1-2019

Actionable Patient Safety Solutions (APSS) #3A: Medication Errors

Ron Jordan
Chapman University, rpjordan@chapman.edu

Jerika Lam
Chapman University, jlam@chapman.edu

Peter Antevy
Handtevy

Steven Barker
Patient Safety Movement Foundation

Linda Beneze
Monarch Medical Technologies

See next page for additional authors

Follow this and additional works at: https://digitalcommons.chapman.edu/pharmacy_articles

🟠 Part of the Health and Medical Administration Commons, Other Pharmacy and Pharmaceutical Sciences Commons, and the Pharmacy Administration, Policy and Regulation Commons

Recommended Citation

Actionable Patient Safety Solutions (APSS) #3A: Medication Errors

Comments

This updated report was published for the Patient Safety Movement Foundation in 2019.

Copyright

Patient Safety Movement Foundation

Authors

Ron Jordan, Jerika Lam, Peter Antevy, Steven Barker, Linda Beneze, Michel Bennett, Laressa Bethishou, Jim Broselow, John Burnam, Mitchell Goldenstein, Kari Hamlin, Helen Haskell, Christopher Jerry, Edwin Loftin, Ariana Longley, Jacob Lopez, Anne Lyren, Brendan Miney, Sidney Morice, Steve Mullenix, Robert Nickell, Rochelle Sandell, David Shane Lowry, Robin Shannon, Deeba Siddiqui, Charles Simmons, Nat Sims, Robert Stein, Laura Townsend, Jason Yamaki, and Sun Yang

Actionable Patient Safety Solutions (APSS) #3A:
Medication errors

How to use this guide
This guide gives actions and resources for creating and sustaining safe practices for reducing medication errors. In it, you'll find:

Patient Safety
MOVEMENT

Executive summary checklist

Medication errors are major causes of inpatient harm and death. Medication errors are preventable adverse events due to wrong medicine use including:

- Wrong medicine
- Wrong dose
- Wrong route
- Wrong time
- Wrong patient
- Wrong documentation of medicine

Ensure best patient care

- ☐ Create a multidisciplinary team to lead the project, including physicians, nurses, pharmacists, and information technology personnel
- ☐ Use systematic protocols for medicine administration, including checklists for writing and filling prescriptions, drug administration and patient transitions of care, and other quality assurance tools including:
  - ☐ Install the latest safety technology to prevent medication errors, such as:
    - ☐ The BD Intelliport Medication Management System
    - ☐ First Databank FDB MedKnowledge drug library system
    - ☐ Other drug dosing solutions such as Monarch Medical Technologies solution for calculating IV & SubQ insulin doses
  - ☐ Use barcoding for identification in the medicine administration process
  - ☐ Check patient's allergy profile before prescribing medicine
  - ☐ Ensure appropriate training and safe operation of automated infusion technologies
  - ☐ Distinguish "look-alike, sound-alike" medicines by labeling, package design, and storage
- ☐ Practice the Six Patient Rights on Medications - all care providers should use this simple checklist: right patient, drug, dose, route, time of administration, and documentation
- ☐ Follow practices to prevent medication errors during Transitions of Care

Engage staff and use data to find areas for improvement

- ☐ Use technology to standardize Computerized Physician Order Entry (CPOE), reporting systems and quality assurance reports to audit compliance
- ☐ Use Clinical Decision Support Systems (CDSS) where possible (Kane-Gill et al., 2017)
- ☐ Review monitoring and reporting results at medical staff meetings and education sessions as a part of Continuous Quality Improvement (CQI)
- ☐ Use patient stories - in written and video form - to identify gaps and inspire change in your staff

What we know about medication errors

Medication errors are a major cause of death. One out of every 2 surgeries has a medication error or an adverse drug event (Nanji et al., 2016). These errors have a global cost of about $42 billion a year (Donaldson et al., 2017).

Addressing medical errors can improve the quality and safety of healthcare and lower costs. It also helps create a safety culture, which is a culture that promotes patient safety and quality of care while reducing preventable risks and harm.

Some types of medication errors are more common or severe. For example:

- Drug infusion pump errors are common and may have serious consequences. Drug infusion pumps are complex and have poorly designed features for the user, which make it difficult for the user to program and use. Patients who get infused medicines are often critically ill and taking multiple medicines, which further increases the chance of error and adverse events.
- Surgery has high rates of medication errors with a higher severity level (NQF, 2010). This is due to a high-stress environment and lack of computerized order entry, pharmacy approval, or second check by another person prior to giving the medicine.

