE; in fact, it may increase to ensure the systems function safely and efficiently.

Somani: Once we have automation, we can get complacent. Some call it automation bias—you defer to the automation rather than actively thinking.

VanEeckhout: When physicians are making rounds, they are assimilating different pieces of information from various sources. The hazard exists that, if not all the information is immediately available or appropriately placed, they could make decisions that are not optimal.

Somani: Current CPOE systems are not expert systems. It will take some time to develop systems that make smart clinical decisions.

Rough: Once CPOE systems become more sophisticated, we may reduce a lot of technical burdens on pharmacists. The retrospective drug utilization evaluations and interventions, therapeutic interchange, error reporting, mediation problem, and nonclinical interventions caused by sloppiness can be resolved before the order reaches pharmacy. Pharmacists can then concentrate on things

like medication histories upon admission, monitoring drug therapy, and defining optimal treatment rather than intervening after the fact.

Woodward: I agree. The amount of hours our pharmacists spend on order entry is huge. We have a long list of things that we need to do more of, including recording medication history upon patient admission and managing therapies, but we can't get to those because we are still so tied to the computer. We would welcome being released from some of our mechanical duties as long as we do not give up the critical activities.

Rough: Before and after CPOE implementation, you need one or two full-time pharmacists to do nothing but work with physicians to explain how you're going to provide adequate clinical support in a CPOE system. You have to invest on the front-end to save on the back-end. However, we had tremendous difficulties in recruiting CPOE pharmacists who wanted to work with physicians to standardize, build consensus, and develop idealized clinical decision support systems. We can't get the pharmacists to apply for this position for two reasons. First, this role is so far ahead of the curve that people who apply don't visualize it well. Second, there is no direct patient care in the work; pharmacists who are really qualified are not that attracted to the job because of the lack of interaction with patients.

Somani: We'll need more of the right types of pharmacists. However, the systems are not at a point to achieve such vision.

Neuenschwander: So you are saying that you are not threatened by CPOE. CPOE may take away some of the mundane responsibilities, but it gives pharmacists the opportunity to provide more meaningful clinical service.

VanEeckhout: I agree, but I think that CPOE will take away part of that safety net we've always provided. Hopefully, we will be able to devote some time to far more meaningful things in patient care.

Somani: Exactly. We haven't even touched on the ambulatory care arena, where most health care is provided. Given the time and opportunity, we can make a tremendous impact on patient care.

Woodward: A lot of clinical interventions performed by pharmacists now are actually clinical housekeeping that could be expedited or eliminated by improved systems.

Somani: I think we have an opportunity to drive toward better and safer patient care rather than resist technology and change.

Rough: And hiring clinical pharmacists is a lot easier than implementing CPOE. They probably do the job better than any commercial, off-the-shelf CPOE system.

Somani: Doing nothing is unacceptable. When it comes to correcting the system to reduce errors, we can do everything at once or we can tackle certain components first. I don't think our patients can wait.

VanEeckhout: You'll write yourself into oblivion if you just sit on your hands.

Bar-coded packaging

Neuenschwander: Automated drug distribution systems have penetrated the marketplace over the last 15 years. About two thirds of all hospitals have some automation for drug distribution and dispensing. However, barely more than 5% of all hospitals have fully decentralized their automation (i.e., dispensing all orders from the automatic cabinets). About 95% of the hospitals in America are still filling cassettes, even if they use automated dispensing cabinets for narcotics and as-needed (PRN) medications. Will the trend continue until all hospitals have 100% automatic drug distribution? I don't know. Do you believe bedside scanning will become standard for practice in most hospitals?

Somani: I believe it's going to become standard for several reasons. One, the barriers to implementing bedside scanning are low. It gives the biggest "bang for the buck." It helps cut 38–40% of errors at the point of drug administration. The retail industry has been using it since 1974, and look at the success it has achieved.

VanEeckhout: Retail pharmacies have implemented bar codes for checking and verifying patients and products.

Woodward: If the process of bar coding at the bedside is in place properly, you can dispense medications easily, efficiently, and safely (in terms of controlled substances), regardless of the dispensing system used.

Neuenschwander: So do we agree that bedside scanning is going to become a standard of practice?

Rough: It will be the best practice standard. I think it will take 5–20 years before it becomes the standard of practice. Rural hospitals may never have bedside scanning. They'll probably use an electronic MAR first.

