



Medical Errors

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Learning Objectives

- Define medical error, adverse event, and near miss
- Understand current magnitude and types of errors (global & US)
- Review root causes and high-risk areas (human and system contributors)
- Discuss evidence-based prevention strategies and implementation

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Definitions

- Medical error: failure of a planned action or wrong plan to achieve intended outcome
- Adverse event: harm caused by medical care, not underlying disease
- Near miss: error that does not reach the patient

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Global Burden

~1 in 10 patients harmed while receiving care (WHO Global Patient Safety Report 2024)

134 million adverse events annually in low- and middle-income countries (LMICs)

~2.6 million deaths annually in LMICs related to unsafe care

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U.S. Perspective

- Johns Hopkins/BMJ estimate (2016): ~250,000 deaths/year attributed to medical error (widely cited)
- Diagnostic errors estimated to cause significant morbidity/mortality (Johns Hopkins 2023 estimates)
- Variability in methods & reporting — caution interpreting single-number estimates
- Underreporting remains common

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Cost of Medical Errors

- When taken just as a financial burden to the health care system, the cost of these errors is estimated to be around \$20 billion per year
- When the financial burden to the families, employers, and overall economy are taken into account, aggressive estimates put the burden at \$1 trillion annually

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Common Types of Errors

- Medication errors (prescribing, administration, dispensing) **Most Common**
- Diagnostic errors (delays, missed, incorrect)
- Communication/handoff failures
- Surgical/wrong-site and procedural errors

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Root causes — systems & human factors

- Complex systems and poorly designed processes
- Workload, fatigue, staffing shortages
- Poor communication and unclear roles
- Inadequate training & supervision
- Technology issues (EHR usability, alerts overload)

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Medication Errors

- Prescribing
 - Standardized order sets & computerized provider order entry (CPOE)
 - Minimize Verbal Orders as much as possible
- Dispensing
 - Barcode medication administration (BCMA)
- Administration
 - 5 rights of medical administration (patient, medication, dose, time, route)
- Monitoring
 - Pharmacist-led medication review & stewardship

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Effect of barcode-assisted medication administration on emergency department medication errors

Joseph Borkowski¹, Cynthia Carles, Joseph Melucci, Jay Miralzo, Beth Prier, Erin Reichert, Susan Moffatt-Bruce, Robert Weber
 Affiliation: ¹ Inspec
 PMID: 24033823 DOI: 10.1111/leam.12189
 Free article

Abstract
Objectives: Barcode-assisted medication administration (BCMA) is technology with demonstrated benefit in reducing medication administration errors in hospitalized patients; however, it is not routinely used in emergency departments (ED). EDs may benefit from BCMA, because ED medication administration is complex and error-prone.
Methods: A retrospective observational study was conducted at an academic medical center implementing BCMA in the ED. The rate of medication administration errors was measured before and after implementing an integrated electronic medical record (EMR) with BCMA capability. Errors were classified as wrong drug, wrong dose, wrong route of administration, or a medication administration with no physician order. The error type, severity of error, and medications associated with errors were also quantified.
Results: A total of 1378 medication administrations were observed (998 pre-BCMA and 382 post-BCMA). The baseline medication administration error rate was 6.3%, with wrong dose errors representing 65.7% of observed errors. BCMA was associated with a reduction in the medication administration error rate to 1.2%, a relative rate reduction of 80.7% ($p < 0.0001$). Wrong dose errors decreased by 90.4% ($p < 0.0001$), and medication administrations with no physician order decreased by 72.4% ($p = 0.001$). Most errors discovered were of minor severity. Anticholinergic medications were associated with the highest error rate.
Conclusions: Implementing BCMA in the ED was associated with significant reductions in the medication administration error rate and specifically wrong dose errors. The results of this study suggest a benefit of BCMA on reducing medication administration errors in the ED.
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80%

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Diagnostic Errors

- Missed diagnoses – complex patients with multiple co-morbidities
- Delayed diagnoses – Large workloads, complex systems, fractured delivery
- Incorrect diagnoses – lack of complete knowledge, delay in getting tests

