Actionable Patient Safety Solutions™ (APSS™):

Medication Errors

How to use this guide

This APSS provides evidence-based resources and recommendations for medication errors for executives, leaders, clinicians, and performance improvement specialists. This document is intended to be used as a guide for healthcare organizations to examine their own workflows, identify practice gaps, and implement improvements. In it, you will find:

Best Practice Summary: A high level summary of evidence-based, clinical best practices. (page 2)

Executive Summary: Executives should understand the breadth of the problem and its clinical and financial implications. (page 2)

Leadership Checklist: This section is for senior leaders to understand common patient safety problems and their implications related to medication errors. Most preventable medical harm occurs due to system defects rather than individual mistakes. Leaders can use this checklist to assess whether best practices are being followed and whether action is needed in their organization around medication errors. (page 3)

Clinical Workflow: This section includes more specific information around medication errors across the continuum of care. Leaders should include the people doing the work in improving the work. This section outlines what should be happening on the frontline. Clinicians can use this section to inform leaders whether there are gaps and variations in current processes. This is presented as an infographic that can be used for display in a clinical area. (page 4)

Education for Patients and Family Members: This section outlines what frontline healthcare professionals should be teaching patients and family members about engaging in their care. Clinicians can inform leaders whether there are gaps and variations in current educational processes. (page 6)

Performance Improvement Plan: If it has been determined that there are gaps in current processes, this section can be used by organizational teams to guide them through an improvement project. (page 8)

What We Know about Medication Errors: This section provides additional detailed information about medication errors. (page 11)

Resources: This section includes helpful links to free resources from other groups working to improve patient safety. (page 12)

Endnotes: This section includes the conflict of interest statement, workgroup member list, and references. (page 13)

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Patient Safety MOVEMENT

Best Practice Summary

Admission:

- Perform a medication reconciliation and document known allergies.
- Understand which medications the patient brought with them to the hospital/ appointment.

Routine Care:

- Prescribe medications only as necessary and when prescribing necessary toxic medications, implement an appropriate monitoring protocol (e.g., monitor serum creatinine when administering nephrotoxic medications).
- Avoid abbreviations when prescribing.
- Use the organization's safety mechanisms for safe prescribing, dispensing, and administration (e.g., bar code scanning).
- Perform an independent double check for high risk medications.
- Confirm the right medication, dose, time, route of administration, and patient using appropriate patient identifiers.
- Document all medications administered, reactions, and changes immediately.
- Evaluate changes in patient's weight, renal and liver functions, and or ability to take medication by mouth, injection, or inhalation.
- Perform medication reconciliation during each and every transition of care.

Discharge:

- Include a pharmacist in the patient's medication administration and education discharge planning.
- Confirm needed medical equipment is ordered, such as a nebulizer machine and IV supplies.
- Coordinate appropriate and timely follow up and monitoring related to labs and chronic disease management.

Executive Summary

The Problem

Europe has cited medication errors as the fifth most common cause of patient death in hospitals (Brussels, 2008). In the US, adverse drug events constitute one third of all adverse events in hospitals (Department of Health and Human Services, 2014). These statistics concerning adverse drug events are anticipated to grow due to the advent of new medicines, the aging population, and expansion of insurance coverage (CDC, 2010).

The Cost

Worldwide, medication errors cost $42 billion per year (Tariq et al., 2020). It has been estimated that nearly three-quarters of medication errors are attributable to distractions, which can be easily mitigated at little cost to the organization (Tariq et al., 2020). Other factors, such as pharmacist involvement in discharge planning, have proven effective in mitigating the near 10% of readmissions due to adverse drug events post-discharge (Lee at al., 2019; Kanaan et al., 2013).

The Solution

Reduce deaths due to medication errors by implementing a thorough evaluation of currently available resources and reallocation for optimization. This document provides a blueprint that outlines the actionable steps organizations should take to successfully reduce medication errors and summarizes the available evidence-based practice protocols. This document is revised annually and is always available free of charge on our website.

