

GUEST EDITORIAL

The current BPOC field position:

Forward Progress and Tough Opponents

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The last decade has seen major progress in the development and implementation of bar code-enabled point-of-care (BPOC) systems. To date, more than 900 hospitals in the United States are using the technology in key areas of patient care. These systems have increased the safety of blood, blood products, and mother's milk, and they have made the collection and reporting of laboratory specimens safer and more accurate. Nonetheless, after a 10-year drive toward the goal line, obstacles remain.

Many BPOC systems, for example, still do not offer a hospital-wide solution for bar code-driven medication administration work flows. The most problematic areas include emergency departments, operating rooms and units where medications are typically administered via I.V. infusion devices.

Fortunately, many BPOC developers and clinicians are addressing these problems and planning the final plays that will change the game, allowing the technology to universally protect hospitalized patients.

Infusions: a Limiting Factor

The most significant limiting factor of BPOC systems has been their inability to eloquently handle I.V. medications that must be administered via infusion devices. I.V. medications are the ones most likely to cause serious adverse drug events in hospitalized patients. Unlike the oral or injected administration of a dose of medication, I.V. administration cannot be defined as a single event; rather, it is a process that occurs over time.

Tim Vanderveen, PharmD, MS, vice president, Center for Safety and Clinical Excellence, Cardinal Health, Dublin, Ohio, explained how extended I.V. administration typically plays out.

"Consider the difference in the administration of an oral Coumadin [warfarin] dose versus a heparin infusion using an I.V. pump," Dr. Vanderveen said. "A daily dose of Coumadin is administered and charted, and the event is complete until the next scheduled dose. The heparin infusion may start with a loading dose followed by a continuous infusion that will frequently be titrated based

on the individual patient response." The problem, he noted, is that I.V. infusions typically extend across multiple nursing shifts. "Current BPOC systems understand event doses, but they have not addressed the [extended] infusion process," he said.

Further complicating the matter, BPOC systems for administering I.V. medications must tackle issues of device integration or risk work flow disruptions.

"Smart" Pumps Can Help

Adding "smart" programmable infusion pumps to the mix can boost safety, but they are not an error-free technology. On the plus side, a pump can intercept attempts to program unsafe doses into it—assuming that the nurse activates the pump's dose-error-reduction software. Unfortunately, the systems cannot automatically verify whether I.V. bags are meant for specific patients. Conversely, BPOC systems can confirm that I.V. medications are as ordered for specific patients but cannot assist nurses in fail-safe pump programming.

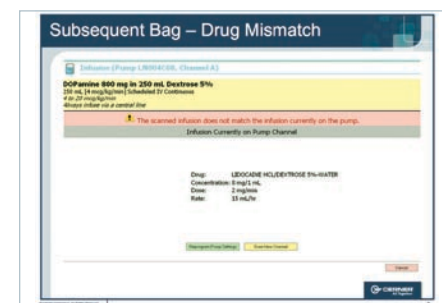
The ideal systems will combine the "five rights" of medication safety—right patient, right drug, right dose, right time and right route—checking with pump-programming safeguards in a seamless bar code-driven work flow. This union, however, has been harder to achieve than mostly everyone first imagined.

The first efforts to unite these capabilities came in 2003, when Alaris Medical Systems, in San Diego, and McKesson Corporation, in San Francisco, partnered to integrate Alaris Medical Systems' smart pumps with the wholesaler's BPOC system at Ohio Valley General Hospital, in McKees Rocks, Pa. Unfortunately, the limitations of an event-centric BPOC work flow and wireless networking and a lack of 24-hour pharmacy coverage stalled progress.

"Nurses would scan a new I.V. bag and they would scan a replacement bag, but other infusion pump interactions, such as titrating a cardiovascular drip, were not associated with scanning," Dr. Vanderveen said. Yet despite the many hurdles, the system was operational in a small ICU for more than a year. "While the joint venture did not produce a commercialized solution, everyone involved gained valuable insight, which has fueled the development of our individual systems and led us toward interoperability."