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Reducing Diagnostic Errors

- Diagnostic checklists and cognitive debiasing training
- Second-review for high-risk cases and peer review
- Improved access to diagnostic tests & follow-up systems
- Use of decision support, structured reflection, and safety-netting

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Improving communication & handoffs

- Structured handoff tools (SBAR-situation, background, assessment, recommendation)
- Face-to-face or recorded handoffs for complex patients
- Standardized transfer checklists and read-backs
- Interprofessional rounds and family involvement

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Surgical Safety

- WHO Surgical Safety Checklist reduces complications and mortality
- Time-outs, site marking, instrument counts
- Team briefings and debriefings

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Surgical Safety Checklist

SIGN IN	TIMEOUT	SIGN OUT
<p>Purposeful Pause Before Induction Intended for attending anesthesiologist (MAC) or Anesthesia Care Team (Anesthetist) Surgical representatives must be present</p> <ul style="list-style-type: none"> <input type="checkbox"/> Team member introductions <ul style="list-style-type: none"> Include patient <input type="checkbox"/> Patient identification (Must use ID band and verbal confirm) <ul style="list-style-type: none"> Procedure Site marked by attending surgeon Confirmed type of anesthesia Confirmed antibiotic and surgical consent <input type="checkbox"/> Patient readiness <ul style="list-style-type: none"> Pre-op products anticipated (if not available) Allergies Antibiotic given IVT prophylaxis (SCS, pharmacological) Positioning, including pressure ulcer prevention Pain catheter Cath status SRB exposure Wetlands in place and functional SRB error risks on whiteboard Equipment/Systems Building needed Any additional case specific Expanded problems and decisions <input type="checkbox"/> Anesthesia assessment <ul style="list-style-type: none"> Anesthesia equipment check Technician Monitor BIPAP/CPAP/Temp Always OSA concerns Organ management <input type="checkbox"/> Prep/paste <ul style="list-style-type: none"> Confirm prep choice vs. allergies Confirm positioning and adjust Verify site 	<p>Purposeful Pause Before First Invasive portion of each procedure Intended for all attending surgeons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Team member introductions <input type="checkbox"/> Identify patient, operation and operative course <ul style="list-style-type: none"> Site marked (visual and verbalized) Site marking method Anticipated operative course Confirm blood product availability Case of pathologic specimens <input type="checkbox"/> Fire safety <ul style="list-style-type: none"> Oxygen concentration Risk factor identified Prep pad and other flammable agents Fire safety risk score Expanded use of other flammable agents <input type="checkbox"/> Allergies <input type="checkbox"/> Antibiotic given <ul style="list-style-type: none"> Antibiotic and dose Documented on white board <input type="checkbox"/> Imaging displayed (reviewed, confirmed patient ID) <input type="checkbox"/> DVT prophylaxis (SCS, pharmacological) <p>If laser to be used, please refer to Laser Safety Timeout</p>	<p>Purposeful Pause After last critical portion of procedure Intended for all attending surgeons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Procedure performed <input type="checkbox"/> Wound dress <input type="checkbox"/> Counts search complete <ul style="list-style-type: none"> Specimens verified/reviewed/labelled if the field Counts confirmed If not as performed If incorrect, follow Incident Case Algorithm <input type="checkbox"/> Red flags addressed <input type="checkbox"/> Final patient disposition <input type="checkbox"/> Post-op orders <input type="checkbox"/> Anesthesia concerns <input type="checkbox"/> Cath status <input type="checkbox"/> SRB confirmed to be removed per policy <input type="checkbox"/> Safety culture management <input type="checkbox"/> Post-op prescriptions complete? <input type="checkbox"/> Equipment/development issues <ul style="list-style-type: none"> Questions or recommendations? <p>Please speak up with questions and concerns. Purposeful pause = everyone pauses in the OR.</p>

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Medical Errors, Past and Present
Amid recent news of medical mistakes, a number of past medical errors stand out.
 By DAN CHILDS
 February 19, 2020, 8:57 AM • 13 min read

Nov. 22, 2007— It's every surgical patient's worst nightmare. And it happened three times at Rhode Island Hospital.