Leadership Checklist

On a monthly basis, or more frequently if a problem exists, the executive team should review the outcomes of patients prescribed one or more medication(s). Use this checklist as a guide to determine whether current evidence-based guidelines and best practice models are being followed in your organization:

- ☐ Measure and report medication safety compliance monthly (Number of ALL reported errors and adverse drug reactions (including harm and NOT causing harm or "near misses")/Number of doses administered over time period). Note trends in areas with low compliance and high medication error incidence. Routinely reassess outcomes.
- ☐ If medication error rates indicate room for improvement, initiate a PI (performance improvement) project. If a problem is not indicated, routinely reassess to identify gaps, and ensure integrity of the data collected.
- ☐ Ensure frontline involvement in medication safety improvement activities. Maintain their engagement and remove barriers to progress.
- ☐ If a PI plan is put in place, measure the associated process outcomes.
- ☐ Ensure that medication safety protocols are embedded into clinical workflows, whether electronic or paper.
- ☐ Ensure there are enough staff to effectively manage necessary preventive care.
- ☐ Ensure adequate training and documentation of medication safety competencies and skills.
- ☐ Eliminate barriers to making rapid changes to documentation templates and order sets.
- ☐ Debrief on a regular basis to solicit team feedback about barriers to sustained compliance. Adjust the plan quickly and nimbly as needed.
- ☐ Hold staff accountable for providing the standard of care and reward success.
- ☐ Develop a just culture for staff to report medication errors.
- ☐ Ensure that leaders have a simple process to oversee medication safety improvement work while also considering how it aligns with other initiatives across the organization.
- ☐ Establish systematic, universally-used protocols for medication administration, including checklists for writing, filling, and dispensing prescriptions, drug administration and patient transitions of care. Use standardized order sets where possible.
- ☐ Establish universal checklists for improving alert use and documentation of drug allergy interactions. See Appendix A.
- ☐ Ensure appropriate training and safe operation of automated infusion technologies
- ☐ 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
- ☐ Use Clinical Decision Support Systems (CDSS) where possible.
- ☐ Review monitoring and reporting results at medical staff meetings and education sessions.

- ☐ Use patient stories to identify gaps and inspire change in your staff, such as the story of Emily Jerry.
- ☐ Monitor medication errors by demographic to understand trends in socioeconomic status and medication errors.
- ☐ Use a standardized feedback system to fine-tune the plan over time.
- ☐ Provide immediate and useful feedback and support to clinicians after they report an error.
- ☐ Set a firm date to begin the safety plan, with measurable outcomes and milestones.
- ☐ Review medication labels and redesign as needed.
- ☐ Standardize a single concentration or dose rate of certain IV infusions if possible.
- ☐ Follow ASHP Guidelines on Preventing Medication Errors in Hospitals.
- ☐ Follow the Institute for Safe Medication Processes (ISMP) guidelines for:
  - ☐ Training and safe use of intravenous infusion pumps
  - ☐ Use of medicine dispensing cabinets
  - ☐ Adult IV Push Medications
  - ☐ High-Alert Medications

Clinical Workflow

1. ADMISSION

- Assess what medications (prescription, over the counter, naturopathic) the patient is currently taking and known allergies to medication
  - o Document details regarding specific reactions to these medications. Use tools such as Computerized Prescriber Order Entry Medication Safety toolkit and its appendices to ensure proper documentation of allergies and adverse drug events.
- Assess pre-existing conditions and disease states.
- Ensure compatibility with newly prescribed medications to facilitate the patient's continued use of current medication regimen

2. PRESCRIBING

- Prescribe only medications as clinically deemed necessary and after considering the patient's renal and liver function when prescribing.
- State the health condition being treated with the prescription in question and evaluate potential drug-to-drug and/or drug-to-herbal interactions with other prescription, over-the-counter, and naturopathic upon admission.

3. TRANSCRIBING

- Use computerized provider order entry or write down or record the prescription with as much detail as possible, avoid abbreviation.
- Provide reliable pharmacist verification with dosing and potential look-alike, sound-alike drugs by specifying drug indication.

4. VERIFICATION AND DISPENSING

- Be vigilant for high-risk medications and double check dosing and frequency by limiting distractions and focusing on individual tasks

5. ADMINISTRATION

- Confirm the right medication, dose, time, route of administration, and patient using appropriate patient identifiers.
- Practice CDC Guidelines for single use injections - one solution, one patient, one syringe.
- Document all medication administration and changes immediately.
- Evaluate the need for high-risk medications, as indicated within ISMP's List of High-Alert Medications in Acute Care Settings such as parenteral opioids and/or other sedative medications See "Considerations for High-Risk Medications" section.

5. MAINTENANCE

- Evaluate changes in patient's weight, renal and liver functions, and or ability to take medication by mouth, injection, or inhalation.
- Perform medication reconciliation during each and every transition of care.
- Maintain an updated medication allergy and medication list.

6. DISCHARGE

- Include a pharmacist in the patient's medication administration and education discharge planning.
- Confirm needed medical equipment is ordered, such as a nebulizer machine, diabetic and IV supplies.
- Coordinate appropriate and timely follow up and monitoring related to labs and chronic disease management.
- Consider patient preferences, clinically and financially, and discuss any alternative treatment options available.

