CPOE or BPOC:
What's the Next Best Step in Preventing Medication Administration Errors?

IntelliDOT®

Introduction

Medication administration errors continue to be one of the biggest threats to patient safety, as well as a huge liability to healthcare organizations. According to a 2006 Institute of Medicine (IOM) report, *Preventing Medication Errors: Quality Chasm*, approximately 380,000 to 450,000 preventable adverse drug events (ADEs) occur annually in U.S. hospitals. That's 1.2 preventable ADEs per every 100 admissions. The report states that in the worst-case scenario, anywhere from 44,000 to 98,000 patients die annually as a result of medical errors.

Not even the rich and famous, who can afford the best in healthcare, are immune from this threat. Earlier this year at highly reputable Cedars-Sinai Medical Center in Los Angeles, the newborn twins of actor Dennis Quaid and his wife were mistakenly injected with an over dose of the blood-thinner heparin – 1,000 times the strength normally used – when they were supposed to have received a simple IV line flush solution containing low dose heparin. The Quaid twins survived and suffered no permanent effects, but three babies at a Midwest hospital died in 2007 when given a similar overdose.

It's not that hospitals aren't taking measures to prevent medication errors. The adoption of computerized physician order entry (CPOE) systems, which are designed to help prevent physician errors that occur when prescribing medications, continues to grow as the healthcare industry scrambles to implement patient safety programs as the Joint Commission on Accreditation of Hospitals (JCAHO) continues to update its standards for patient safety.

But CPOE is not enough. Studies by Harvard professor David Bates and colleagues indicate that of the 39 percent of medication errors that occur during prescribing, about half of these are caught by pharmacists and nurses subsequently reviewing the orders. In comparison, the studies showed that 38 percent of medication errors happen at the bedside during the administration of the drug. Virtually none of these errors are caught since a nurse administering medications in the room acts alone, with no one there to catch the mistakes.

A remedy for improved safety in medication administration is barcode point-of-care (BPOC) technology used at the bedside. While not studied as rigorously as CPOE, many hospitals report BPOC to be an effective solution that is proven to reduce errors, as well as provide fast implementation with Healthcare Information Systems (HIS). While not new to the healthcare industry, BPOC has evolved over the past decade to become a more effective and widely accepted, almost mainstream solution.

The bottom line is that while CPOE can improve patient safety in regard to medication errors, it does not address all areas of medication administration safety. This white paper will explore the "next best step" to reducing the risk of medication errors and offer guidelines and research findings to help hospitals make the best decision on implementation – either a marriage of BPOC with an existing CPOE, or an initial implementation of BPOC (whether followed by CPOE or not) to reduce costs and implementation time.

Which comes first – CPOE or BPOC?

The questions for healthcare organizations boil down to this. Which system should be implemented first, CPOE or BPOC? Which one will make the greatest initial impact on patient safety?

Opinions vary across the industry, and the research and anecdotal results presented in this white paper support different views. But a recent post by national patient safety leader Robert "Bob" Wachter, MD, in his lively and to-the-point "*Wachter's World*" blog, may be evidence of a turning tide toward BPOC implementation before CPOE. Wachter is Professor and Associate Chairman of the Department of Medicine at the University of California, San Francisco, and Chief of the Division of Hospital Medicine and Chief of the Medical Service at UCSF Medical Center. He has also authored books on the prevention of medical errors and promoting patient safety.

Underneath his numerous titles, Wachter is a practicing physician who has struggled with the above questions himself and has previously stated that study results support the implementation of CPOE first because there is stronger evidence supporting it. Now, he's changed his mind, as the excerpts from his blog entry of May 2, 2008, "*Should Hospitals Install Barcoding or CPOE First? Why I've Changed My Tune*":

- "After all, whatever the reasons, the fact remains that barcoding has not been researched very much or very well. But, with all the medication administration errors I'm hearing about, this is now an area in which I am willing to relax my evidence standards a bit – it is beginning to seem like the equivalent of barricading the cockpit doors after 9/11, a "relatively" low cost, low complexity (at least when compared with CPOE) and commonsensical intervention that can potentially save a lot of victims - both patients and nurses."

- "Ultimately, of course, we need both barcoding and CPOE, and we need rigorous studies looking at what works and what doesn't. But you have to start somewhere. Even though the evidence continues to trail, based on what I know today, if I was a hospital ready to get into the IT game, I'd go with barcoding first."

Wachter's opinion aside, as individual solutions both CPOE and BPOC provide benefits for improving patient safety. Both provide safety benefits to the medication management cycle, but at different points. For many hospitals, cost often prohibits the implementation of both systems, despite the advantages of "closed loop medication administration," which includes CPOE and BPOC systems in addition to decision-support tools for pharmacists reviewing the orders, and controlled automated dispensing cabinets.

One of the first steps in making the "CPOE vs. BPOC first" decision is taking a look at the unique benefits of each system in regard to improving patient safety and caregiver workflow, as well as cost, ease and speed of implementation.

The case for CPOE

The foundation of CPOE is reduction of prescribing errors related to illegible handwriting and inaccurate order transcription. However, a CPOE system integrated with effective decision support tools and other technologies can help physicians optimize delivery of care and improve patient safety during and beyond the prescription process. The best CPOE systems include a broad range of alerting functions – allergy and drug interaction and medication dosing alerts, for example – that ultimately improve clinical outcomes. These systems should be able to be tailored to various practice settings to avoid what physicians call "alert fatigue," as they become immune to a constant barrage of alerts and ignore many of them. Most of all, the most effective CPOE is one that physicians will actually use. Adoptability issues will be discussed later in this paper.

The best CPOE systems will also:

- Deliver real-time patient information and clinical knowledge to support the physician's prescribing decisions.

- Provide 24/7 access to the patient's medical record and ability to place orders remotely – a feature that may reduce the number of orders misunderstood over the phone.

- Provide the latest clinical information to help physicians stay current with new medications.

- Provide TALL MAN lettering and drug-specific information to reduce confusion over look-alike and sound-alike drug names.

- Where possible, improve prescriber efficiency to reduce healthcare costs.

- Improve fulfillment time of drug orders, resulting in faster delivery of treatment.

In addition to patient safety, CPOE systems have the potential to lower drug costs by limiting prescribed drugs to the hospital formulary resulting in financial savings, as well as enforcing evidence-based best practices. Also, because CPOE helps build an electronic health record (EHR), hospitals have more accurate patient records and documentation of services provided, resulting in more accurate and efficient insurance claims processing. Hospitals can benefit from faster, full reimbursement of claims, as well as measurable quality improvements.

CPOE patient safety statistics

Although there have been numerous studies of CPOE system efficacy, adoption has been limited to roughly 10 percent of US hospitals, according to a March 2006 Leapfrog Group report.[i] These studies have produced an array of findings – not all of which agree. In 1999, Bates and colleagues found that "non-intercepted serious medication errors (those with the potential to cause injury) fell 86 percent" as a result of CPOE implementation.[ii] Yet in March 2008, Walsh and colleagues published the results of a pediatric study that found only seven percent of non-intercepted serious medication errors were reduced.[iii]

CPOE has also not proven to be as effective in preventing patient deaths due to medication errors. In 2005, Han and colleagues[iv] from the University of Pittsburgh, analyzed mortality rates 13 months pre-implementation and five months post-implementation of a commercial CPOE system. After CPOE introduction, mortality rates increased dramatically from 2.8 percent (39 of 1394) to 6.6 percent (36 of 548). Han and colleagues suggested that the additional time required for CPOE use, disruptions to caregiver communication and technical network failures might have been contributing factors.

An August 2007 article in the *Journal of the American Informatics Association* exposed yet another consideration in prioritizing CPOE in a hospital's technology plans. Author Fern Fitzhenry, RN, MM, PhD, and colleagues found that although inpatient CPOE orders were legible, ward-based medication administrations did not consistently occur as ordered. Despite the implementation of an ideal CPOE solution, administration errors will still occur at the point-of-care without changes in medication administration processes.[v]

The case for BPOC

While CPOE addresses the basics of producing legible prescriptions and expands to integration of decision support for accurate *prescribing* of medication, BPOC has its primary focus on eliminating medication *administration* errors by verifying five rights medication management at the bedside: right medication, right dose, right route, right patient, right time. Essentially, a BPOC system can bring the pharmacy to the bedside, as well as meet JCAHO patient safety standards for patient identification, medication use, error reporting, and process improvement. Some portable handheld solutions also eliminate the need for heavy, bulky, computer on wheels (COW) carts that restrict nurses from managing medication administration at the bedside.

Since not all BPOC systems are the same, it is worth reviewing the following key attributes needed for these systems to achieve their highest possible error prevention results, as well as best practices:

- Requires that the patient wristband be scanned prior to medication administration to assure the nurse has approached the correct patient prior to medication scanning and medication administration.

