Bar Code Medication Administration

Report Highlights

- Most reporting hospitals have a bar code medication administration (BCMA) system connected to an electronic medication administration record (eMAR), but only one-third fully meet Leapfrog's BCMA standard for safe and effective implementation of the system

- Hospitals not meeting the Leapfrog standard are most often failing by not scanning both the patient and medication at least 95% of the time or not having adequate decision-support elements in place

- Nearly four out of five hospitals have all five of Leapfrog's recommended processes and structures in place to monitor and reduce "workarounds" that diminish the capacity of bar coding to improve patient safety

- Urban hospitals were more likely to fully meet the standard than rural hospitals, and teaching hospitals showed greater improvement from 2016 to 2017 than non-teaching institutions

Medication errors result in an estimated 1.5 million adverse drug events (ADEs) in the U.S. annually.[1] The typical hospitalized patient is exposed to at least one medication error daily,[2] with those mistakes contributing to an estimated 7,000 deaths each year.[3] But with proper safeguards and use of technology — such as bar code medication administration — lives could be saved.

Bar code medication administration (BCMA) systems scan a patient's wristband and medication to be given in order to prevent medication errors. Preventable medication errors impact more than 7 million patients and cost almost $21 billion annually across all care settings.[4] In one study, the use of BCMA was associated with reducing medication administration errors by up to 93%.[5] Leapfrog has developed the only national standard for using BCMA at the bedside and the annual Leapfrog Hospital Survey is the only source of publicly reported data on U.S. hospitals' use of BCMA systems to prevent bedside medication errors — enabling patients to make well-informed choices about where to seek care.

Minimizing Adverse Drug Events

An ADE occurs when a patient is harmed due to medication. In these cases, a decimal point error, overlooking patient allergies or a potentially harmful drug interaction, and/or confusing similarly named drugs could cause death or a serious injury.

BCMA systems — linked with eMARs — are designed to prevent medication errors at the point of administering medication to patients at the bedside. A nurse or other clinician administering medication scans a bar code on a patient's wristband to confirm he or she is the right patient, and then scans a bar code on the prescribed medication to verify the right drug, dose, and time of delivery. The system also connects with the electronic medical record to check vital signs and allergies and call for backup support if needed.

Assembling a national panel of experts,[6] The Leapfrog Group examined best practices for BCMA, including its proper use and how to avoid workarounds that could nullify the benefits in developing a standard for hospital adoption of BCMA. Publicly reported for the first time on the 2016 Leapfrog Hospital Survey, this report, based on the 2017 Survey, provides key insights into the progress made to date and the room for improvement that still remains.

FIGURE 1: About BCMA

What it is

An electronic scanning system that intercepts medication errors at the point of administration. By scanning bar codes on a patient's wristband and on prescribed medications, nurses or other clinicians can confirm that they have the right patient, right medication, and right dose, given at the right time.

Benefits

- Ensures that patients receive the right medication in the right dosages, when needed
- Provides a valuable double check on the clinical reasoning of pharmacists and nurses
- Adds efficiency by eliminating manual recording in a patient's chart and updating the hospital's electronic health record (EHR) system
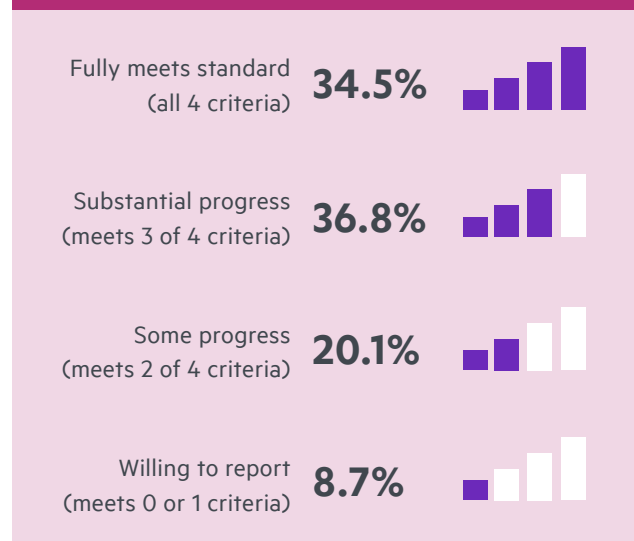
Leapfrog's Standard

- Implement a BCMA system linked to an electronic medication administration record in 100% of the hospital's medical and/or surgical units (adult and pediatric), labor and delivery units, and intensive care units (adult, pediatric, and neonatal)
- Scan both patient and medication bar codes in 95% of bedside medication administrations in BCMA-equipped units
- Use a BCMA system that includes all seven decision-support elements identified as best practices by the Leapfrog BCMA Expert Panel
- Implement all five best-practice processes and structures to prevent workarounds of the BCMA system