Preventing medication errors

To reduce medication errors, there are a variety of new approaches that hospitals and healthcare systems can commit to using, such as automated infusion and IV injectable technologies, electronic medical records, and checklists.

Leadership plan

Hospital governance, senior administrative leadership, clinical leadership, and safety/risk management leadership need to work collaboratively to reduce medication errors.

Show leadership's commitment

- Create a medicine safety plan that follows the National Quality Forum (NQF) safe practices (NQF, 2010)
- Educate and empower patients, healthcare professionals, researchers, and insurers
  - Provide information so that leadership and all healthcare professionals fully understand the performance gaps in their own area of care
  - Make sure all clinical/safety leadership endorse the plan to ensure it's put into place across all providers and systems

Create the infrastructure needed to make changes

- Identify approaches to medication safety that:
  - Have strong evidence that they work to reduce preventable deaths
  - Can be applied in multiple care settings and for multiple patient types
- Set a firm date to begin the safety plan, with measurable outcomes and milestones - "Some is not a number. Soon is not a time." (IHI, n.d.)
- Get approval for the plan's budget from governance boards and leadership
- Use a standardized feedback system to fine-tune the plan over time

Engage staff
- Use patient stories – in written and video form – to teach and inspire change in your staff
- For example, the story of Emily Jerry, daughter of Chris Jerry, is one of many compelling stories that can be viewed and shared for free:
  https://youtu.be/9jmULQ_m04o

Action plan

Provide staff training
- Create a multidisciplinary team that includes physicians, nurses, pharmacists, and information technology personnel
- Assess opportunities to reduce medication errors using a self-assessment process (ISMP, 2011)
- Create and deliver monthly or quarterly education on medication error and patient safety updates

Create protocols
- Create a universal checklist for medicine administration that includes:
  o Patient name
  o List of patient's current medicines
  o Medicine to be given and its:
    - Dose
    - Route
    - Timing
    - Documentation
- Systematize tools and practices, including checklists, for:
  o Patient allergy and medicine interaction checks on every patient
  o CPOE (Computerized physician order entry)
  o Medicine barcoding
  o Patient education and adherence
  o Correct and on-time medication administration (ISMP, 2011)
- Practice hand hygiene when giving medicine as tablets, capsules, and pills by hand, such as wearing gloves instead of bare hands
- Use standardized order sets where possible
- Review medicine labels and redesign as needed (Practices, n.d.)
- Prepare medicine in separate, designated rooms to lower interruptions (Huckels-Baumgart et al., 2016)

Follow guidelines and regulations
- Follow the Institute for Safe Medication Processes (ISMP) guidelines for
  o Training and safe use of intravenous infusion pumps
  o Use of medicine dispensing cabinets (ISMP, 2011)
  o Adult IV Push Medications
  o High-Alert Medications

- Ensure that all FDA and USP regulations are met and followed by either in-house production or third party vendor as part of a standardized process for compounding sterile medicines (Practices, n.d.)
- Follow the APSS#4 guidelines for continuous monitoring of all patients who are receiving parenteral narcotics or other sedative drugs
- Practice CDC Guidelines for single use injections - one solution, one patient, one syringe
- Use FDA Manufactured Single Use Injection Kits (SUIK) when available

Ensure safety during transitions of care

- Consider the following high-risk medicine groups:
    1. Opioids
        a. Consider all pain medicines including over the counter
        b. Concern for over-using tylenol
    2. Anti-diabetics
        a. Resume Metformin, confirm kidney function appropriate
        b. Adjust insulin based on food intake
    3. Anticoagulation/Antiplatelet
        a. INR levels, renal function, OTC medicine use (NSAIDs)
    4. Antibiotics
        a. Appropriate duration of therapy
        b. Labs ordered (vancomycin follow up)
        c. Home health ordered
- Coordinate appropriate follow up and monitoring, such as:
    o Labs: INR, Digoxin levels, electrolytes, blood sugar, vancomycin troughs, thyroid levels
    o Chronic disease state management, such as heart failure, asthma, and COPD
- Confirm medicine dose for any changes in health status, including changes in:
    o Weight
    o Renal and liver function
    o Functions that could affect the patient's ability to take medicine by mouth, injection, or inhalation
- Confirm needed medical equipment is ordered, such as a nebulizer, diabetic supplies, and IV antibiotic
- Evaluate for high risk disease states
    o Check patients comply with core measures and immunizations when appropriate (Stroke, MI, Heart Failure)
    o Ensure patients receive and are educated on scheduled vaccines (influenza, pneumonia, etc)