Neuenschwander: In my opinion, however, bedside scanning is going to be adopted more quickly than automated distribution and dispensing has been adopted. Within the next seven years it will be virtually universal.

Rough: If we can get health care payers to understand that they need to differentially reimburse based on quality. Automation is so expensive. Hospitals that have no margin to implement point-of-care technology cannot afford it. I bet that half the hospitals could not afford automation even if they had universal consensus that it is the right thing to do.

Neuenschwander: There is no business case for it. It's a case for safety and quality of care. After the FDA hearing on bar codes on packages, someone said, "I am afraid that, once bar codes are put on packages, hospitals are going to be afraid to have scanning, because they will have electronic documention to show exactly what medications are adminis-

tered and when." Somebody else commented, "No, hospitals will be afraid *not* to have scanning."

Most soft-dollar investments are hard to sell with hospital administration. If you can show that you got rid of three FTEs, that is convincing, but if you say you have avoided three errors at $5000 per error, that is not so compelling for them.

Rough: Let me throw a monkey wrench in the argument for bar codes and fully decentralized drug dispensing cabinets. Bar-coded packages take up a lot more space in the dispensing cabinet than non-bar-coded doses. We had to cut the inventory by about 30%, which is why we had to restock our high-use automated dispensing machine more frequently. If we have a fully decentralized system to dispense 90% of all doses, I would need to double the number of dispensing cabinets to accommodate all the bar-coded doses. So I think the approach for dispensing is to use a combination of cassette drawers and dispensing cabinets, using the latter for narcotic floor stocks, emergency medications, and so forth.

Somani: That's assuming that the packaging is not going to change. Economics is going to drive it. Pharmacy has to insist on getting bar-coded packages.

Rough: We keep saying that, in addition to NDC numbers, we want lot numbers and expiration dates. We need to be careful of what we wish for. I firmly believe if we insist on everything, we will get nothing. Manufacturers will stop producing unit doses to contain costs.

Neuenschwander: From what I heard at FDA hearings and through my interactions, I believe FDA is going to mandate bar codes on all immediate containers. FDA will not use the term "unit dose." It doesn't use that nomenclature because it doesn't use it now in packaging regulations. What is an immediate container? For a pill, it is a blister pack with one pill, it is a paper bag with two aspirin, it is a bottle of 10, a bottle of 50, a bottle of 5000. For liquids, it's an ampul, vial, or syringe.

When the mandate comes through that requires every immediate container to have a bar code on it, if manufacturers hold back from doing pills, pharmacies have means to rapidly and relatively safely package pills themselves. The real crunch is the ampuls, vials, and syringes. The manufacturers just have to put bar codes on the containers, and they will. At first, the bar code has to contain the drug identifier. Later, perhaps a number of years away, the bar code will probably contain a lot number and an expiration date. Reduced-space symbology (RSS), which is available now, will make this possible. An encouraging sign is that Abbott and Pfizer have committed to using RSS and are leading the wave.

Rough: It's really cost neutral to package our own unit doses. We need 1.5 technician FTEs to do the repackaging, but we're saving over $65,000 a year on drug acquisition costs. We're actually saving a little bit of money by purchasing in bulk instead of unit doses. However, buying in bulk and doing our own repackaging can raise some new quality-control concerns. Pharmacy repackaging errors may be perpetuated once bedside scanning is implemented, because nurses tend to rely on a correct bar code for identifying the correct drug.

Woodward: We're going through the same thing. Some new technology will soon become available to change the whole bar-code issue because there are now labels with paint or ink impregnated with information, like a small computer chip. In fact, it may be the little imprint on the pill itself. This technology is being tested right now.

Neuenschwander: Two comments about that. Microchips containing information will be used, but perhaps later than we think. Also, it takes time for new technology to be widely adopted. My argument to FDA was: Don't limit the rules to certain technology. Require machine-readable codes rather than bar codes. We do not have to fix the discussion on specific codes or chips. Drugstores are already using bar codes. Let's first get there and then migrate to more advanced technology. Bar codes may have lot lumbers and expiration dates one day.

Woodward: And even patient-specific identification before you compound and tag the drug.

VanEeckhout: That's one thing that we struggle with for chemotherapy drug products. You have to have a license-plate-type of bar code, because you often have multiple drugs and doses for one course of chemotherapy.