Some Progress, but Significant Improvement Needed

Nearly all reporting hospitals (98.7%) have a BCMA system implemented in at least one inpatient unit — with the vast majority of these hospitals (96.8%) using the system in all applicable units.[7]

However, only 34.5% of reporting hospitals fully met all four requirements of the BCMA standard (Figure 1). This represents an improvement from the 30.2% of hospitals that fully met the standard in 2016. Another 36.8% of reporting hospitals have made substantial progress toward the Leapfrog standard, meeting three of the four criteria. An additional 20.1% of hospitals met two of the four requirements (Figure 2).
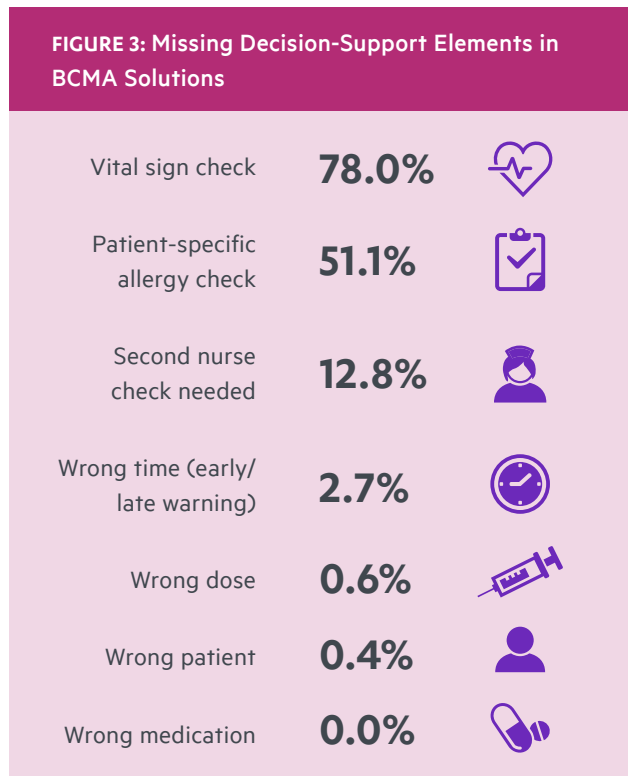
FIGURE 2: How Hospitals Measure up on BCMA

Fully meets standard (all 4 criteria) **34.5%**

Substantial progress (meets 3 of 4 criteria) **36.8%**

Some progress (meets 2 of 4 criteria) **20.1%**

Willing to report (meets 0 or 1 criteria) **8.7%**

A Closer Look at Where Hospitals are Falling Short

Of hospitals reporting that they lack at least one of the four requirements for Leapfrog's BCMA standard, the most disappointing lapse — and dangerous from a patient safety perspective — is that 42.0% are failing to scan both the patient and the medication for at least 95% of bedside medication administrations. This means that more than two in five hospitals that have implemented BCMA technology simply aren't using it consistently enough to safeguard all their patients.

Another frequent omission (45.5%) was hospitals not having all seven decision-support elements in place to help guard against medication errors. Only about three in five (60.9%) of reporting hospitals with a BCMA system in place in at least one inpatient unit had all seven types of decision support. The decision-support elements most likely to be missing were a built-in vital sign check (78.0% of those reporting and missing one or more decision supports) and a patient-specific allergy check (51.1%) (Figure 3).

FIGURE 3: Missing Decision-Support Elements in BCMA Solutions		
Vital sign check	**78.0%**	
Patient-specific allergy check	**51.1%**	
Second nurse check needed	**12.8%**	
Wrong time (early/late warning)	**2.7%**	
Wrong dose	**0.6%**	
Wrong patient	**0.4%**	
Wrong medication	**0.0%**	

Working to Avoid Dangerous Workarounds

Human error is unavoidable. The effectiveness of any technology is only as good as the effectiveness of its implementation in the delivery of care. Even when BCMA systems are well designed, problems can arise that force users of the system to act outside of the prescribed norms. The Leapfrog BCMA standard incorporates five best-practice processes and structures to prevent the workarounds that undermine the efficacy of BCMA as a patient safety tool. These include:

- A formal committee to oversee BCMA use

- Backup systems for hardware failures

- A help desk to respond to BCMA issues in real-time

- Conducting real-time observations of staff using the BCMA system

- Engaging with nursing leadership on BCMA usage

Most (79.1%) of the hospitals that have implemented BCMA systems have incorporated all five recommendations to guard against workarounds. This is a slight improvement over 2016 when 76.0% of hospitals had all five in place. Of those that were missing one or more of these best practices to prevent workarounds, the most common slip was not conducting real-time staff observations (58.0%), followed by not establishing a formal committee to review data on BCMA use (56.7%).

In 2018, the Leapfrog Hospital Survey will be updated to ask hospitals about three additional processes to prevent workarounds.

FIGURE 4: Real-time observation of staff helps ensure effective use of BCMA to avoid medication errors.