- Does not allow the nurse to scan other, identical barcodes located away from the bedside in place of the wristband barcode. Supplemental barcodes which are identical to the patient wristband barcode can result in "workarounds" or other shortcuts to avoid scanning wristband and medications in the patient's room.

- Delivers medication instructions, or comments added by the pharmacist and other alerts as needed during medication administration.

- Provides nurse-specific dose due, and dose follow-up reminders for selected medications.

- Provides nurse-specific alerts of new medication orders, and requires nurses to verify the orders prior to administration.

- Provides nurse-specific alerts of discontinued medications, potential duplicate doses, and PRN intervals during medication administration.

- Checks for allergy and drug interactions prior to administration of stat or emergency medications given prior to pharmacy or CPOE screening.

- Maintain an up-to-the-minute accurate electronic medication administration record (eMAR), including discontinued medications, since all medications scanned at bedside are documented.

- Reduces time spent documenting medication administration.

Some BPOC solutions include a full spectrum of patient safety applications on the same hardware platform allowing nurses to use the same handheld unit for all of them. Desirable applications include vital signs collection, phlebotomy specimen collection, mother-baby breast milk matching and blood product administration.

BPOC patient safety statistics

A simple scan of the Quaid twins' wristbands with a BPOC unit would have alerted the nurse that she was about to administer the wrong dose of heparin. The tiny patients' pain, the parents' anguish, and the nationally broadcasted bad publicity for the hospital could have been easily avoided.

Although only a few highly-controlled studies of BPOC have been conducted, a number of hospitals and health systems have shared their positive results.

- Sutter Health Network in Northern California conducted a rigorous study that found that BPOC prevented administration errors in 1.1 percent of all attempted administrations.[vi]

- The Department of Veterans Affairs, one of the first entities to adopt BPOC, also reported an 86.2 percent reduction in reported errors, estimating that BPOC systems prevented 549,000 errors from 8,000,000 doses.[vii]

- After implementing BPOC in 22 of 26 in-patient care areas, the University of Wisconsin Medical Center reported an 87 percent reduction in observed medication administration errors, from 9.09 percent of all administrations to 1.21 percent.[viii]

- Northern Michigan Regional Health System reported that its BPOC system prevented 1,300 medication errors, the majority involving wrong dose, wrong drug, and discontinued orders between January and August 2002.[ix] Although not defined in such a way to compare system effectiveness across hospitals or vendors, these data consistently indicate substantial error reduction.

In addition to medication error reduction, BPOC systems have proven effective in limiting specimen collection errors and correct patient/blood product matching prior to transfusion. Hospitals using BPOC-enabled transfusion systems have demonstrated accurate identification of mismatches with clinician acceptance[x] – including a 100 percent accuracy rate at Georgetown University Medical Center.[xi]

Implementation and adoptability issues

Factors such as the size and complexity of the implementation, the number of sites, and additional hardware and software required all influence the cost and implementation time of both CPOE and BPOC installations from one hospital to another. Both systems require a one-time investment in capital and operating costs, plus ongoing annual operating costs and vendor service fees.

CPOE

The benefits of CPOE notwithstanding, and also realizing that CPOE is most often implemented in large academic medical centers, implementation takes on average one to four years and usually requires significant human and capital outlays – as much as nearly $8 million in initial costs and ongoing costs of approximately $1.3 million.[xii]

Most damaging to both operations and the hospital's bottom line is the high risk of incomplete implementation due to the lack of adoption by physicians and other clinicians.

For example, according to a March 2005 article in the *Washington Post* by Ceci Connolly, Cedars-Sinai Medical Center in Los Angeles abandoned its home-grown $34 million CPOE system after just three months after a "staff rebellion" with doctors and nurses refusing to use the system. They cited slow system performance, poor training, "alert fatigue," and the overwhelming amount of change resulting from a "big bang" implementation as key complaints. Ironically, the article leads with an anecdote about a physician who had been "mixing up a certain drug dosage for decades" – by 10 times the correct amount – in his handwritten prescriptions. The nurses had been covering for him by changing the order to the correct dosage. The CPOE caught the error the first time the physician entered it, but the physician still rejected the computerized system as too time consuming to use.

On the other hand, when CPOE systems are built to accommodate physicians' workflow, the adoption improves. Understanding what physicians really want and expect from a CPOE system – based on productivity, quality, and efficiency – should precede CPOE implementation.

BPOC

In significant contrast, best-in-class BPOC systems can be implemented in 4-6 months without requiring additional staff or disrupting daily hospital processes. According to estimates from a roundtable meeting at the 2006 HIMSS Conference, system costs may suggest that total acquisition and implementation costs for a BPOC system can range from $400,000 to $2 million, depending on the sophistication of software chosen, whether a wireless network and computing hardware pre-exist, the selection of mobile computing equipment, and the expertise of hospital personnel in implementing the system.

While costs and implementation times can vary widely from vendor to vendor, many hospitals report the best approach to be a turn-key implementation where all aspects of the implementation process are managed by a multi-disciplinary implementation team.

BPOC technology has been available for well over a decade, but adoptability has been slow due to early generations of technology that was too difficult to use and actually reduced nurse workflow efficiency instead of enhancing it. Patient safety, also, still had the potential to be compromised since earlier systems – and some still existing today – allowed software "workarounds" or software pathways that allow nurses to take shortcuts, such as keeping duplicate patient wristbands in a pocket so as to avoid scanning medications at the bedside.

Today, BPOC systems such as the IntelliDOT System are enjoying fast adoptability because it meets or exceeds all key criteria for an effective BPOC system mentioned earlier. Additionally, the IntelliDOT system also features ease of use, simple operation, fast learning curve, and lightweight portability. Perhaps most importantly, the IntelliDOT System does not allow workarounds that could compromise patient safety.

Choosing the best BPOC system

Not all BPOC systems are created equal, even today, as the technology has evolved to become more comprehensive and user friendly. Hospital decision makers need to closely examine the features and benefits of each vendor's system – whether as a standalone system or integration with an existing CPOE – to ensure that it will deliver the promised patient safety benefits and be a system that nurses will actually use.

The following checklist indicates the "must haves" in a best-in-class BPOC system:

- Seamless integration with any pharmacy system and HIS.
- Implementation in as little as four months – with 24-hour, on-site vendor support during go-live.
- Purpose-built for bedside documentation with a custom handheld designed by nurses for nurses.
- Rugged, water resistant design that's cleanable with all common disinfectant solutions.
- Absolutely no workarounds or shortcuts – nurses must scan patient wristband at bedside.
- Simple, straightforward user interface that's easy to learn and operate.
- Light, handheld wireless device for easy carrying and one-hand operation – not bulky COWs that cannot be taken into rooms.
- Batteries that last an entire 12-hour shift or longer.
- 99.99 percent uptime performance and easy maintenance – no additional staff required.
- Ability to scan 100 percent of all medications in the pharmacy.
- Easy expansion to comprehensive bedside care modules – vital signs collection, blood product administration, mother-baby breast milk matching, and phlebotomy specimen collection.

IntelliDOT hospitals see results

IntelliDOT Corporation is one vendor who meets all of the above criteria with its BPOC system. As the following brief case studies show, using the IntelliDOT System for barcode medication administration not only reduced risk of serious errors, but also provided financial benefits.

Jane Phillips Medical Center

Jane Phillips Medical Center (JPMC), Bartlesville, Oklahoma, has created a "safety culture" with the implementation of IntelliDOT Bedside Medication Administration™, which integrates with the hospital's Cerner Millennium HIS. Jane Phillips selected IntelliDOT because of its ease of use and low potential for workarounds. Hospital-wide implementation of the IntelliDOT System was completed in about two months from the time the first unit went live.

Observations of 250 medication administration procedures before and four months after the IntelliDOT implementation prove that JPMC is achieving the benefits of improved patient safety in this area. JPMC reduced total medication errors from 51 out of the 250 administrations observed in the study, or 20.4 percent to 17 out of 250 or 6.8 percent. The 17 remaining post-implementation errors were timing errors, meaning that the medication was either given early or late as defined by hospital policy. This represents a 67 percent reduction in the medication error rate at JPMC. Serious errors or Adverse Drug Events (ADE's) were reduced from 5 out of 250 in the pre-implementation observations to 0 – a 100 percent reduction. Nurse acceptance has been very high at over 95 percent and documentation of pain scale follow-ups after administering pain medication is at 100 percent.

Southwest Mississippi Regional Medical Center

Southwest Mississippi Regional Medical Center (SMRMC), McComb, Mississippi implemented IntelliDOT Bedside Medication Administration, which integrates with the McKesson HIS. Among other benefits, the IntelliDOT System has helped SMRMC resolve a problem with documenting patient reassessment after administering pain medication. In the business office, SMRMC has been able to improve reimbursement due to more accurate real-time documentation.

