

## Point-of-care bar coded medication administration: experience in the United States

Ever since the 1999 Institute of Medicine (IOM) Report, *To Err is Human: Building a Safer Health Care System*<sup>1</sup>, hospitals have increased their focus on the prevention of medical errors especially those involving medications. This report noted that bar coding is “an effective remedy” for medication errors, a “simple way to ensure that the identity and dose of the drug are as prescribed, that it is being given to the right patient, and that all of the steps in the dispensing and administration processes are checked for timeliness and accuracy.” The IOM estimated the financial costs of drug-related morbidity and mortality at about \$77 billion a year. A second report by the IOM, *Crossing the Quality Chasm*<sup>2</sup>, urged that health systems begin a greater emphasis on adoption of technology to provide a safer, more efficient, and higher quality healthcare system. Although not the panacea for error prevention, the safe use of technology can provide a decreased reliance on manual systems of redundancies and the dependence on individual performance to prevent errors from reaching patients. Some of the technologies that can improve medication safety include: electronic prescribing (Computerized Prescriber Order Entry [CPOE]) with medication alerts and clinical decision support, automated drug storage and dispensing devices that include review of orders by pharmacists before medications are available as well as provide medication safety alerts to nurses, medication robotic storage and dispensing systems, and bar coded identification of medications before they are administered to patients (bar coded enabled point-of-care [BPOC]) systems. This last use of technology, BPOC, has been gaining popularity due to the number of errors that can occur at drug administration and the impact on error prevention at a vulnerable point in patient care.

The results of the *ADE Prevention Study*<sup>3</sup> revealed that one of the areas in which serious medication errors are most likely to occur is at drug administration. They noted that 39% of errors occur during the prescribing phase, 12% occur during transcription, 11% occur during dispensing, and 38% occur during administration. More importantly, they revealed that 48% of the prescribing errors were intercepted before they reached

patients but only 2% of the administration errors were intercepted. This would be expected since drug administration is the last line of defense. There are very few system safeguards at the point of drug administration whereas pharmacists and nurses may have several opportunities to intercept a prescribing error before it would reach the patient. A direct observation study of drug administration by Barker, et al. found an error rate of 19% (close to one in five doses of medications to be administered) in 36 health care facilities with 7% of these errors representing potential adverse drug events<sup>4</sup>.

With evidence mounting that BPOC systems could help prevent medication administration errors, the Food and Drug Administration (FDA) held a public hearing on a proposed regulation requiring pharmaceutical manufacturers to include bar codes on all medications. They subsequently published a regulation in March 2003 that went into effect in April 2004<sup>5</sup>. All new medications released after April 2004 must contain a bar code on the final package label and by April 2006 all existing medication labels must contain a bar code. The regulation was widely supported by healthcare trade and professional organizations as an impetus to move hospitals toward the implementation of BPOC systems. According to FDA estimates if bar code technology can cut medication errors in half over the next 20 years then the nation will save \$93 billion in health care costs<sup>6</sup>. Up until this time many manufacturers were not including bar codes on their unit dose medication labels and hospitals were reluctant to implement BPOC since only about 35% of unit dose medications actually contained a bar code. There are some limitations to the FDA regulation. It does not require that manufacturers include a product's lot number and expiration date in the bar code, although they will encourage it. It also does not mandate that manufacturers must package medications in unit dose form. It only states that the final package label, that could be unit-of-use bottles, bulk bottles, or unit dose packages, must contain a bar code. One of the concerns of many hospital pharmacists in the US is that manufacturers may eliminate unit dose packaging of some medications because of the new bar code requirement. It will take more re-tooling of manufacturer equipment to place a bar code on labels of unit dose packages than it will on placing a bar code on the label

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of bulk bottles of medications. There has been some reports in the US of this occurring and this is something that professional organizations are keeping a close eye on.

Since the FDA bar code regulation went into effect, many more hospitals in the US have begun to implement or seriously consider BPOC. In the 2000 ISMP Medication Safety Self Assessment<sup>®</sup> for hospitals only 1% of the hospitals responding said they had totally implemented BPOC and 2.5% said they had partially implemented it. In November of 2002 ISMP published a white paper, *A Call to Action: Safeguard Drug Administration Within Two Years*<sup>17</sup>. In the 2004 ISMP Medication Safety Self Assessment<sup>®</sup> for hospitals, 6% of respondents reported that they had totally implemented BPOC and 7% reported they had partially implemented it. The numbers are still small but the market is growing. In fact, in the 2004 assessment, 67% of respondents said they had considered BPOC compared to only 36% in 2000. Currently all Veteran Hospitals in the US (approximately 170 hospitals) have adopted this technology and a major for-profit healthcare chain has committed to BPOC for its 180 hospitals. More than half of that number is already using this technology.