Nominal Difference Between Teaching and Non-Teaching Hospitals

In the 2017 Leapfrog Hospital Survey, 35.0% of teaching hospitals and 34.2% of non-teaching hospitals fully met the BCMA standard, indicating very little difference between the two types of facilities' ability to implement BCMA and use it effectively. Teaching hospitals as a group did make the largest improvement between 2016

and 2017, with the percent of teaching hospitals fully meeting the standard increasing by more than one-third (from 25.9%) in 2016.

Urban hospitals were more likely to meet the Leapfrog BCMA standard than rural hospitals, with 36.5% of urban hospitals fully meeting the standard in 2017 compared with 25.2% of rural hospitals.

Better Use and More Transparency Needed

Clearly, there's significant room for improvement in how hospitals use BCMA systems to deliver maximum patient safety benefits for patients. In addition, a considerable number of hospitals still do not report on BCMA usage. Additional transparency from these facilities is critical to making true patient safety gains.

By participating in the Leapfrog Hospital Survey, hospitals can assess their use of BCMA systems at the bedside and identify better ways to prevent harm to patients, while enabling patients to make more-informed decisions on where to seek care.

The Leapfrog Hospital Survey

The Leapfrog Group invites all adult general acute care and free-standing pediatric hospitals in the United States to voluntarily report on topics such as maternity care, healthcare-associated infections, medication safety, safe practices for better health care, and never events through its annual Survey. In 2017, nearly 2,000 hospitals submitted a Survey, representing two-thirds of inpatient beds nationwide. This report uses final hospital data from the 2017 Leapfrog Hospital Survey (data submitted through December 31, 2017).

The Leapfrog Hospital Survey includes measures that are endorsed by the National Quality Forum (NQF) and/or aligned with those of other significant data collection entities, including the Centers for Medicare & Medicaid Services (CMS) and The Joint Commission. Leapfrog partners with the Armstrong Institute for Patient Safety and Quality at Johns Hopkins Medicine to review Survey measures and standards, and updates them annually to reflect the latest science. Additionally, panels of volunteer experts meet regularly to review the Survey measures and recommend performance standards for each subject area covered in the Leapfrog Hospital Survey. The full list of measures included in the Survey is available at http://www.leapfroggroup.org/survey.

1.   Aspden P, Wolcott J, Bootman JL, Cronenwett LR, eds. "Preventing Medication Errors: Quality Chasm Series." ." Institute of Medicine (US) Committee on Identifying and Preventing Medication Errors, July 2006.. http://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/2006/Preventing-Medication-Errors-Quality-Chasm-Series/medicationerrorsnew.pdf. Accessed March 19, 2018.

2.   Aspden P, Wolcott J, Bootman JL, Cronenwett LR, eds. "Preventing Medication Errors: Quality Chasm Series." Institute of Medicine (US) Committee on Identifying and Preventing Medication Errors, July 2006.. http://www.nationalacademies.org/hmd/~/media/Files/Report%20Files/2006/Preventing-Medication-Errors-Quality-Chasm-Series/medicationerrorsnew.pdf. Accessed March 19, 2018.

3.   Kohn LT, Corrigan JM, Donaldson MS. "To Err Is Human: Building a Safer Health System." Institute of Medicine (US) Committee on Quality of Health Care in America, Nov. 1999. https://www.ncbi.nlm.nih.gov/books/NBK225182/. Accessed March 19, 2018.

4.   Da Silva, Brianna A., and Mahesh Krishnamurthy. "The Alarming Reality of Medication Error: A Patient Case and Review of Pennsylvania and National Data." *Journal of Community Hospital Internal Medicine Perspectives* 6.4 (2016): 10.3402/jchimp.v6.31758. PMC. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5016741/. Accessed March 19, 2018.

5.   Johnson, CL, Carlson, RA, Tucker CL, Willette, C. "Using BCMA software to improve patient safety in Veterans Administration Medical Centers." *Journal of Healthcare Information Management,* 2002 Winter;16(1):46-51. http://www.himss.org/using-bcma-software-improve-patient-safety-veterans-administration-medical-centers. Accessed March 19, 2018.

6.   The Leapfrog Group Bar Code Medical Administration Expert Panel. http://www.leapfroggroup.org/about/expert-panelists

7.   The Leapfrog Group assesses BCMA adoption in intensive care (adult, pediatric, and neonatal), medical and/or surgical units (adult and pediatric) including telemetry units, and labor and delivery units. The 2016 survey did not review BCMA usage in telemetry or labor and delivery units.

8.   Sakowski JA, Ketchel A. "The Cost of Implementing Inpatient Bar Code Medication Administration." *American Journal of Managed Care.* 2013;19(2):e38-45. http://www.ajmc.com/journals/issue/2013/2013-1-vol19-n2/the-cost-of-implementing-inpatient-bar-code-medication-administration?p=2. Accessed March 19, 2018.