Technology plan

These suggested practices and technologies have shown proven benefit or, in some cases, are the only known technologies for certain tasks. If you know of other options not listed here, please complete the form for the PSMF Technology Vetting Workgroup to consider:

https://patientsafetymovement.org/actionable-solutions/apss-workgroups/technology-vetting/

System or practice	Available technology
All settings	
ONC Meaningful Use Cert ified EHR system Electronic Health Record (EHR) System with the following capabilities: • Computerized Physician Order Entry (CPOE) • Drug-drug interaction check • Drug-allergy interaction check • Electronic Prescribing (eRx) • Electronic Prior Authorization (ePA)	
Electronic Medication Administration Record (eMAR) system with pharmacy and bedside barcoding capabilities	First Databank FDB MedKnowledge system (First Databank, 2014)
FDA approved clinical decision support solution for medication therapy recommendation	Monarch Medical Technologies* Endotool Solutions for insulin
Infusion pumps that wirelessly communicate data back to the electronic eMAR	
Patient and medication barcoding system	
CPOE simulation tool to quantify the risk of serious ADEs with your current system CPOE (Metzger et al., 2010; Leung et al., 2013)	Leapfrog CPOE Evaluation Tool (Leapfrog, 2016)
Drug libraries	
Pharmacy workflow manager	DoseEdge from Baxter Healthcare

Surgery environment	
IV injectable doses, audible and visual feedback for each syringe attached with measurement of dose, allergy alerts and more accurate and timely documentation wireless to the anesthesia information system	BD Intelliport* Medication Management System.
Continuous physiologic monitoring on patients receiving IV medications to provide an early indication of deterioration due to a medication error	Masimo* rainbow Acoustic Monitoring (Mimoz et al., 2012)
Pharmacy	
Pharmacy robots to reduce safety problems associated with providers drawing up their own medications, and risks associated with contamination from outsourced compounders	BAXA Intellifil Robot
Utilize single use injection kits or pre-mixed sterile solutions	• Asclemed USA Inc., Injection Kits • Nubratori RX, Pre-mixed sterile solutions
Other considerations	
"End-to-end" smart pump system, or other electronic pump systems	

*Company has signed some form of the Open Data Pledge, more information can be found on the Patient Safety Movement Foundation website: https://patientsafetymovement.org/partners/open-data-pledges/view-all-open-data- pledges/

Measuring outcomes

Key performance indicators

Adverse drug event: Adverse drug event (ADE) with harm to patient (Category E or higher on NCC-MERP classification) that is preventable (i.e., not an unknown first-time reaction to a medicine).

Outcome measure formula

Numerator: Number of reported adverse drug events with harm (as defined above) – by class or medication

Denominator: Number of doses administered (by medicine or class of medicines)

Rate is typically displayed as ADE with harm/1000 doses given

Metric recommendations

Indirect impact (preventable rate): All patients

Direct impact (non-preventable rate): All patients prescribed medicines

Lives spared harm:

Lives Spared Harm = (ADE Rate baseline - ADE Rate measurement) X Doses or Adjusted Patient Days baseline

Lives saved:

Lives Saved = Lives Spared Harm x Mortality Rate

Notes

Top medicine classes and triggers:

1. Opioids

2. Sedatives and hypnotics (including propofol)

3. Anticoagulants

4. Antimicrobials (including antivirals and antifungals)

5. Anti-diabetic medicines (including insulin, and other injectable and oral medicines)

6. Injectable medicines

Initial or baseline measurement will show ability to capture ADE information, since most are voluntarily reported. Over time, decreases in this rate can show lives spared harm. To ensure that reductions are not due to decreased reporting, a control measure should also be measured:

Control rate calculation

Numerator: Number of ALL reported errors and adverse drug reactions (including harm and NOT causing harm or "near misses")

Denominator: Number of doses administered over time period

Control ADE rate should be consistent or increase, with corresponding decrease in ADE with harm.

