



## Pharmacy Informatics Task Force White Paper

### The Ideal Barcode Point of Care System for the Pharmacy Informaticist

Medication administration errors represent a large component of the overall medication error spectrum, and, perhaps, one that is the most easily addressed. Barcode point-of-care (BPOC) systems are intended to prevent these types of errors by enforcing the “five rights” at the time of administration:

- Right Patient
- Right Drug
- Right Dose
- Right Route
- Right Time

The success or failure of these systems depends entirely on their reliability. That is, they are successful to the extent that they block attempts at inappropriate dose administration, and permit appropriate dose administration. To the extent that they fail to perform either of these tasks, BPOC systems may be bypassed, providers will create ‘work arounds’, and the systems may be perceived as adding work, without adding value.

Patient identification via bar code is routine and many hospitals issue patient wristbands that contain a bar code that positively identifies the patient.

Barcode identification of the drug, dose and route requires that the dose itself be encoded in a way that permits identification of these three features. This provides challenges in that a dose is not always fulfilled by a single medication entity. For example, a 500 mg oral dose of Ampicillin might be fulfilled using 2 x 250 mg capsules, 1 x 500 mg capsule or 10 mL suspension at 250 mg/5 mL. Ideally, a BPOC would accept any of these possibilities when fulfilling the order. Given the volatility in the availability of drug products, a pharmacy may be required to send different products at different times to fulfill a given medication order because that is all they can obtain at that time.

In an effort to facilitate this checking, the Food and Drug Administration (FDA) has mandated the inclusion of the national drug code (NDC) in an industry standard bar code. The NDC code is a 10-digit number that identifies a

medication product as a particular manufacturer's instance of a specific amount of a drug in a specific form in a specific package size. It is intended that such a code would permit a BPOC system to identify a dose provided in its original manufacturer's container as fulfillment of a medication order. The BPOC system would convert the unformatted 10-digit NDC code into a drug product description (drug, dose and dosage form) and would infer suitability for the ordered route ("right route") from the ordered dosage form.

There are limits to the usability of this implementation in that many doses require over labeling - obscuring the manufacturer's labeling - and, especially in pediatrics and geriatrics, the dose may need to be a mixture of commercially available products or a portion of a commercially available product.. For example, the NDC code for a 4 oz bottle of Phenobarbital Elixir could tell you that you had the right drug, and that it was intended for the right route of administration, but could not verify that you were administering the right dose. The need for over labeling represents additional opportunity for error.

As a result, some BPOC systems place a drug identifier and dose (e.g. L6207 1 gm) in the bar code to represent a drug/dosage form and dose that can be verified against an order.

Alternatively, the pharmacy system assigns a unique number to each order for a patient, or to each dispensing of each order. Known approaches include the assignment of a traditional prescription number to each unique patient order, or assignment of a dispensing ID (a unique number generated for the dispensing of medication supplies at a particular time for a particular patient in response to a particular order).

Some systems are a hybrid, however, in which the type of bar code expected to verify a medication at the bedside depends on the products selected during the pharmacy order entry/order verification process. Thus, if the medication product chosen is a commercially available unit-of-use medication, then the system "expects" an encoded value that is an NDC code or some similar product identifier. If the dose is compounded, or is prepared as a portion of an available commercial product (e.g. a half tablet, or 3 mL of an oral liquid), the system assigns a prescription number, or dispensing ID.

IV admixtures represent these cases in the extreme. Traditionally, IV admixtures have been manually compounded doses (as opposed to doses manufactured in ready-to-administer form). However, recent pushes by the Joint Commission (JCAHO) to eliminate preparation of compounded sterile preparations in patient care areas has increased the use of commercially prepared ready-to-use IV doses. A recent survey of pharmacy practice by the American Society of Health System Pharmacists (ASHP) indicates that 98% of hospitals purchase and use some form of commercial ready-to-use intravenous medication doses<sup>1</sup> even though those doses create considerable additional expense and have known

rates of clinical misuse. BPOC systems that require a patient-specific order or dispensing ID within their bar code still cannot support the use of these commercial products at the bedside without requiring a provider to affix a patient-specific label.

The result is that the success or failure of the BPOC system becomes directly related to the method by which an order is entered into the pharmacy or hospital information system, requiring pharmacy personnel to remember how orders for particular drugs, or particular doses of particular drugs are to be entered in order to ensure that they will verify properly at the bedside. If the person entering the order selects the wrong product, or the wrong order type, an otherwise correct medication is denied by the BPOC system because the bar code does not contain the expected value.

This also requires that the medication order be changed in the system whenever the pharmacy is forced to supply the medication in a different form, even if the patient, drug, dose, route and time have not changed. For example, if an order for an intravenous antibiotic is normally fulfilled with a ready-to-administer product, but must be compounded by the pharmacy because that product is temporarily unavailable, most BPOC systems would require the order to be modified or completely re-entered in order to permit the alternative dosage form to be successfully scanned at the bedside. While this may or may not be a problem in standalone pharmacy systems, such practice clutters an Electronic Health Record (EHR) with order changes that do not reflect changes in clinical intent.

Following Bauer's notion that the correct solution can be identified by starting from desired outcomes rather than starting with what is currently available,<sup>2</sup> one can envision an ideal BPOC system with the following traits:

- Permits interoperability between a variety of disparate systems.
- Permits dose verification irrespective of the products used to fulfill the order
- Permits provider order entry (of any kind) that does not require the provider to know or understand how the dose will be supplied from the pharmacy
- Requires a change to the medication order only when there is a change in clinical intent
- Offers an encoding standard that permits specification of the variety of medication fulfillment options so that the BPOC system can reliably identify the information being provided. Both UCC and HIBCC offer encoding standards that purport to permit this kind of information transfer.
- Supports the acquisition of encoded information from a variety of sources including 1-D bar code symbologies, 2-D barcode symbologies and RFID transmission.

Such a system would resolve orders and bar codes with the “five rights” and accept or reject medications only on the basis of whether or not they provided in total the therapy that had been ordered for a patient.

- If the bar code represents an NDC code, the BPOC system would resolve it to a drug, dose and form, compare it to orders currently due for administration, and accept it because it was proper; reject it because it was improper; or make it pending it because it represented an incomplete dose.
- If a bar code represents a specific patient order, the BPOC system would resolve that order number to a specific drug, dose, form and route and perform the same verification
- If a bar code contains a drug identifier and dose (e.g. a partial dose), the BPOC system would use the drug identifier to verify the drug and form, and use the dose expressed in the bar code to confirm the correct dose.
- If a bar code contains expiration date information, the BPOC system would include evaluation of that information in its verification process.

The implementation of such a system provides benefits to the pharmacy information system vendor community in that it permits a wide variety of labeling formats.

It provides benefits to pharmacy providers in that order entry/verification does not require conscious concern over support by the BPOC system.

It provides benefits to nursing because the rate of failure due to product selection issues is reduced or eliminated, making the system warnings rare enough to be truly valuable.

It provides benefits to the patient, because the system is doing what it is intended to do, capture and report potential misadventures before they become errors.

---

<sup>1</sup> Pederson C, Schneider PJ, Scheckelhoff DJ. *ASHP national survey of pharmacy practice in hospital settings: Dispensing and administration—2005*, **Amer J Health-Sys Pharm** 63 pp327-345 (Feb 2006)

<sup>2</sup> Bauer JC, *Patient Safety: Getting It Right by Doing It Backwards* **Journal of Healthcare Information Management** 20(4):5-6 (Sept 2006)