A "before and after" observation of 250 medication administration procedures proves that the IntelliDOT CAREt System is making a big difference in reducing the risk of errors at SMRMC. The hospital reduced total errors from 68 (27.2 percent) to 3 (1.2 percent), and reduced serious errors from 2 (.8 percent) to 0. Thanks to the alerts in the IntelliDOT System, three serious error near misses were caught. In addition, 100 percent of patients are identified by barcode wristbands per hospital policy and JCAHO standards. Clinical charting is also 100 percent compliant.

Conclusion

Each individual hospital will need to evaluate its own workflow, technology, and financial issues when deciding whether to implement CPOE, BPOC, or both, and in what order. However, despite the relatively few studies to date on BPOC performance in preventing medication errors, the growing volumes of anecdotal evidence among clinical users speaks highly for pursuing BPOC as the next best step.

BPOC systems are faster and less expensive to implement than CPOE. Additional staff is not needed, nor are operations disrupted by lengthy installations. User acceptance is high and is not subject to physician resistance, which is all too common with CPOE despite the well-documented evidence of error reduction when used consistently.

In addition to patient safety advocates such as Dr. Bob Wachter, other healthcare industry leaders are expressing positive opinions about BPOC as either a cost-effective alternative or complement to CPOE:

- Bedside barcode scanning is less complex than CPOE, is easier to implement and has a "great payback," according to Michael R. Cohen, RPh, MS, ScD, President of the Institute for Safe Medication Practices.[xiii]

- Kasey Thompson, PharmD, Director of Patient Safety for ASHP, is in agreement saying BPOC is "not as complicated from a technology standpoint as decision support and CPOE." He attributes the relative success of BPOC to the strong role of pharmacy in its use, "Barcoding is a pharmacy-managed system. It affects nursing the most as far as processes of care, but as far as the database management – the labels and the packing – it is really a pharmacy-based system; that is one aspect that makes it a bit more readily implementable," Dr. Thompson said.[xiv]

- A 2005 thorough review of current practice and member-hospital experience also led the University Healthcare Consortium to recommend: "For hospitals considering but not yet implementing computerized prescriber order entry, BCMA should take precedence."[xv]

- Most importantly, BPOC prevents medication administration errors at the bedside – at the point where patients are most vulnerable, and where no one else can catch them – whereas CPOE systems occur upstream in the medication process, and are subject to screening by pharmacists and nurses. A BPOC system could have prevented the heparin overdoses on

the infant patients; CPOE could not. Thus, when the primary goal is patient safety, concentrating on a point-of-care system such as BPOC stands out as the next best step in eliminating medication administration errors.

About IntelliDOT

The IntelliDOT System is a best-of-breed wireless, workflow manager that connects caregivers with the information systems they need at the point-of-care. Designed by nurses for nurses, the IntelliDOT System enables clinicians to perform safety checks and safely administer and document medications at the bedside using a lightweight, handheld device. The IntelliDOT System satisfies Joint Commission standards for patient identification and assures accuracy by verifying the five rights of medication administration: *right medication, right dose, right route, right patient, right time*; as well as ensuring required follow-up documentation, such as pain scale, is performed in a timely manner and accurately recorded. Additional modules that run on the same handheld device include phlebotomy specimen collection, blood product administration, mother-baby breast milk matching and vital signs collection. For more information, visit **www.intellidotcorp.com** or e-mail **information@intellidotcorp.com**.

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Eliminating Phlebotomy and Transfusion Errors with Barcode Point-of-Care Technology

IntelliDOT®

Introduction

A mislabeled vial of blood – caused by inaccurate identification of the patient at the time of collection – can result in the wrong diagnosis, delay in treatment and overall poor quality of care. Even worse, a unit of blood administered to the wrong patient can transform a life-saving transfusion into a life-threatening medical error that puts the patient at risk for serious injury or death.

Patient safety continues to be at the forefront of healthcare industry initiatives in U.S. hospitals, especially in the area of bedside medication administration and blood transfusion accuracy. Yet in recent years, healthcare industry watchers have noted that phlebotomy errors are rarely caught or reported and most hospitals have not implemented specific technology to improve patient safety during these processes.

Without safety technology in place to assure phlebotomy workflow accuracy, hospitals are at greater risk for phlebotomy and even transfusion errors. These errors are caused simply because humans perform complicated phlebotomy tasks repetitively for multiple patients in pre-analytical processes. And errors can occur before, during and after a transfusion. Establishing clear phlebotomy processes with safety checks and improving communication among all caregivers involved are critical to improving patient safety in this area.

This white paper will examine the common areas where phlebotomy and transfusion errors occur and how a lack of consistent, safety-driven workflow guidelines contributes to these errors. It will also explore how barcode point-of-care (BPOC) technology – similar to BPOC for medication administration – can eliminate human error at the bedside and in documentation. To conclude, this paper provides guidelines for evaluating a BPOC solution dedicated to phlebotomy and transfusion workflow.

Where phlebotomy and transfusion errors happen and why

Most specimen collection errors happen at the bedside where busy phlebotomists or nurses may fail to confirm the patient's identity or mislabel a specimen tube. These errors also affect lab processes, such as when a specimen is rejected by the lab due to errors in phlebotomy technique. Such errors can lead to incorrect or inaccurate results, which in turn may lead to a wrong diagnosis or treatment plan, perhaps causing the patient to undergo unnecessary procedures. In all cases, the right care is delayed, causing emotional and physical stress to the patient.

Transfusion errors on the other hand, are almost always life threatening as this tragic example illustrates. As reported by CBS affiliate WKMG, in March 2008 a patient at Orlando Regional Medical Center bled to death as a result of what state officials called a "suspected transfusion error" after being given a blood transfusion of the wrong blood type. According to a report by the Agency for Healthcare Administration, a patient in the emergency room required O-positive blood and after a proper initial unit was transfused, two more units were requested. The patient was then given two units of A-positive blood that was left over from another patient, the report said.

Eight units of Type A blood were prepared for the other patient but only six were used, the report said. The report by the Agency for Healthcare Administration reveals that there was "no documentation of what was done with the additional two units of blood." Less than an hour later, the patient requiring O-positive blood arrived at the emergency room and was later given the wrong type of blood. When doctors ordered more blood, the nurse realized the transfusion error. The ID tag for the A-positive blood was found on the floor and another nurse who hung the blood did not notice it was the wrong type because of the missing tag, the report stated. The patient died several hours later.

Fatal transfusion-related errors like this and general specimen collection errors overall may not be as numerous or as widely reported as medication administration errors, but they are typically fatal to patients, causing incredible anguish to their families and their caregivers. While this real life example came from a U.S. hospital, recent research indicates that this problem is also a global healthcare concern.

Findings cited in *Serious Hazards of Transfusion*, a 2005 report by the Manchester Blood Centre, Manchester, U.K., indicated that, "the risk of an error occurring during transfusion of a blood component is estimated at 1:16,500, an ABO incompatible transfusion at 1:100 000 and the risk of death as a result of an incorrect blood component transfused (IBCT) is around 1:1,500,000."

With approximately 15 million units of blood administered in the U.S. annually across 5,500 hospitals, it is clear that transfusions errors are being made – with most of the consequences being life threatening. Recognizing the key areas where blood product administration errors are most likely to occur is the first step to eliminating them and improving patient safety.

The Joint Commission International Center for Patient Safety has identified the following "root causes" that drive the risk of adverse outcomes of blood transfusions as cited in its *Sentinel Event Alert Issue 10 – Blood Transfusion Errors: Preventing Future Occurrences*:

- "Patient assessment such as incomplete patient/blood verification

- Patient assessment such as the signs and symptoms of a transfusion reaction not being recognized

- Care planning such as no informed consent for a transfusion

- Laboratory procedures such as multiple samples crossmatched at the same time or a crossmatch being started before the order was received

- Staff-related factors such as insufficient orientation and training or insufficient staffing levels

- Equipment-related factors such as blood for multiple operating room patients being stored together in the same refrigerator

- Information-related factors such as incomplete communication among caregivers or patient identification band, specimen label or blood label errors"

In the same report, The Joint Commission also recommends strategies for reducing the risk of human error with an emphasis on redesigning transfusion-related procedures and the technical systems that support them. Several recommendations specifically support the need for technology such as a dedicated BPOC system for blood product administration, including:

- System redesign efforts such as enhanced computer support and corresponding barcoded patient identification band system

- Not using the patient's room number to identify blood samples or transfusion units

- Considering the use of blood-specific identification bands for patients receiving blood transfusions

- Introducing a computerized verification step into the process

Most telling of all in the *Sentinel Event Alert* is the expert recommendation by Kathleen Sazama, M.D., J.D., professor of pathology and laboratory medicine at MCP Hahnemann University in Philadelphia. The *Sentinel Event Alert* stated, "Sazama says that organizations should use a handheld barcode reader to read both barcoded wristbands on every patient and a barcode identifier on the tag of the (blood) components (to be administered). If the barcode reader fails to confirm the identity between the wristband and the tag, then the healthcare worker cannot proceed with the transfusion."