Documenting: No Easy Task

Beyond their technical limitations, integrated solutions present documentation challenges. When a nurse uses bar-code scanning to hang a new I.V. bag whose



Via the Cerner Bridge Medical BPOC system, the nurse is alerted to potential errors in pump programming.

contents will be infused continuously over two days, the safety features of the BPOC system and the smart pump will ensure "five rights" verification and safe pump programming. However, the documentation of that I.V. is another matter. BPOC systems register and document the "event" as a single administration initiated at a single point in time and can link it to a specific caregiver and patient. An infusion device, on the other hand, sees the infusion as a process that may entail rate changes, multiple bags and interruptions in the infusion, but as a stand-alone device, it does not document caregiver and patient information.

Brigham and Women's Hospital, in Boston, has created a procedural approach to feeding its electronic medication administration (eMAR) system with ongoing infusion data. Policy requires caregivers to re-scan I.V. infusions at every shift to document that the medications are still being infused. Yet the goal for hospitals is ultimately to marry the data of BPOC systems and those of infusion devices to provide a comprehensive record of medication administration.

"Bringing together these two different views of I.V. administration is both the challenge and the beauty of integrating BPOC systems with infusion devices—the patient record will seamlessly display single administration events as well as more detailed information about the infusion over time on the I.V. flow sheet," said Barbara Trohimovich, director of technology alliances at Hospira Worldwide, in Lake Forest, Ill.

The Lancaster General Hospital Experience

Seven years after Ohio Valley clinicians first attempted to tackle universal point-of-care bar-code verification, a second generation of providers is rising to the challenge. Lancaster General Hospital (LGH), in Lancaster, Pa., is currently using a solution, developed jointly by Cerner Corporation, in Kansas City, Mo., and Hospira, that provides I.V. interoperability between their BPOC system and smart infusion devices. The interoperability ensures "five rights" verification of I.V. medication administrations and eliminates another source of medication errors—manual programming of the infusion device.

The bar code-driven work flow at LGH

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wirelessly sends information about the I.V. medication order from the BPOC system to the infusion device, automatically populating the programming values on the pump. Once programmed, the smart-pump dose-error-reduction software conducts a final check to ensure that the ordered dose is within safe dosing parameters. The result is what Richard D. Paoletti, RPh, MBA, director of pharmacy at LGH, considers the most comprehensive approach to I.V. medication safety. “Until now, BPOC and smart infusion have occupied the same space at the bedside, but they didn’t work together,” Mr. Paoletti said. “What we’ve designed is a smart-pump system of redundancies that prevents errors whether [caused by] a wrong drug or a double key bounce,” he said about a project that has been alive at his facility since July 2008.

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— William W. Churchill, MS, RPh

Technology and work flow optimization is also part of the solution at LGH. “We’ve reduced 17 nursing steps to seven and are currently evaluating time-and-motion studies to demonstrate the overall reduction of nursing time,” said Amanda Prusch, a medication safety specialist at LGH. “The result is a significant advancement in I.V. infusion safety.”

Emergency Departments

The need for tools to ensure medication administration safety in emergency departments (EDs) is clear. In 2003, the U.S. Pharmacopeia, Center for the Advancement of Patient Safety found that “fewer [23%] errors were intercepted before reaching patients as opposed to a general interception rate of 39% for all other areas within the hospital.” Additionally, “77% of medication errors cited in the ED occurred during the prescribing and administering phases.”¹

Medication administration errors in the ED can be attributed to the rushed pace of care, communication failures and a lack of error-checking redundancy. Unlike medication orders in other inpatient scenarios, “stat” medication orders are generally given verbally by a physician and are immediately carried out by a nurse without pharmacy review. There is little opportunity for error interception if the ordered dose is unsafe or the wrong drug is retrieved for administration.

BPOC systems have been used in limited fashion in the ED. Although systems cannot match drug administrations to physicians’ orders for “five rights” verification, they can offer critical administration guidelines when medications are scanned and document the medications given. For example, should a physician order vecuronium for a new patient, a scan of the drug vial will present the nurse with an alert: “Vecuronium is a paralyzing agent—patient must be ventilated.” Similarly, such alerts can help prevent administration via the wrong route and look-alike/soundalike errors without adding significant time to administrations.