Data collection

ADE reporting information is based on volunteer reporting and accuracy of people verifying reports (preferably from pharmacy and a medication errors reporting program, MERP).

Medicine usage information is usually collected from billing information rather than medicine orders (more accurate if patient received the dose or not).

If medicine usage information is not available, denominator could be per 1000 patient days. This can track over time, especially for all ADE reporting, however, will not adjust ADE rate for high or low utilization medications.

Scales

- The Adverse Drug Reaction Probability Scale (Naranjo) determines the causality of an ADR or how likely is the drug the true cause of the ADE (NLM, 2015)

Mortality (will be calculated by the Patient Safety Movement Foundation)

The PSMF, when available, will use the mortality rates associated with Hospital Acquired Conditions targeted in the Partnership for Patients (PfP) grant funded Hospital Engagement Networks (HEN).

The program targeted 10 hospital acquired conditions to reduce medical harm and costs of care. "At the outset of the PfP initiative, HHS agencies contributed their expertise to developing a measurement strategy to track national progress in patient safety—both in general and specifically related to the preventable HACs being addressed by the PfP. Along with CMS's overall leadership of the PfP, AHRQ has helped coordinate development and use of the national measurement strategy. The results using this national measurement strategy have been referred to as the "AHRQ National Scorecard," which provides summary data on the national HAC rate (AHRQ, 2015). Adverse drug events was included in this work with published metric specifications. This is the most current and comprehensive study to date.

Based on these data the estimated additional inpatient mortality for Adverse Drug Events is 0.020 (20 per 1000 events).

Conflicts of interest disclosure

The Patient Safety Movement Foundation partners with as many stakeholders as possible to focus on how to address patient safety challenges. The recommendations in the APSS are developed by workgroups that may include patient safety experts, healthcare technology professionals, hospital leaders, patient advocates, and medical technology industry volunteers. Some of the APSS recommend technologies offered by companies involved in the Patient Safety Movement Foundation that the workgroups have concluded, based on available evidence, that these technologies work to address APSS patient safety issues. Workgroup members are required to disclose any potential conflicts of interest.

Workgroup

Co-Chairs

Ron Jordan	Chapman University School of Pharmacy
Jerika Lam	Chapman University School of Pharmacy

Members

This list represents all contributors to this document since inception of the Actionable Patient Safety Solutions.

Peter Antevy	Handtevy
Steven Barker	Patient Safety Movement Foundation;Masimo
*Linda Beneze	Monarch Medical Technologies
Michel Bennett	Patient Safety Movement Foundation

Laressa Bethishou	Chapman University School of Pharmacy
Jim Broselow	eBroselow
John Burnam	Louise H. Batz Patient Safety Foundation
Mitchell Goldstein	Loma Linda Medical Center
Kari Hamlin	Hackensack Medical Center
Helen Haskell	Mothers Against Medical Error
Christopher Jerry	The Emily Jerry Foundation
Edwin Loftin	Parrish Medical Center
Ariana Longley	PatientSafetyMovementFoundation
Jacob Lopez	Patient Safety MovementFoundation
Anne Lyren	Children's Hospitals' Solutions for Patient Safety
Brendan Miney	Talis Clinical
Sidney Morice	Lee Health
Steve Mullenix	National Council for Prescription Drug Programs
Robert Nickell	Enovachem
Rochelle Sandell	Patient Advocate
David Shane Lowry	Rosalind Franklin University of Medicine and Science
Robin Shannon	The T System
Deeba Siddiqui	Hackensack Medical Center
Charles Simmons	Cedars-Sinai Medical Center
Nat Sims	Massachusetts General Hospital
Robert Stein	Keck Graduate Institute
Laura Townsend	Louise H. Batz Patient Safety Foundation
Jason Yamaki	Chapman University School of Pharmacy
Sun Yang	Chapman University School of Pharmacy

Metrics integrity

Robin Betts	Kaiser Permanente, Northern California Region

*This Workgroup member has reported a financial interest in an organization that provides a medical product or technology recommended in the Technology Plan for this APSS.

References

(2011). APsF Newsletter, 26, 21–26.