Will BPOC systems impact medication administration errors? Tests have shown that bar-code scanning has an error rate of 1 error in 10,000,000 characters, compared with keyboard-entry error rates of 1 error in 100 characters<sup>8</sup>. There have been several studies that have shown that BPOC can reduce medication errors from reaching the patient by 65-86%<sup>8-10</sup>. As more hospitals begin to implement these systems we will learn more about the challenges and possible new errors we need to watch out for with this new technology in place. One thing we have learned so far is that BPOC does require a lot of planning on the part of pharmacy and nursing. Physicians must also be included in the process. Even with the FDA regulation, many hospitals are realizing that the number of medications they must repackage in unit dose and label with a bar code is tremendous. Compounded intravenous solutions, partial tablet

strengths (i.e., 1/2 tablet doses), repackaged unit-dosed oral liquids, and medications unit dosed from bulk bottles must all be bar coded by the pharmacy if the system is to work as intended<sup>10</sup>. The pharmacy information system must also be capable of producing medication labels that contain a bar code. A bar coding readiness assessment is available for free at [www.medpathways.info](http://www.medpathways.info). This assessment, which should be completed with a multidisciplinary team from the hospital, will help to highlight those areas that hospitals and must address before they consider implementation of this technology. Questions about hardware considerations wireless availability in the hospital, are included so that the hospital can get a good feel to their state of readiness before they move forward with BPOC and increase their chances of a successful implementation. Many manufacturers and group purchasing alliances are already assisting hospitals in the adoption of BPOC. Group purchasing alliances have notified manufacturers that products, which contain bar codes down to the unit dose level, will be preferred or even required in awarding contracts. Labeling and packaging vendors have begun to offer bar coding capabilities for the software used by hospitals to repackage medications<sup>11</sup>.

BPOC is gaining momentum and as more hospitals implement this technology, vendors will be even more prepared to streamline the process and learn from any mistakes encountered by the early adopters of this technology. One must remember, though, that technology in itself, including, BPOC is not the total solution for error prevention and medication safety. Standardized processes, safe medication storage (especially with the use of high alert medications), proper labeling of all medications (syringes, IV admixture containers), and other safe practices must not be forgotten.

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## References

1. Kohn LT, Corrigan JM, Donaldson MS, et al. To err is human: building a safer healthcare system. Washington (DC): National Academy Press, 1999.
2. Committee on Health Care in America. Institute of Medicine. Crossing the quality chasm: A new health system for the 21st century. Washington (DC): National Academy Press, 2001.
3. Leape LL, Bates DW, Cullen DJ, Cooper J, Demonaco HJ, Gollivan T, et al. Systems analysis of adverse drug events. JAMA 1995; 274: 35-43.
4. Barker KN, Flynn EA, Pepper GA, Bates DW, Mikeal RL. Medication errors observed in 36 health care facilities. Arch Intern Med 2002; 162: 1897-903.
5. U.S. Food and Drug Administration. Bar code label for human drug products and blood: proposed rule. Fed Regist 2003; 68: 1233399-534.
6. News. FDA to require bar coding of most pharmaceuticals by mid-2006. Am J Health-Syst Pharm 2004; 61: 644-5.
7. A call to action: Safeguard drug administration within two years! The Institute for Safe Medication Practices, 2002. (Available at <http://www.ismp.org/MSAarticles/WhitepaperBarCoding.htm>)
8. Puckett F. Medication management component of a point-of-care information system. Am J Health-Syst Pharm 1995; 52: 1305-9.
9. Johnson CL, Carlson RA, Tucker CL, Willette C. Using BCMA software to improve patient safety in Veterans Administration medication centers. J Healthc Inf Manage 2002; 16: 46-51.
10. Neuenschwander M, Cohen MR, Vaida AJ, Patchett JA, Kelly J, Trohimovich B. Practical guide to bar coding for patient medication safety. Am J Health-Syst Pharm 2003; 60: 768-79.
11. Vaida AJ. Observation on the proposed FDA bar coding rule. Hosp Pharm 2003; 38 (Supl. 1): S7-S8.