ED demands may require an expansion of current BPOC functionality. Without pharmacy review, nurses need a means to identify safe doses. For example, systems could allow nurses to enter doses prescribed verbally by a physician before they are administered. Also, in addition

to the clinical alerts mentioned previously, BPOC systems could verify doses entered against hospital-defined safe dosing parameters.

The unique environment that leaves ED clinicians vulnerable to errors also presents problems for BPOC systems. Despite well-documented failings in current ED processes, emergency care providers often resist the adoption of new practices that might slow response times for patients in need. Also, ED clinicians would likely prefer handheld or tablet devices to the computers-on-wheels typically deployed elsewhere in their hospitals. User interfaces would have to take into account the extreme time sensitivity of ED users, forcing developers to rethink current features such as log-in procedures.

Operating Rooms

The OR presents a medication use process like none other in the hospital. During surgical cases, anesthesiologists order, prepare, administer, monitor and document all medication administrations. In the course of a single operation, multiple drugs are used either in succession or simultaneously. The complexity of the anesthetic technique, the possibility of poor lighting, the ever-increasing production pressure to move faster for cost savings, the fact that in some instances fewer than 10 seconds elapse

between a decision to prescribe a drug and its administration, the lack of label standardization and the high-stress environment of the OR are some of the issues that open doors to medication errors. Furthermore, unlike caregivers in other treatment areas, who perform redundant checks as a matter of policy, members of the anesthesia care team (a physician/anesthesiologist medically directing a nurse anesthetist or an anesthesiologist’s assistant) do not customarily double-check medications before delivery.

For this reason, the Joint Commission has outlined safe medication-labeling practices in the OR to reduce common preventable medication errors.² In addition to these guidelines, the American Society for Testing and Materials (ASTM) has issued international standards requiring that the generic names, concentrations, volumes and bar codes of drugs be printed in a standardized font with contrasting background colors chosen according to their classification.³ These steps are evidence that regulators see the need for improved processes. However, because the work flow in the OR affecting the selection, preparation and administration of drugs is unique and not subject to pharmacist review, current BPOC systems do not match what is needed to address all the potential medication errors in the OR suite.

Well-known for their leadership in patient safety, anesthesiologists are becoming passionate about the need for process change to reduce adverse drug events. They are combining insight into their work space with available technology to create bar code–driven solutions that more effectively match identified needs. Many efforts are under way. For example, at Massachusetts General Hospital, in Boston, anesthesiologists are scanning bar codes on medication vials to automatically produce labels for syringes used during each case. All syringes that are drawn up and leave a physician’s hands must be labeled, greatly reducing the opportunity for syringe mix-ups.

Brigham and Women’s Hospital

Brigham and Women’s Hospital, in Boston, has taken a different approach, opting to provide prefilled bar code–labeled syringes for surgical cases from the OR pharmacy. The hospital is also adding automated dispensing carts with bar-code verification functionality for intraoperative drugs.

William W. Churchill, MS, RPh, executive director of pharmacy, said, “The goal, of course, is to provide connectivity with order entry, pharmacy and eMAR systems, but with each intermediary step we reduce the potential for error and lay a stronger foundation for future bar code–driven work flows.”

Some hospitals have elected a more technology-intensive approach, in which

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RPh, MBA

anesthesia practitioners administer most of their medications through an I.V. port within a computerized box that not only reads a bar code but also measures plunger movement. The end result is that all “five rights” are verified, documentation is enhanced and practitioners have access to unprecedented clinical decision support. Via bar code–enabled drug identification, a check against the First Data Bank registry and the patient’s comorbidities, allergies and current medications is automated. System warnings reveal if the drug has expired, whether it is contraindicated based on the patient’s health problems, allergies or other ordered medications and if the syringe has been used on another patient.

Closing the Gap

Although the hurdles facing BPOC are daunting, there are ample reasons to believe that players are set in the right formation for a strong finish. Their efforts are yielding increasingly elegant solutions to bar code–driven work flows in a growing number of hospitals—gains that are putting us within range of our ultimate goal of comprehensive medication safety.

—Ms. Kelly is an independent marketing consultant serving health care information technology vendors and is a long-time evangelist for medication safety. Additionally, Ms. Kelly and her partner, Mark Neuenschwander, organize the annual unSUMMIT for Bedside Barcoding (www.unsummit.com) educational forum.

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