

Measure Background

Medication errors often have tragic consequences for patients. Many serious medication errors result in preventable adverse drug events (ADEs), approximately 20% of which are life-threatening.^{1,2} According to the Institute of Medicine's report, *To Err is Human*, medication errors alone contribute to 7,000 deaths annually.³ Despite clinicians' best efforts, over 40% of serious and life-threatening ADEs are preventable.⁴

Medication errors also result in tremendous financial costs. ADEs add more than \$7.5 billion per year nationwide in hospital costs alone.⁵ Furthermore, this figure excludes other important costs of medication errors, such as malpractice insurance premiums and losses in worker productivity.

Errors resulting in preventable ADEs occur during the stages of ordering, administration, transcription, and dispensing. Over 30% of these errors are committed at the point of administration.⁴

What is Bar Code Medication Administration?

Bar code medication administration (BCMA) systems are electronic scanning systems that intercept medication errors at the point of administration. When administering medications with BCMA, a nurse scans a bar code on the patient's wristband to confirm that the patient is the right patient. The nurse then scans a bar code on the medicine to verify that it is the right medication at the right dose, given at the right time by the right route. These are known as the "Five Rights of Medication Administration."

BCMA is typically used in conjunction with electronic medication administration record (eMAR) systems. An eMAR serves as the communication interphase that automatically documents the administration of medication into certified Electronic Health Record (EHR) technology. By linking BCMA with the eMAR, information on medication administration is captured in a much timelier manner than a manual documentation process can accomplish.

BCMA systems also can be used for pharmacy stocking and retrieval processes to help avoid medication dispensing errors. BCMA implementation in the

pharmacy has been shown to significantly reduce dispensing errors.⁶ Leapfrog's current focus is on BCMA use at the bedside, with possible future expansion into the pharmacy.

Effectiveness of BCMA in Reducing Errors

BCMA implementation can be remarkably effective in reducing medication administration errors. A study of BCMA-eMAR implementation in an academic medical center demonstrated a 41.1% relative reduction in nontiming errors in medication administration, resulting in a 50.8% relative reduction in potential ADEs due to such errors.⁷ BCMA implementation in the ED has also shown a relative reduction of 80.7% in medication administration errors.⁸

BCMA has also demonstrated financial benefits. While BCMA implementation costs approximately \$2,000 per harmful medication error averted, this is less expensive than the estimated \$3,100 - \$7,400 cost of a harmful error.⁹

The Leapfrog BCMA Standard

With the guidance of a [national panel of experts](#) in BCMA use, The Leapfrog Group developed a standard for hospital adoption of BCMA. Leapfrog's standard focuses on four components of BCMA implementation:

- The extent of a hospital's BCMA implementation throughout the hospital with a focus on medical and/or surgical units (adult and pediatric), intensive care units (adult, pediatric, and neonatal), and labor and delivery units.
- A hospital's compliance with both patient and medication scans at the bedside prior to administering medications.
- The types of decision support that the hospital's BCMA system offers.
- A hospital's structures to monitor and reduce workarounds.

Hospitals fully meeting the Leapfrog standard:

- Have implemented BCMA systems in 100% of their medical and/or surgical units (adult and pediatric), intensive care units (adult, pediatric, and neonatal), and labor and delivery units.

- Have both patient and medication scans in 95% of the bedside medication administrations in units that have implemented BCMA
- Have a BCMA system that includes all five elements of decision support that have been identified as best-practice by the Leapfrog BCMA Expert Panel.
- Have implemented at least six of the eight best-practice processes and structures to prevent workarounds.

Challenges to BCMA Implementation

While most hospitals reporting to the Leapfrog Hospital Survey indicate that they have implemented BCMA system in at least one inpatient unit, some hospitals have not adopted BCMA or are not using it in all units. What are the challenges?

- BCMA adoption requires significant efforts to redefine caregiver responsibilities and workflows, which must all be communicated to staff through trainings and demonstrations.
- Cultural obstacles may inhibit BCMA implementation. For example, some nurses resist utilizing BCMA as it introduces additional steps into their already-hectic care schedules.¹¹
- The cost of implementing and operating BCMA is one major hurdle for some hospitals. A study by Sakowski and Ketchel estimated the cost of implementing and operating BCMA including electronic pharmacy management and drug repackaging over five years to be \$35,600 to \$54,600 per BCMA-enabled bed.⁹ As such, a 100-bed hospital can spend over \$3 million in BCMA implementation over the initial five years.

Why Purchasers Need to Get Involved

Given these challenges, hospitals may need encouragement from purchasers to maximize the efficiency of their BCMA systems. While BCMA systems may require significant investments, they help avoid even more significant costs due to medication errors. More importantly, BCMA systems can significantly reduce the risk of adverse drug events that can cause significant harm or even death to employees.

References

1. Bates DW, Teich JM, Lee J, et al. The impact of computerized physician order entry on medication error prevention. *J Am Med Inform Assoc.* 1999;6(4):313-321.
2. Bates DW, Leape LL, Cullen DJ, et al. Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. *JAMA.* 1998;280(15):1311-1316.
3. Kohn LT, Corrigan JM, Donaldson MS. To err is human: Building a safer health system. committee on health care in america. institute of medicine. . 1999.
4. Bates DW, Cullen DJ, Laird N, et al. Incidence of adverse drug events and potential adverse drug events: Implications for prevention. *JAMA.* 1995;274(1):29-34.
5. Bates DW, Spell N, Cullen DJ, et al. The costs of adverse drug events in hospitalized patients. *JAMA.* 1997;277(4):307-311.
6. Poon EG, Cina JL, Churchill W, et al. Medication dispensing errors and potential adverse drug events before and after implementing bar code technology in the pharmacy. *Ann Intern Med.* 2006;145(6):426-434.
7. Poon EG, Keohane CA, Yoon CS, et al. Effect of bar-code technology on the safety of medication administration. *N Engl J Med.* 2010;362(18):1698-1707.
8. Bonkowski J, Carnes C, Melucci J, et al. Effect of barcode-assisted medication administration on emergency department medication errors. *Acad Emerg Med.* 2013;20(8):801-806.
9. Sakowski JA, Ketchel A. The cost of implementing inpatient bar code medication administration. *Am J Manag Care.* 2013;19(2):e38-45.
10. Pedersen CA, Schneider PJ, Scheckelhoff DJ. ASHP national survey of pharmacy practice in hospital settings: Monitoring and patient education—2012. *Am J Health Syst Pharm.* 2013;70(9):787-803.
11. Gooder V. Nurses' perceptions of a (BCMA) bar-coded medication administration system: A case-control study. *Online Journal of Nursing Informatics (OJNI).* 2011;15(2).

For a comprehensive list of references please review the Bar Code Medication Administration Bibliography, available here:

<https://ratings.leapfroggroup.org/measure/hospital/safe-medication-administration>