According to Associated Press reports, the hospital was fined \$50,000 and reprimanded by the state Department of Health on Monday after the third episode this year involving a doctor performing brain surgery on the wrong side of a patient's head.

Fortunately, the chance of a serious mistake occurring during any given medical procedure is small. But these errors do happen—a fact evidenced by this recent news.

Not all hospitals share this track record. But due to the sheer number of medical procedures that take place in the country every year, even isolated incidents add up. A report last April by the independent health care-ratings company HealthGrades found through Medicare hospitalization records that nearly 3 percent of patients in the nation's hospitals risk experiencing hospital errors.

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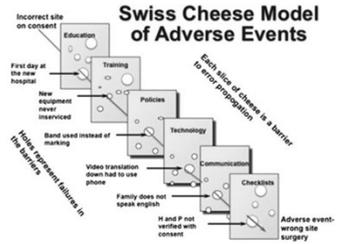
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Surgical Safety – instrument counts

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How Does a Mistake Happen?



Seshia SS, Bryan Young G, Makhsinson M, Smith PA, Stobart K, Crookery P. Gating the holes in the Swiss cheese (part 1): Expanding professor Reason's model for patient safety. *J Eval Clin Pract.* 2017;1-11

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System Factors

- Workflow design – make all checklists easy to follow and accessible
- Staffing and training – everyone on the same page
- Every voice is important
- Technology usability – adequate training and supervision

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Every Voice is Important

- Adopt the model of communication used in Aviation
- Crew Resource Management
 - Every voice is heard
 - Any member of the team can stop the line at any time to address issues

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Safety Culture

- Non-punitive reporting systems and learning culture
 - The more reports you get the better
- Executive-level commitment and resources
- Transparency and patient engagement
- Report back as often as possible

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Measurement, reporting & learning systems

- Implement local incident reporting and RCA for serious events
- Use trigger tools and routinely measured safety indicators
- Benchmarking and external reporting (e.g., Joint Commission data)

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Quality improvement methods

- PDSA cycles, Lean, Six Sigma for process redesign
- Human factors engineering for workflow and device design
- Simulation for team training and crisis resource management

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Technology

- EHRs, Computer Provider Order Entry (CPOE), and Clinical Decision Making (CDM) reduce some errors but introduce new risks
- Alert fatigue, copy-paste errors, interoperability gaps
- User-centered design and rigorous testing required

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Case Example

- Scenario: look-alike drug confusion leading to wrong infusion
- Root cause analysis findings: labeling, storage, nurse workload
- Interventions implemented and outcome



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Implementing a safety program — roadmap

- Assemble multidisciplinary patient safety team
- Prioritize high-risk processes with data
- Pilot interventions, measure outcomes, scale successful changes
- Sustainability: embed into policy, training, hiring

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Barriers to implementation

- Resource constraints and competing priorities
- Resistance to change and blame culture
- Data limitations and measurement burden

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Engaging patients & families

- Encourage patients to ask questions and maintain medication lists
- Use teach-back, involve families in handoffs
- Transparent disclosure and apology practices

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Policy & regulatory levers

- National action plans (WHO Global Patient Safety Action Plan 2021–2030)
- Accreditation standards (Joint Commission) and reporting requirements
- Payment incentives and penalties tied to safety metrics

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Practical checklist: 10 actions to reduce errors (for teams)

- 1) Standardize high-risk processes
- 2) Implement medication reconciliation
- 3) Use checklists/time-outs
- 4) Improve handoffs (SBAR)
- 5) Invest in training & simulation
- 6) Use CPOE/BCMA where effective
- 7) Encourage reporting & RCA
- 8) Engage patients
- 9) Measure and publish safety data
- 10) Leadership commitment

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Measuring impact — sample metrics

- Rate of adverse drug events per 1,000 patient days
- Handoff-related incident counts
- Surgical site infection and wrong-site surgery rates
- Patient-reported safety incidents

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Takeaways & call to action

- Medical errors remain a major global patient safety challenge
- Focus on systems, not blame; start with high-impact interventions
- Measure, learn, and scale what works; involve leadership and patients

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