Improving phlebotomy and transfusion processes with BPOC

The purpose of BPOC solutions designed for phlebotomy specimen collection or blood product administration is to assist nurses, phlebotomists and laboratory personnel in a number of ways. BPOC solutions assure blood samples are drawn from the correct patients, assist laboratory personnel in accurate matching of blood samples with correct blood or blood products, and assist nursing personnel in assuring that blood or blood products are administered to the correct patient. It also enables the immediate documentation of any adverse reaction data when needed.

A handheld BPOC system for phlebotomy specimen collection, for example, can help nurses and phlebotomists raise the bar for patient safety by getting blood draws right the first time and every time. Scanning the patient's wristband first ensures identity before the samples are drawn. Then, the system provides other workflow prompts that ensure accurate documentation, collection and labeling. Ideally, the BPOC system has a wireless printer for printing collection tube labels at the bedside, thus eliminating specimen-labeling errors.

In an ideal transfusion scenario, phlebotomists and nurses use a wireless handheld BPOC system that they can easily transport to the patient's bedside. When an order is issued for a type and crossmatch in anticipation of a possible blood transfusion, the phlebotomist first scans the patient's wristband to verify identification. He or she then draws the blood and correctly labels the specimen collection tubes at the patient's bedside with labels printed at bedside directly from a portable wireless printer. Once the sample arrives in the blood bank, laboratory personnel use the BPOC device to scan barcodes on the patient's blood sample tube and the crossmatched blood product, assuring a match in the system software.

Once the type and crossmatch is completed, the blood bank notifies the patient's nurse that the blood is ready for pick-up. Some BPOC systems use the same handheld devices to communicate this information to the nurse. When the order to transfuse the blood component is received, the nurse again scans the patient's wristband and the barcode on the blood unit to verify a match. If there is no match, the BPOC system will not allow the transfusion procedure to continue. However, if the match is confirmed, the BPOC device can be configured to prompt the nurse to obtain a second nurse to witness the procedure. Some BPOC systems then prompt the nurse to record baseline vital signs, and ideally, the system should also prompt the nurse to check on the patient at predetermined intervals during the transfusion to assure any changes in patient condition are detected.

Choosing a best-in-class phlebotomy BPOC solution

According to several recent publications, nurses often "work around" inefficient software workflows and inconvenient, or hard to use BPOC hardware. Consequently, easy-to-use systems with smooth workflows are desirable to drive fast adoption among caregivers. This is one of the top features to look for in a BPOC solution for both specimen collection and blood product administration. Even a system with the best safety prompts cannot save lives if phlebotomists and nurses find it difficult to use. A wireless BPOC system with a lightweight handheld scanning unit and wireless printer accessory is preferable to bulky computers on wheels (COWs) that are difficult to bring directly to the bedside. In addition, system prompts should make it easy for caregivers to complete all safety checks and documentation. With a well-designed system, workarounds can be virtually eliminated if the BPOC system meets all of the above characteristics for ease-of-use.

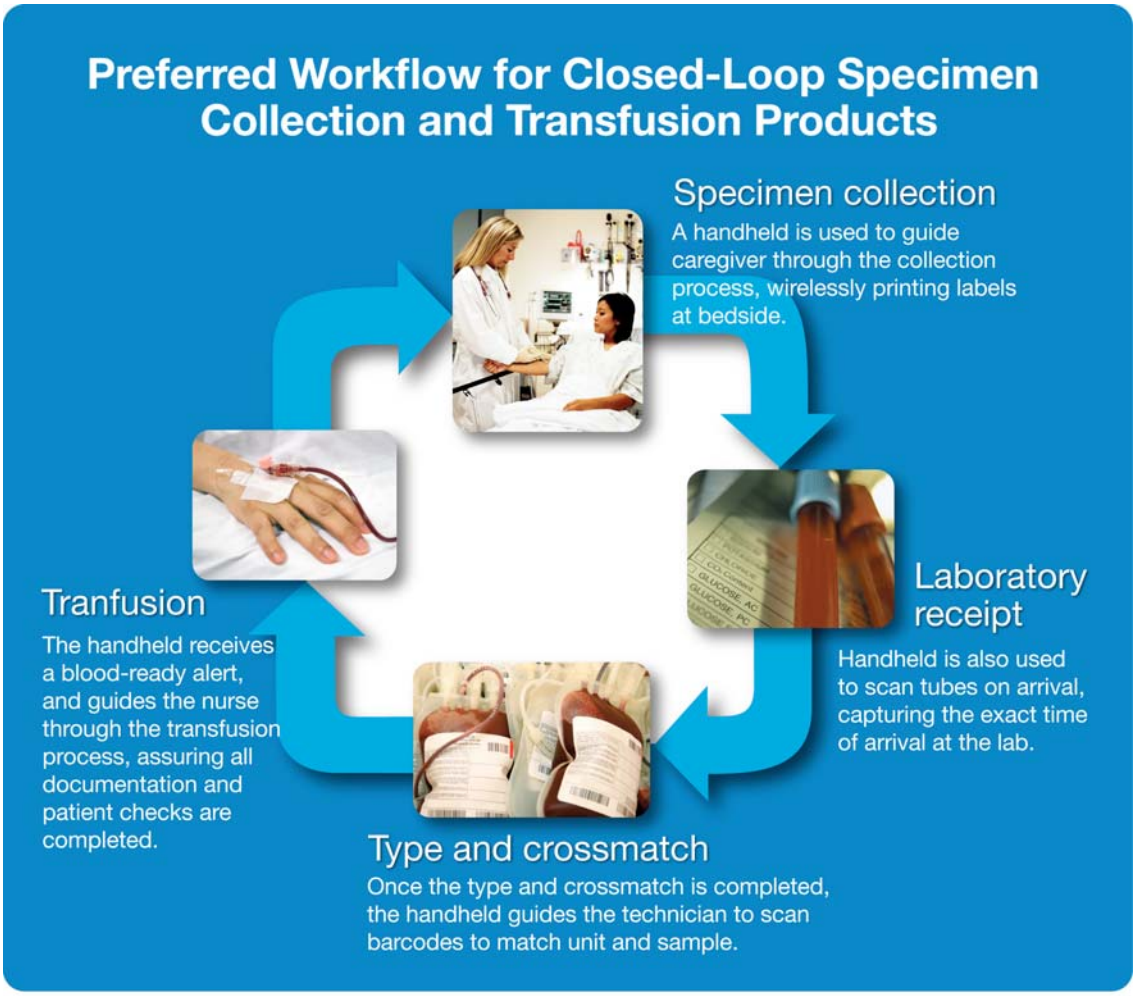
Best-in-class BPOC solutions for specimen collection and blood product administration must also meet The Joint Commission standards for patient identification and assist in ensuring accurate management, administration and documentation of blood/blood product administration in the following ways:

- Matches patient wristband barcodes to blood sample label barcodes printed and adhered at the bedside
- Assists laboratory personnel with matching blood product label barcodes and barcodes on specimen tubes at type and crossmatch
- Prints an accessory "bag tag" for the blood/blood product, which further identifies the blood/blood product for the correct patient
- Prompts blood bank professionals to confirm that the label matches the tag before attaching it to the blood product bag
- Audibly and visually alerts nurse if there is a blood product tag to patient wristband mismatch prior to blood/blood product transfusion so the transfusion does not continue

The system should also incorporate multiple workflows including blood acquisition, crossmatch and transfusion to ensure prompt and accurate patient observations and documentation.

Other key features to look for include:

- Fast, expert clinical implementation that ensures the adoption of policies and procedures that assure safe practice and work with the new technology
- Ability to interoperate with any pharmacy or Healthcare Information System
- Ability to be configured to accommodate common variations in clinical workflows
- Industry-leading service and support from a vendor with a specialty in BPOC



Conclusion

Using a BPOC system that provides clear, step-by-step guidelines for safe blood product administration and documentation can prevent transfusion errors. Simply scanning the label on the unit of blood before administration could have saved the life of the ER patient in Orlando. BPOC can also help hospitals stop pre-analytical laboratory errors at the bedside with a solution for phlebotomy specimen collection.

As hospitals consider or implement BPOC for medication administration they should also seriously consider including the patient safety benefits of similar, complementary systems for specimen collection and blood product administration. The results of observational studies on well designed and well-implemented medication administration systems have been compelling.

