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 patient harm and death. Medication errors are preventable adverse events resulting from, but not limited to:

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

Ensure best patient care

- ☐ Create a multidisciplinary team to lead the project, including physicians, nurses, pharmacists, and information technology personnel
- ☐ Use systematic protocols for medication 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:
    - ☐ Medication Management System
    - ☐ A drug library system
    - ☐ Other drug dosing solutions such as a solution for calculating IV & SubQ insulin doses
  - ☐ Use barcoding for identification in the medicationine administration process
  - ☐ Check patient's allergy profile before prescribing medicationine
  - ☐ Ensure appropriate training and safe operation of automated infusion technologies
  - ☐ Distinguish "look-alike, sound-alike" medicationsmedicines by appropriate 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 Provider Order Entry (CPOE), reporting systems and quality assurance reports to audit compliance
- ☐ Use Clinical Decision Support (CDS) systems 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).

Preventing medication errors 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 medicationsmedicines are often critically ill and taking multiple medicationsmedicines, which further increases the riskchange of error and adverse events.
- Surgery has high rates of medication errors with a higher severity level (National Quality Forum, 2010). This is due to a high-stress environment and lack of computerized order entry, pharmacy approval processes, 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 medication safety plan that follows the National Quality Forum (NQF) safe practices (National Quality Forum, 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." (Institute for Healthcare Improvement, 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:
  http://patient.sm/oemrzL
- Preventing Medication Errors video: **http://patient.sm/Dtiyi3**

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 Medication Safety Self Assessment for Hospitals, 2011)
- Create and deliver monthly or quarterly education on medication error and patient safety updates

Create protocols

- Create a universal checklist for medication administration that includes:
  - Patient name
  - List of patient's current medicines
  - Medication to be given and its:
    - Dose
    - Route
    - Timing
    - Documentation
- Systematize tools and practices, including checklists, for:
  - Patient allergy and medication interaction checks on every patient
  - CPOE (Computerized Provider Order Entry)
  - Medication barcoding
  - Patient education and adherence
  - Correct and on-time medication administration (Acute Care Guidelines for Timely Administration of Scheduled Medications, 2011)
- Practice hand hygiene when giving medication as tablets, capsules, and pills by hand, such as wearing gloves instead of using bare hands
- Use standardized order sets where possible
- Review medication labels and redesign as needed (Practices, n.d.)
- Prepare medication 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
  - Training and safe use of intravenous infusion pumps
  - Use of medication dispensing cabinets (ISMP, 2011)

- Adult IV Push Medications
- 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 medications (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 when available

Ensure safety during transitions of care

- Consider the following high-risk medication groups:
  1. Opioids
     a. Consider all pain medications over-the-counter (OTC), that can put patients into respiratory depression because of additive somnolence effects
     b. Concern for exceeding the recommended daily maximum dose of acetaminophen
  2. Anti-diabetics (See APSS #3C for more information)
     a. Prior to initiating or resuming metformin, confirm kidney function is appropriate
     b. Adjust insulin based on food intake
  3. Anticoagulation/Antiplatelet
     a. Check and monitor INR levels, renal function, OTC medication use (i.e., NSAIDs)
  4. Antibiotics (see APSS #3B)
     a. Determine appropriate duration of therapy for the infection
     b. Ensure pertinent labs are ordered (i.e., vancomycin and aminoglycoside concentrations)
     c. Obtain a thorough antibiotic history within the past 3 months
- Coordinate appropriate follow up and monitoring, such as:
  - Labs: INR, digoxin levels, electrolytes, blood sugar, antibiotic concentrations, thyroid levels
  - Chronic disease state management, such as heart failure, diabetes, asthma and COPD
- Confirm medication dose for any changes in health status, including changes in:
  - Weight
  - Renal and liver function
  - Functions that could affect the patient's ability to take medications by mouth, injection, or inhalation routes
- Confirm needed medical equipment is ordered, such as a nebulizer, diabetic supplies, and IV antibiotic
- Evaluate for high risk disease states
  - Check patient's compliance with core measures and immunizations when appropriate (Stroke, MI, Heart Failure)
  - 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 Certified Electronic Health Record (EHR) System with the following capabilities: • Computerized Provider 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	
FDA approved clinical decision support solution for medication therapy recommendation	
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 adverse drug events (ADEs) with your facility's current CPOE system (Metzger et al., 2010; Leung et al., 2013)	
Drug libraries	
Pharmacy workflow manager	

Surgery environment	
IV injectable doses, audible and visual feedback for each syringe attached with measurement of dose, allergy alerts and more accurate and timely wireless documentation to the anesthesia information system	
Continuous physiologic monitoring on patients receiving IV medications to provide an early indication of deterioration due to a medication error	
Pharmacy	
Pharmacy robots to reduce safety problems associated with providers drawing up their own medications, and risks associated with contamination from outsourced compounders	
Utilize single use injection kits or pre-mixed sterile solutions	
Other considerations	
"End-to-end" smart pump system for IV medication infusions	

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 medication).

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 medication or class of medication)

**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 medications

Lives spared harm:

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

Lives saved:

Lives Saved = (Lives Spared Harm) x (Mortality Rate)

Notes

Top medication 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 medications)
6. Injectable medications

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 a 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 the medication error reporting and prevention (MERP) program

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

If medication usage information is not available, the 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 (Adverse Drug Reaction Probability Scale (Naranjo) in Drug Induced Liver Injury, n.d.)

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 were 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 ADEs 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.

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