Neuenschwander: Granted, there are problems that we have to solve internally in the hospital. My message to FDA is this: The important thing about manufacturers' labeling is that the caregivers know exactly what they have when they scan the package, the system knows whether the drug should go to a particular patient, and the screen specifies the correct dose for the patient. We want to achieve standardization, obviously. But if we can't get to standardization 100%, the computer screen can tell the caregiver the correct dose to give to the patient. I do believe that we will have bar-coded packages—that battle is over. I believe that FDA will have a proposed regulation on the *Federal Register* in February 2003, then provide a period for public review. FDA said this review is on fast track and it is committed to it. It's just a matter of time.

Rough: A lot of versions of clinical software used now may not be able to read RSS.

Neuenschwander: You need to upgrade your software. I understand that because you were an early adopter, but RSS will become the standard.

Somani: The retail industry has a similar problem. In 2005, it has to go from a 12- to a 13-digit bar code. It

has to change all of its scanners across the country.

Neuenschwander: It has to change the software on the scanners.

Somani: A lot of retail pharmacies have to buy new scanners.

Pharmacists' role and responsibility

Woodward: Every organization has to develop a strategy for adopting technology and determine where pharmacy stands in the discussion. CPOE is a hugely political issue. Once it gets out of the box before pharmacy really has adequate input, many bigger issues will come back to haunt us. We have to respond and react very quickly to ensure that adequate and appropriate pharmacy input occurs.

Rough: I agree with your assessment. My concern is that most pharmacists do not view their role as taking charge of implementing patient safety initiatives. In our organization, everyone understands our role in the entire medication-use process. The message has to be clearly disseminated to everyone.

VanEeckhout: Pharmacists who do not take the initiative are going to have to deal with their institution's decisions. Fundamentally, most pharmacists are too comfortable sitting in the locked box called the pharmacy and doing what they do on a daily basis. Ultimately, they will have the primary responsibility of implementing and maintaining CPOE. The medication-use process is pharmacy's responsibility. Pharmacy owns it.

Somani: If you give it up, you won't be around.

Woodward: The reality is that nobody else is really going to do it.

Somani: This is a golden opportunity for bedside scanning.

Neuenschwander: I have found that, in most hospitals implementing point-of-care technologies, the process is more often being driven by a pharmacist than a nurse.

VanEeckhout: In most cases, pharmacists are driving it, because it is part of the medication-use process.

Rough: In every decision we make about how we adopt technology to improve the process, we must consider how nurses will receive it. We have to view nurses as a higher level of customer, not just a customer receiving orders. We need to view it as our responsibility to convince nursing leadership the important of patient safety technologies. The support of nurses helps ensure the funding and successful implementation of these initiatives.

Neuenschwander: Let's give our final thoughts.

Somani: I think we have an excellent opportunity to advance patient safety and care through bedside technology. We need to make the most of it.

Rough: I think we have to be careful not to waste our technology investment because of an inefficient manual medication-use system. Now is a good time to start making sure that a hospital dispenses as many exact doses as possible for nurses to administer to patients and start developing a business plan from a safety perspective by getting input and endorsement from your medical staff. Insist that any new system must provide a minimum level of functionality to prevent errors. Avoid the mistake of implementing a CPOE system that might do more harm than good.

Woodward: We've been talking a long time about the medication-use process. Regardless of whether we are implementing CPOE or bar-code scanning, we have to collaborate with the other players. I think the key is, we've got to stay on the offense.

Neuenschwander: It seems to me that if you don't lead bedside scanning, it won't happen. If you're not careful, CPOE will happen without you. What you're saying is take leadership of both.

Rough: I think we should recommend that organizations such as ASHP develop guidelines on these issues. It is impossible to implement a fully automated system, including CPOE and bedside scanning, that is better than the existing manual system unless adequate personnel and financial resources are invested to manage the system. These systems cost more and always will require more personnel. I think the message should come from a group CEOs really listen to.

Neuenschwander: I am thinking of what I call the Osprey principle. The Air Force once made this Osprey jet, the most advanced aircraft that could do things that no other jet could. The trouble was that it kept crashing and killing the pilots. So the old technology was better than the new technology that wasn't quite ready. The axiom is, any system you employ should be as safe as or safer than the system that you replace.

VanEeckhout: My final comment is that I think pharmacists need to realize that they own the medication-use process. As technologies evolve, pharmacists will have more and more responsibilities, even with CPOE. Pharmacists must be ready to collaborate with other disciplines, more so than ever before. Physicians and nurses are our customers. We cannot afford to disenfranchise the end user.