For example, a "before and after" observation of 250 medication administration procedures at Southwest Mississippi Regional Medical Center in McComb, MS, proved that IntelliDOT Bedside Medication Administration™ (IntelliDOT BMA™), a wireless handheld BPOC system, helped the hospital reduce total errors (right medication, dose, patient, route and time) from 68 (27.2 percent) to 3 (1.2 percent - timing errors only), and reduced potential Adverse Drug Events from 2 (0.8 percent) to 0. Thanks to the alerts in IntelliDOT BMA, three near misses were caught. In addition, 100 percent of patients are identified by barcode wristbands per hospital policy and Joint Commission standards. Clinical charting is also 100 percent compliant. The hospital plans to add IntelliDOT Blood Product Administration™ as an integrated module.

The bottom line is that BPOC systems are not created equal and hospital management should carefully listen to the requirements of their phlebotomists and nurses – as well as consider patient safety recommendations by The Joint Commission – before selecting a vendor and a system.

Most of all, as experience with BPOC for medication administration has proven, BPOC systems for specimen collection and blood product administration must be easy to use, easy to transport and intuitive so that caregivers will actually use it. This assurance not only saves patient lives, but also protects the hospital's investment in new technology – not to mention its reputation for providing safe care.

About IntelliDOT

The IntelliDOT System is a best-of-breed wireless, workflow manager that connects caregivers with the information systems they need at the point-of-care. Designed by nurses for nurses, the IntelliDOT System enables clinicians to perform safety checks and safely administer and document medications at the bedside using a lightweight, handheld device. The IntelliDOT System satisfies Joint Commission standards for patient identification and assures accuracy by verifying the five rights of medication administration: *right medication, right dose, right route, right patient, right time*; as well as ensuring required follow-up documentation, such as pain scale, is performed in a timely manner and accurately recorded. Additional modules that run on the same handheld device include phlebotomy specimen collection, blood product administration, mother-baby breast milk matching and vital signs collection. For more information, visit **www.intellidotcorp.com** or e-mail **information@intellidotcorp.com**

Overcoming Obstacles to BCMA Adoption and Usability

In recent years, there has been a growing consensus among most acute care hospital professionals that barcode medication administration (BCMA) technology used for medication administration safety and other bedside procedures promises many patient safety benefits and a healthy return on investment. However, recently completed studies[i] indicate that many of these systems have not delivered on these promises on both counts because nurses are reluctant to use it or will use only part of the BCMA functionality.

There are several points of view on why nurses circumvent this potentially lifesaving technology. Some contend that nurses are fierce patient advocates and in order to complete critical tasks in a timely manner must take shortcuts to complete patient care. Others say that nurses are simply looking to short-cut procedures for convenience and do not have the time to learn to use the equipment correctly. In either case, one can only assume that nurses "work around" the BCMA functionality because the correct pathway was less desirable to use than the pathway chosen.

At the core of the workaround issue is the realization that nurses find it too difficult or cumbersome to follow the correct procedure to get the job done within the allotted time for each patient. Complex BCMA technology is at least partly to blame causing nurses to take these workarounds because they are simply overwhelmed and cannot deal with convoluted BCMA processes. Additionally, many nurses also do not have a high tolerance for difficult-to-use systems or difficult procedures. Even a quick survey of hospitals using these systems reveals that bad experiences with BCMA products and systems have been the rule rather than the exception, mainly because many BCMA developers have not taken the time to understand nurse workflow.

Therefore, chief nursing officers and administrators searching for a resolution to the workarounds issue must look beyond merely "nurse cooperation" with hospital policies, since that is not the core issue that needs to be resolved. Instead, workarounds are a symptom of the fundamental problems with poorly designed and executed clinical IT processes, equipment, and installations.

This white paper will address ways that hospitals can overcome the obstacles to BCMA adoption through improved BCMA system usability and implementation. The paper will explain how well researched and designed products implemented by an experienced team will result in a significant reduction of nurse workarounds and considerable improvement in patient safety.

This paper will also examine how a BCMA solution that has well-designed hardware that is mapped to well-designed processes can boost usability to above 95+ percent compliance – and help hospitals achieve top return on investment while meeting patient safety goals.

What is BCMA?

While the features may vary, in general BCMA systems are made up of either wireless handheld or tethered scanning devices linked to an electronic database of medications prescribed by the physician. The scanning devices are used by nurses to read barcodes on patient ID wristbands and prescribed medications, as well as verify the five rights of medication administration: right patient, right medication, right dose, right administration route, and right time. Once completed, the system documents the administered medication. The administering nurse's identity is also confirmed by scanning his or her ID badge.

Once the administration is complete, the completed administration information is sent through an electronic interface to the patient's electronic medication administration record (eMAR). Nurses, physicians and other clinicians can view the orders either on the screen of a handheld device or on a laptop or computer on wheels

To enhance patient safety, more advanced BCMA systems provide personal handhelds for each nurse. The handhelds can be configured to trigger visual or audio alerts reminding the nurse when medications or related tasks are due. While some BCMA systems require nurses to share handhelds and do not provide alerts, those that do offer a significant advantage. Alerts can be configured during medication administration to warn of an incorrect medication, when the patient ID barcode does not match the medication barcode, or if the order and the medication/dose do not match. These alerts are intended to stop the nurse from administering the medication and provide the opportunity to correct whatever is wrong, avoiding a life threatening error.

Workarounds and low usability – symptoms of poor BCMA design

Hospitals adopt BCMA technology primarily to eliminate serious medication administration errors and complete medication administration records, but there's a catch – nurses and other caregivers must use the system consistently and correctly in order to achieve the patient safety benefits.

In 2006, a nurse at a Madison, Wisconsin hospital admitted to not using the facility's barcode system when she thought she was infusing a dose of penicillin into an IV line placed in the hand of a 16-year-old pregnant patient who was in labor. Instead of administering penicillin, the nurse mistakenly infused an epidural anesthesia drug – intended for a spinal nerve block – into the IV line. Within five minutes the patient had a seizure, followed by cardiac arrest. She died despite heroic efforts to save her. Federal investigators found that using the barcode system at that hospital was "policy but not practice" according to a televised news report.

This tragedy could have been avoided had the nurse scanned the barcode on the medication she intended to infuse prior to administering it. The news report did not say why the nurse did not use the hospital's barcode system, nor did it reveal the name of the system. But recent research on BCMA system usability and workarounds has identified multiple reasons why nurses either refuse to use BCMA or find ways to get around the medication administration procedures. In most cases, however, the problem of difficult-to-use software and hardware lies in the poor design of the BCMA system that makes nurses less likely to use it correctly since, in their opinion, the system is a barrier to safe patient care rather than an enhancement.

"Workarounds to Barcode Medication Administration Systems: Their Occurrences, Causes, and Threats to Patient Safety", a research article by Ross Koppel, PhD, et al published in the July/August 2008 issue of the Journal of American Medical Informatics Association, examined the use of BCMA systems developed by two major Healthcare Information System (HIS) vendors between 2003 and 2006. The article cites 15 types of system workarounds and 31 probable causes for them. The authors link the workaround of administering medications without scanning them to 19 of the 31 causes.

Omitting key medication administration process steps or performing these steps out of sequence makes up one of the key categories of system workarounds that threaten patient safety. These include:

- Failure to scan patient ID wristband
- Failure to scan medications
- Failure to follow system prompts or alerts
- Failure to visually confirm the medications and the eMAR orders

The report also identified these major workarounds – affixing duplicates of patient ID barcodes to computers on wheels key rings, belt rings, or nursing stations so that nurses could pre-scan all medications prior to entering the patient's room and administering them at the bedside.

While the various methods of working around the system provided a graphic picture of the methods used by nurses to shortcut their BCMA system, the reasons for the workarounds documented by the researchers provided insight into their resolution.

According to the article, of the 31 reasons why nurses work around the system:

- 11 were found to be directly related to the technology used – i.e. the BCMA software and hardware itself. Examples include battery failure, difficult to read screens, etc.

- 3 were attributed to BCMA system workflows. Examples included circumventing slow processes and unfamiliar workflows, which affect nursing workflow.

- 11 were "organizational" causes – where hospital policies were not consistent with good BCMA practice. Examples included barcodes not on patient medications since the hospital had no procedure in place.

- 3 were "patient related". Examples included vomiting, refusal to take meds, etc.

- 3 were "environmental causes". Examples included lack of wireless connectivity in certain areas, computers on wheels not able to get to bedside, etc.

For many of the reasons cited above, the issue isn't noncompliant nurses, but rather, badly designed technology which doesn't take the nursing workflow into consideration. This makes it difficult for even the most conscientious nurse to use BCMA solutions efficiently.