Donaldson, L. J., Kelley, E. T., Dhingra-Kumar, N., Kieny, M.-P. and Sheikh, A. (2017). Medication Without Harm: WHOs Third Global Patient Safety Challenge. *The Lancet*, *389*(10080), 1680–1681.doi:10.1016/s0140-6736(17)31047-4

First Databank. (2014) Case Study: Enterprise EMAR, hospital [Pharmacy, Barcoding Meta Healthcare IT Solutions. Retrieved from: http://www.fdbhealth.com/~/media/downloads/form%20required/us/case%20study%20-%20fdb%20medknowledge%20-%20barcoding%20-%20meta%20healthcare.ashx

Huckels-Baumgart, S., Baumgart, A., Buschmann, U., Schüpfer, G. and Manser, T. (2016). *Separate Medication*

Preparation Rooms Reduce Interruptions and Medication Errors in the Hospital Setting: A Prospective Observational Study. *J Patient Saf.*

Institute for Healthcare Improvement. Overview of the 100,000 lives campaign. Retrieved from: https://www.ihi.org/Engage/Initiatives/Completed/5MillionLivesCampaign/Documents/Overview%20of%20the%20100K%20Campaign.pdf

ISMP. (2011). ISMP Acute Care Guidelines for Timely Administration of Scheduled Medications. ISMP. ISMP Guidelines for Safe Preparation of Compounded Sterile Preparations.

ISMP. ISMP's Guidelines for Standard Order Sets. ISMP. Institute for Safe Medication Practices.

ISMP. Institute for Safe Medication Practices. Institute for Safe Medication Practices (ISMP) Guidance on Automated Dispensing Cabinets.

ISMP. (2011). 2011 ISMP Medication Safety Self Assessment for Hospitals.

ISMP. Proceedings from the ISMP Summit on the Use of Smart Infusion Pumps: Guidelines for Safe Implementation and Use.

Kane-Gill, S. L., Dasta, J. F., Buckley, M. S., Devabhakthuni, S., Liu, M., Cohen, H., … Smith, B. S. (2017).

Clinical Practice Guideline: Safe Medication Use in the ICU.. *Crit Care Med*, 45, e877–e915.

Kerr, E. (2000). What is an Error?. *Effective Clinical Practice*, *6*.

Nanji, K. C., Patel, A., Shaikh, S., Seger, D. L. and Bates, D. W. (2016). Evaluation of Perioperative Medication Errors and Adverse Drug Events. *Anesthesiology*, *124*(1), 25–34. doi:10.1097/aln.0000000000000904

The Leapfrog Group. (2016). Prepare for CPOE Tool. Retrieved from: http://www.leapfroggroup.org/survey-materials/prepare-cpoe-tool

Leung, A. A., Keohane, C., Lipsitz, S., Zimlichman, E., Amato, M., Simon, S. R., ... & Seger, D. L. (2013).

Relationship Between Medication Event Rates and the Leapfrog Computerized Physician Order Entry Evaluation Tool. *Journal of the American Medical Informatics Association, 20*(e1), e85-e90.

Medicine, U. S. N. L. of. (2015). Adverse Drug Reaction Probability Scale (Naranjo) in Drug Induced Liver Injury.Retrieved from https://livertox.nih.gov/Narajo.html

Metzger, J., Welebob, E., Bates, D. W., Lipsitz, S., & Classen, D. C. (2010). Mixed Results in the Safety Performance of Computerized Physician Order Entry. *Health Affairs, 29*(4), 655-663.

Mimoz, O., Benard, T., Gaucher, A., Frasca, D., & Debaene, B. (2012). Accuracy of Respiratory Rate Monitoring Using a Non-invasive Acoustic Method After General Anaesthesia. *British Journal of Anaesthesia, 108*(5), 872-875.

Palmieri, P. A., DeLucia, P. R., Peterson, L. T., Ott, T. E. and Green, A. The Anatomy and Physiology of Error in Adverse Health Care Events. In *Advances in Health Care Management* (pp. 33–68). Emerald (MCB UP). doi:10.1016/s1474-8231(08)07003-1

Quality, A. for H. R. and. (2015). Efforts to Improve Patient Safety Result in 1.3 Million Fewer Patient Harms. Retrieved from http://www.ahrq.gov/professionals/quality-patient-safety/pfp/interimhacrate2013.html

(2010). Washington, DC, National Quality Forum.