In addition to the technology related reasons cited by the article, heavy and bulky computers on wheels that are difficult to get in and out of small hospital rooms – not to mention close to the bedside – can encourage workarounds. Even handheld PDA systems with small hard to read screens and as many as 40 buttons have proven too complex to learn quickly and use daily in an often chaotic work environment. In addition, short battery life and battery failure also contributed to the poor usability of these systems.

What nurses want in BCMA

Healthcare industry watchers are finding that, first and foremost, nurses want to spend more time directly caring for their patients. In theory, they know that information technology such as barcode systems can help them do that, but they are adamant about wanting IT solutions that adapt to their workflows.

As writer John Pulley reports in his March 24, 2008 article published in the online edition of Government Health IT, *"What nurses want. Frontline caregivers are calling on developers and policy-makers to shape clinical IT to their needs"*, the American Academy of Nursing's Workforce Commission surveyed nurses and other caregivers at 25 hospitals across the U.S. about what they would consider ideal IT solutions for healthcare. Among the top 10 solutions on their wish list, several applied specifically to BCMA and other bedside procedures:

- Computerized order entry systems (CPOE) to eliminate errors caused by illegible handwriting

- Touch-screen or voice-activated technology to facilitate documentation
- Automated downloading of the patient's vital signs to the electronic health record
- Wireless and hands-free applications
- A single device for multiple point-of-care functions, rather than separate devices for each

Most importantly, the nurses surveyed wanted technology designed to enhance their workflows rather than changing or disrupting them. Pulley quotes Connie White Delaney, dean of the University of Minnesota's School of Nursing, who said that nurses will be very receptive to "clinical information systems that are truly responsive to patient care situations and . . . [particularly] applications that truly have been built to integrate into workflow processes." (The entire article can be found at www.govhealthit.com.)

What to look for in a BCMA solution for high usability

When planning the implementation of a BCMA system, hospital leaders must ask for and heed the input from the nursing staff to ensure that nurses will consistently use the new technology – first and foremost for patient safety, as well as to hedge against lost return on investment. To minimize workarounds, Koppel and colleagues specifically recommend that "evaluators and implementation teams should work with technology vendors to align hardware, software, user, policy, workflow, and patient safety needs. But hospitals must maintain ultimate control."

The following BCMA system features and functionality are characteristic of systems that promote high usability and virtually eliminate workarounds:

- Well-designed and well-integrated hardware and software in one package for better usability and reliability
- System design should be based on input from nurses – systems truly designed by nurse focus groups can greatly enhance workflow design
- Easy-to-read displays are a must for an aging US nursing population approaching 50 years old
- A lightweight handheld device which is easy to carry and can be placed in a pocket
- One-handed operation that leaves one hand free for patient care

- Fast-learning curve – ideally nurses should be able to learn usage in less than one shift
- Configurable workflows, particularly for workflows that vary from unit to unit
- Pharmacy order verification function to assure order entry consistency and overall accuracy as compared to the Physician's order
- Checks for drug-drug interactions and drug allergies, particularly for emergency orders or orders occurring when a pharmacist is not available for screening
- Automatic posting to medication administration documents
- Optional add-on modules for vital signs collection, phlebotomy specimen collection, blood product administration, and mother-baby breast milk matching – all in a single device
- Real-time wireless links to patient electronic records
- 12+ hour battery life that lasts an entire nursing shift
- Seamless communication with any pharmacy system and HIS
- Fast, accurate implementation process that includes planning and design sessions that eliminate procedural opportunities for workarounds
- Implementation by professionals with core BCMA experience

The user-friendlier the system – and the more it complements nursing workflows – the more likely that usability will be high and workarounds will decrease.

Case study: Southwest Mississippi Regional Medical Center

Southwest Mississippi Regional Medical Center (SMRMC), McComb, MS, started looking at BCMA safety systems as early as 2000. However, the evaluation committee made up of nursing, pharmacy and IT staff rejected each one as being too difficult to use. The nurses said they knew they wouldn't use them.

SMRMC required that the new BCMA system had to be user friendly, adapt to many of the nurses' existing workflows and be easily adoptable so that nurses would use it. In December

2005, the committee evaluated several vendors with the latest generation of BCMA solutions. This time they found a system that everyone agreed on and really wanted to use: IntelliDOT BMA™, part of the CAREt® System.

The CAREt handheld unit is very small and lightweight and fits easily in the nurse's scrub or lab coat pocket. The unit has a simple, point-and-press operation – just hit the OK button to verify information. Nurses can operate the keypad with only one hand, leaving the other hand free during medication administration to assist the patient with their water, juice or other tasks. The straightforward, easy-to-use handheld makes workarounds unnecessary. Nurses scan and click through medication administration and documentation effortlessly. A bright, easy-to-read LED light system keeps them on track – for example, yellow means additional documentation is required. This step is easily accomplished using IntelliDOT's "Documentation of Treatment" or DOT System – simply scan to document common responses.

"Our compliance is a steady 96-97 percent," said Katie McKinley, Assistant Administrator, Nursing Services at SMRMC. "As long as we have patient emergencies, we're going to have a handful of meds that are documented on a computer workstation away from the bedside, and not documented with the CAREt handheld, but I think the compliance rate speaks for itself. Our nurses are using it and using it consistently."

Case study: Parkview Medical Center

In 2004, Parkview Medical Center, Pueblo, CO began to look for new barcode technology for bedside medication administration to take the hospital to the next level of efficiency and patient safety.

CNO Eileen Dennis and the hospital's quality team had specific requirements for a BCMA system and so did the Parkview nurses. They didn't want to be tied to computers on wheels, but many of the solutions at the time were tethered, bulky and complicated to use. "We wanted something that was more convenient and easy for the nurses to use," Dennis said. "The IntelliDOT System appealed to us because it was wireless, small, and handheld."

Dennis is strict about reporting and does not allow non-compliance when it comes to using the IntelliDOT System. She and her nursing directors review monthly reports and the nurses themselves receive "report cards" to let them know how they're doing in regard to using the system.

Dennis believes that a hospital's administrative team is responsible to the patients to ensure that nurses use the IntelliDOT System. "When you put in any system that is meant to make patent care

safer, the administrators must make sure that it is being used and that there are no workarounds," Dennis says. "User compliance is well above 99 percent. The IntelliDOT System really does catch the errors and you can see that in the number of times that a nurse will cancel out and go back to check the orders."

Conclusion

In order for a BCMA system to be quickly adopted and used by nurses, it must be designed to prevent workarounds. Each workflow must be designed to work with the nurses and not against them – essentially working the way nurses work. Hard-to-use systems will result in nurses not using BCMA or using it partially with workarounds as a result, negating any patient safety benefits and causing the investment in BCMA to be a waste of time and money.

Good BCMA design makes all the difference between a nursing staff that relies on workarounds and one that uses BCMA nearly 100 percent of the time to reduce serious errors at the bedside to zero.

About IntelliDOT

The IntelliDOT System is a best-of-breed wireless, workflow manager that connects caregivers with the information systems they need at the point-of-care. Designed by nurses for nurses, the IntelliDOT System enables clinicians to perform safety checks and safely administer and document medications at the bedside using a lightweight, handheld device. The IntelliDOT System satisfies Joint Commission standards for patient identification and assures accuracy by verifying the five rights of medication administration: *right medication, right dose, right route, right patient, right time*; as well as ensuring required follow-up documentation, such as pain scale, is performed in a timely manner and accurately recorded. Additional modules that run on the same handheld device include phlebotomy specimen collection, blood product administration, mother-baby breast milk matching and vital signs collection. For more information, visit **www.intellidotcorp.com** or e-mail **information@intellidotcorp.com**.

[i] *Journal of the American Medical Informatics Association* (JAMIA) by Koppel et al, "*Workarounds to Barcode Medication Administration Systems: Their Occurrences, Causes and Threats to Patient Safety*", July 1, 2008

Interfaces to Barcode Point-of-Care Solutions: What CIOs Need to Know (That HIS Vendors Won't Tell Them)

IntelliDOT®

Introduction

The conversation usually goes like this:

CIO: *We're looking at XYZ's best-of-breed system for bedside medication administration. It provides the best clinical functionality we've seen. Do you have an interface for that system?*

HIS vendor: *No, and it's impossible to build one. Even if you found someone to do it, it would cost you hundreds of thousands of dollars to have this developed. And then you'd have the headache of dealing with yet another vendor when the interface goes down – which it will. Go with our integrated module – and we'll give you a great discount. It's completely integrated with our database and with the rest of our systems so you can rest easy.*

CIO: *But our clinical teams, including our CNO, nurses and pharmacy staff, have already told us that your system lacks the clinical functionality XYZ offers – and yours is not as easy to use.*

HIS vendor: *Oh, they'll get used to it. They'll have to. An integrated solution is the only way you'll be able to proceed*.

Sound familiar? The truth is that interfaces ***do*** work. They are used successfully at a growing number of hospitals across the nation, integrating best-of-breed systems – such as third party barcode point-of-care (BPOC) solutions – with existing Healthcare Information Systems (HIS). Interestingly, when you dig deeper into the so-called integrated solutions offered by some HIS vendors, you'll find that they also operate from separate databases. They are no more integrated than the third-party systems.

Studies show that BPOC medication administration solutions, when implemented and used effectively, can help hospitals improve patient safety by eliminating medication errors at the patient's bedside. Many major HIS vendors now offer a barcode medication administration system as an add-on. Usually, these systems are tethered computers-on-wheels (COWs) or off-the-shelf PDA-type devices that have proved difficult to use and configure for nurse workflows.

While these systems are intended to eliminate medication errors, nurses frustrated with difficult workflows often balk at using them. As this frustration increases, they work around the system, and in some cases completely defeat the patient safety checks. In other cases, the systems allow nurses to work around warnings and safety prompts in the name of efficiency, with the result

being that patients are still at risk for preventable errors. The ultimate pain for a CIO is going through the expense and disruption of installing a clinical system, only to have the clinicians refuse to use it – or work around it so that promised efficiency and safety gains are not realized.

There are BPOC options available from third-party vendors that are more compatible with nurse workflow – and meet the practical requirements imposed by nursing. However, many CIOs are reluctant to work with a dedicated BPOC vendor because of the perceived complexity involved with interfacing their HIS with a third party application.

Of course, many HIS vendors capitalize on this hesitance: they could insist that no interface is available, or, if there is one, suggest it won't work reliably or would be astronomically expensive. HIS vendors continue to preach the *integration is better* sermon, but CIOs should be cautioned that this is a false doctrine.

The reality is that there is no single vendor who can provide everything a hospital needs in today's diverse healthcare environment. Furthermore, as the industry evolves and moves closer toward a universal health record for all citizens, the need for interoperability among systems will continue to increase. This reality is driving development of interfaces that are easy to implement and maintain.

There is no reason for CIOs to continue to sit on the fence and worry about interfaces when it comes to implementing a BPOC system. Functional, reliable interfaces are widely available and are being used successfully to provide precise data imports to a number of core healthcare information systems.

This white paper will explore the common misconceptions about interfacing third-party BPOC systems with an existing HIS. It will discuss the similarities and differences between interfaces and integrations, and how both approaches can lead to a successful marriage of best-of-breed BPOC systems with an existing HIS. The paper will also arm CIOs with the facts about how BPOC interfaces are created, how they work, and how some U.S. hospitals are successfully using them with the major HIS providers today. It will also look at the future of healthcare and the role that interfaces will play in connecting U.S. hospitals. Also included are tips for CIOs who are having conversations with their HIS provider about BPOC.

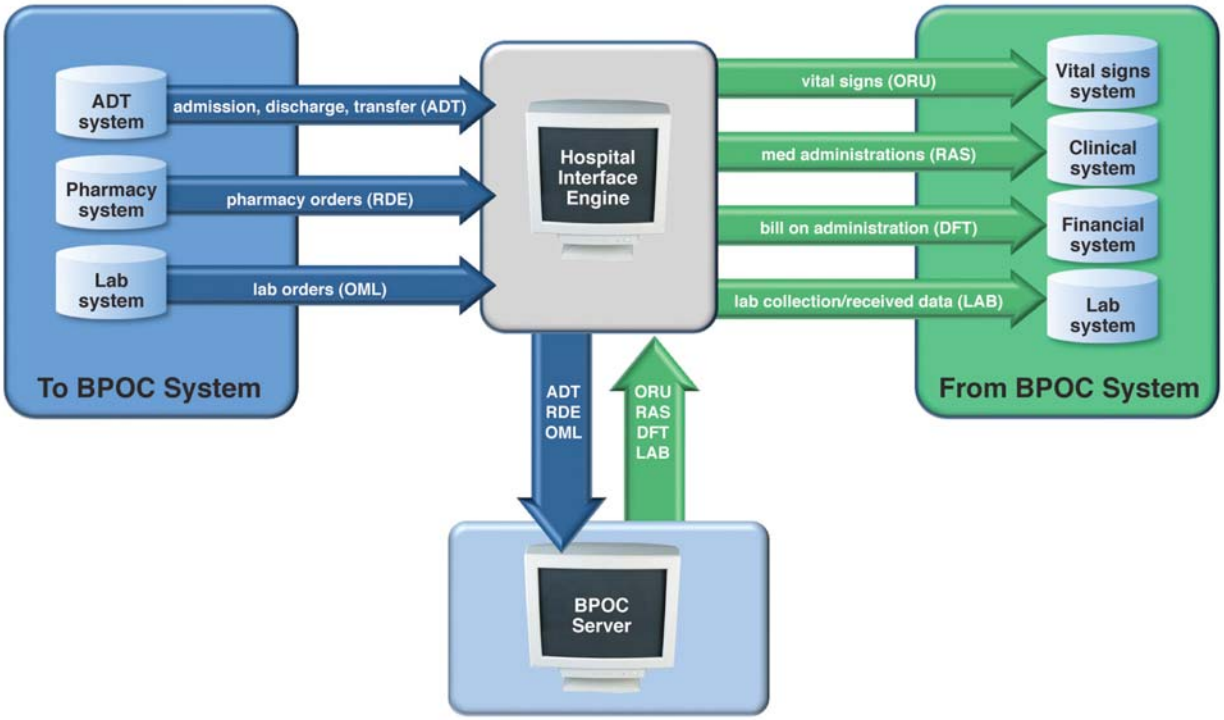
Interface vs. integration: what is the difference?

When listening to some HIS conversations, it can appear that *interface* has become a dirty word in healthcare IT. This stereotype paints a picture of interface links that are fraught with daily crashes, frustrated technicians and angry nurses, while integration conjures up images of maintenance-free systems that require little attention. Neither perception is accurate. Each approach, in fact, has pros and cons. The important question is this: which approach – and which BPOC product – best moves the hospital toward its goal of eliminating medication errors and saving patient lives?

First let's look at a typical interface between a BPOC system for bedside medication administration and a major HIS.

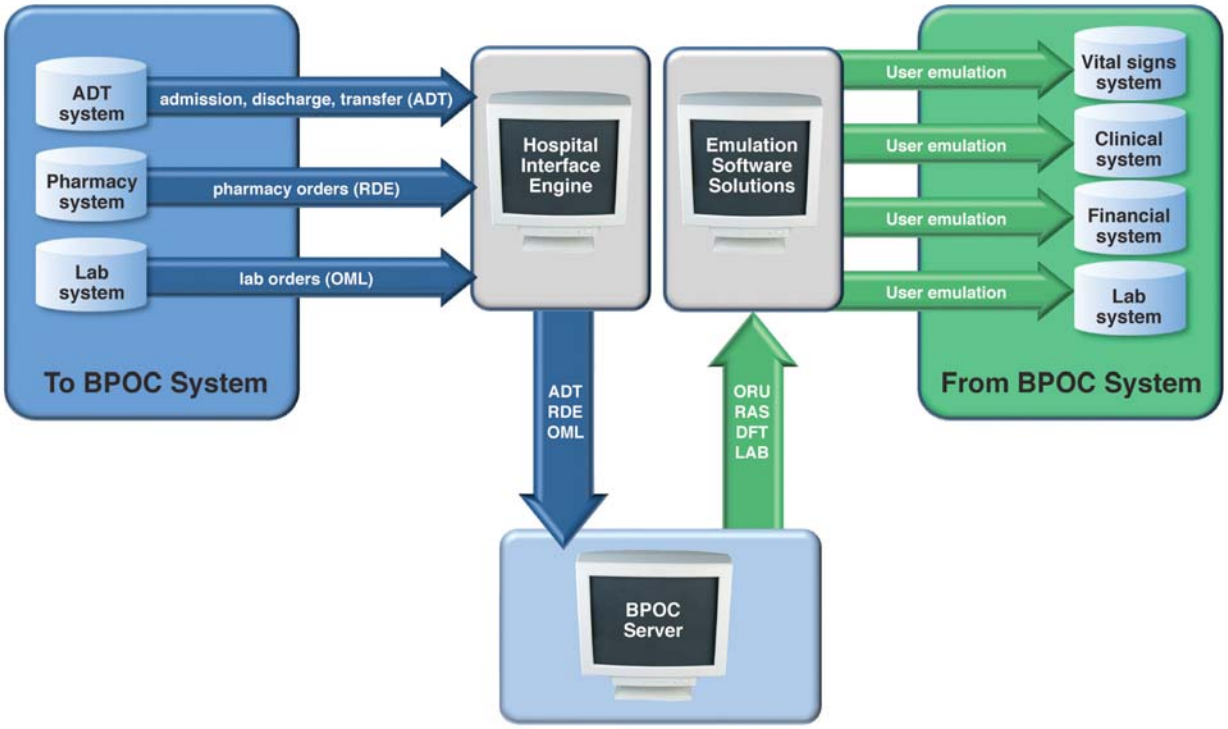
An interface has the capability of sending information from one operational information system to another. For example, medication administration data is captured at bedside by a wireless handheld BPOC unit. The data is routed back to a central server and exported to an interface engine, which translates the data into an acceptable (i.e. HL7) format and transmits it to the core HIS for documentation in the medication administration record (MAR).

Interface example 1



Additionally, a best-of-breed BPOC system can transmit data to an HIS using emulation software, such as Boston WorkStation, as the application integration engine. This type of interface uses the existing workstation-based user interface as the base for a high-speed data transmission, which sends data in formats similar to a user entering it manually. In essence, this method passes data quickly and efficiently, with outcomes similar to the interface engine example above. Messages are sent from the BPOC server to the emulation software which then logs into the HIS client software and performs the documentation task.

Interface example 2



Both of these interface processes are transparent to the nurses and other caregivers who use the BPOC system, and meet the goal of providing rapid documentation of medication administration on the host system's electronic MAR. These two interface processes can be mixed and matched to suit the interface requirements of the host systems. In addition, in terms of security and privacy compliance, interfaces are as secure as the entire network and the access to it.

Conventional wisdom would say that integration in its purest form exists when the BPOC system is a bolt-on module from the same HIS vendor. In fact, many of these so-called integrated products have actually been acquired from other companies and then interfaced with the core system. Many large HIS vendors purchase new modules as a means of expanding their HIS

software suites. Even when modules are built in-house by the HIS vendor, they are typically built over many years and require interfaces. Often, the one-database-approach is just not viable. Consequently, CIOs should be aware that, in many instances, these vendor-provided solutions actually communicate with the host HIS system using the same standard HL7 interfaces as those from independent best-of-breed providers.

The fact that some HIS systems use these interfaces as their internal communication method further validates that these companies can – and do – accept HL7 data, regardless of the make and brand of the software sending the message. In addition, other interface methods – for example emulation software solutions such as Boston WorkStation from Boston Software Systems – provide additional means to accomplish these interfaces. Therefore, conversations like the one at the beginning of this paper must be closely scrutinized to ensure that the HIS vendor has the hospital's best interest in mind.

Overcoming complexity

Another common perception is that best-of-breed BPOC systems are too complex to interface with an existing HIS system. The widespread use of interfaces in virtually all hospital environments speaks to their utility and reliability. However, as with all healthcare IT technology, it does take careful planning and preparation when interfaces are involved.

As with any IT project, working with a vendor who has proven success interfacing with the major HIS systems is key to assuring a good outcome. In a typical scenario, the vendor provides the hospital with a template specification outlining the data which can be transmitted through the interface. The hospital then provides the vendor with a completed specification document noting the data it wants to use. The vendor then works closely with the interface developers – at either the hospital or the third-party interface company – to determine how the messages should be formatted and what data should be available in each field. Once the interface scripts are installed, vendor engineers work with hospital staff to perform clinical interface testing. This task should be undertaken even when implementing an integrated solution.

Often, once the BPOC vendor has developed a message script for use with a particular HIS, the interface template can be replicated and/or customized for another hospital using the same HIS at a lower overall cost. In some cases, this process can be straightforward and the BPOC vendor may not need to make any changes to the existing interface code. Testing of the interface is required; it is usually performed on-site. In choosing a BPOC vendor, attention to interfaces, including test plans and guarantees, should be an important consideration.

Tips from a successful CIO: Roger Neal, Duncan Regional Hospital

Roger Neal, Chief Information Officer, Duncan Regional Hospital, Duncan, Oklahoma has successfully led an implementation of a BPOC system for bedside medication administration which interfaces with MEDITECH Magic, the hospital's HIS. He offers these tips for other healthcare IT leaders in working with HIS vendors and BPOC providers on interface projects.

1. Don't believe vendor hype and don't take no for an answer.

You may have a long-time relationship with your vendor, but don't believe the hype about interfaces being too difficult or impossible to implement. There is proof in the industry today of hospitals that are successfully using interfaces. In addition, don't believe that an integrated solution has a lower risk than an interface. With an integrated solution, only one vendor carries the risk. With an interface, two or three vendors may share the risk. In the end, don't be quick to abandon a superior BPOC product just because your HIS vendor claims that an interface is not possible – because it is.

2. Ask for the interface guide

At the same time we look at product demos, we ask the vendor for an interface guide that shows all of the HL7 information on the product. Ask the vendor about interfaces they have already done. Then give the interface guide to your interface partner so they can see what is needed and start creating a plan. There may be some extra development costs to get this done, but it is worth it. The better the planning, the better the end-product interface is going to be.

3. Have an open mind on product selection

As CIO, I try to keep an open mind on product selection and I encourage my team to do the same. Even though we are sold on our HIS system, we are also open to proven solutions from other vendors. At Duncan, we have learned that a decision should not be based strictly on whether we buy an interfaced product or an integrated product. We know we need to keep the bias out and pick the best product that will satisfy the needs of end users, and will actually be used consistently without any workarounds.

4. Get an SLA agreement

In our contracts with interface vendors, we usually ask for two things: a Service Level Agreement (SLA) that outlines how they will monitor our interfaces and what the response times will be. We want to make sure that no matter what side goes down, the interface will continue to queue up all the results or information so when it comes back up all of the data that was put into the system

while the link was down is transferred over. We don't lose any data. Most interface vendors today are used to providing 24x7, 365-days-a-year service.

5. Write it into all your new contracts

Any new contract or contract extension should include language stating that the HIS vendor will agree to interface with other vendors selected by the hospital, and that the costs of such interfaces will be reasonable and aligned with the costs normally charged by the HIS vendor for interfaces within its product suite.

6. Keep the goal of patient safety at the forefront

Interface or integration is not the question. Nor is cost. The question is: Is this a superior BPOC system that our nurses will use with 95 percent or more compliance? Not even the most affordable and easy-to-integrate system is the best choice if it doesn't do the job of eliminating medication errors. The system can't do that if the nurses don't use it. The choice of product should always come down to ***what is best for the patients and your frontline caregivers***.

The key truth is that no single vendor can offer a complete healthcare system in a fully integrated package. We need interfaces and should not be afraid to implement them to get the best product to meet our patient safety goals.

Conclusion: It's all about patient safety

Patient safety continues to be at the forefront of issues facing hospitals today and the need for reliable, easy-to-use BPOC systems for medication administration and other processes such as phlebotomy or vital signs collection has never been greater. Healthcare CIOs must be aware of all of the options available in the BPOC market space and not rely only on the advice – or discouragement – of their HIS vendors when considering a BPOC product that is not a part of the integrated HIS suite. Interfaces for best-of-breed BPOC systems with major HIS systems do exist today and they have been very successful.

Moreover, the push toward a universal health record for all Americans is another reason why hospitals should keep an open mind about interfaced clinical products. As hospitals get on board with integrated healthcare, not all will have the same HIS. Well-written, proven interfaces will be vital to the interoperability that will be required in the next generation of healthcare.

In the end, the priority is to provide the patient with the best and safest care. Therefore, it is the responsibility of the CIO – along with the Chief Nursing Officer, the Director of Pharmacy, and other clinical experts – to choose the BPOC product that will be best at eliminating errors at the patient's bedside. That product must be the one that nurses and other caregivers will use ***consistently*** without the desire to work around the safety prompts that are designed to save lives.

Despite what HIS vendors are saying, interfaces are here to stay. They will play an important role in providing the right products that meet the needs of the hospital enterprise, provide better service to the end user, and help achieve the vision of safe and efficient patient care.

About IntelliDOT

The IntelliDOT System is a best-of-breed wireless, workflow manager that connects caregivers with the information systems they need at the point-of-care. Designed by nurses for nurses, the IntelliDOT System enables clinicians to perform safety checks and safely administer and document medications at the bedside using a lightweight, handheld device. The IntelliDOT System satisfies Joint Commission standards for patient identification and assures accuracy by verifying the five rights of medication administration: *right medication, right dose, right route, right patient, right time*; as well as ensuring required follow-up documentation, such as pain scale, is performed in a timely manner and accurately recorded. Additional modules that run on the same handheld device include phlebotomy specimen collection, blood product administration, mother-baby breast milk matching and vital signs collection. For more information, visit **www.intellidotcorp.com** or e-mail **information@intellidotcorp.com**.