Education for Patients and Family Members

The outline below illustrates all of the information that should be conveyed to the patient and family members by someone on the care team in a consistent and understandable manner.

Explain all changes including, additions, adjustments, and removal of medications. A member of the healthcare team should explain why the decision was made to change any of the patient's medications. The provider should have consistent, iterative conversations with the patient and family members about:

- The purpose of the medication
- The potential side effects
- The interactions with diet and over the counter medications
- How to properly take the medication
- How to keep the medication safe from children and pets
- How to store the medication

Additionally, the provider should confirm in discussion with the patient that their allergies and other medications were assessed for potential adverse events prior to introducing this new medication.

Indicate what to watch out for. Family members can serve as an extra pair of eyes and ears and can alert medical staff if something might be wrong. Family members should have an understanding of what to look for that may indicate deterioration, such as abnormal vital signs or a change in patient alertness. In order to adequately welcome patients and family members into the care team, it is not enough to explain "what" patients and family members should look for or "what" is going to happen in their care. The "what" must always be followed with a "why" to aid in genuine understanding. Upon adjusting to their new medication, patients and family members should look out for signs and symptoms such as, but not limited to:

- Hives
- Rash
- Fever
- Swelling
- Shortness of breath

- Wheezing
- Runny nose

Instead of employing a directive conversation style, an active, engaging conversation should take place, leaving capacity for questions and repeat-back strategies. When patients and family members understand the signs and symptoms that could be indicative of a problem, they are able to serve as an extra set of eyes in order to elevate this concern as early as possible.

Clinicians should provide a high-level overview of the processes in place at their organization to ensure safe medication practices. This demonstrates competence of the organization, will likely bolster patient and family comfort, and will provide the patient and family members with information for which to reference if they may be suspicious of a problem.

Patients and family members should know exactly when to call for help, where to go for help, and with whom they should speak. Emphasize to patients and family members the importance of early recognition and their role in keeping themselves or their loved one safe. It is essential that patients and family members understand that they should not be ashamed to ask any of their questions and that many patients in similar situations often have similar questions.

By engaging in these conversations before a problem arises, family members can be prepared in the circumstance of necessary treatment and will have an understanding of where to go to find out more information about their loved one's condition.

Explain what is expected of them during their care. By giving patients and family members a "job" while they are in the hospital, they can be immersed fully in the routine care, can hold other team members accountable, can feel more confident voicing their concerns or opinions, and can serve as an extra set of informed and vigilant eyes to optimize medication safety. This team involvement can also reduce their anxiety by transforming concern into proactive action.

Patients and family members can:

- Engage in conversations around current potential health conditions, allergies, and current prescription and over the counter medications
- Take notes about how their medication should be taken, stored, and disposed of
- Ask for clarification of medication safety standards
- Monitor vital signs and alertness and speak up if there are any abnormalities
- Monitor for hand hygiene in all healthcare providers and visitors

Explore next steps. Planning for life after the hospital, whether in assisted living, returning home, or another option, should begin as early as possible between the healthcare providers and the patient and family. Patients and family members should understand their post-discharge appointment schedule, roles of and contact information for the healthcare providers with whom they will interact, and information about medications they are sent home with. Ensure the patient knows how to properly take, store, and dispose of their medications. Reiterate the importance of taking the medications as directed and the purpose of each individually in their plan of care. Consider barriers to medication and provider access post-discharge and prepare for these challenges while the patient is still in the hospital to ensure a seamless transition post-discharge.

Performance Improvement Plan

Follow this checklist if the leadership team has determined that a performance improvement project is necessary:

☐ **Gather the right project team.** Be sure to involve the right people on the team. If possible, you'll want two teams: an oversight team that is broad in scope, has 10-15 members, and includes the executive sponsor to validate outcomes, remove barriers, and facilitate spread. The actual project team consists of 5-7 representatives who are most impacted by the process. In general, the key is having the right people on the team (people impacted by the process, executive sponsors, and subject matter experts), no matter the size of the organization. Whether a discipline should be on the advisory team or the project team depends upon the needs of the organization. Patients and family members need to be involved in all improvement projects, as there are many ways they can contribute to safer care. Define what constitutes a quorum, which team members are needed to make the quorum, and who can serve as alternatives.

Complete this Lean Improvement Activity:
Conduct a SIPOC analysis to understand the current state and scope of the problem. A SIPOC is a lean improvement tool that helps leaders to carefully consider everyone who may be touched by a process, and therefore, should have input on future process design.

RECOMMENDED MEDICATION SAFETY IMPROVEMENT TEAM	
• Pharmacists	• EHR experts
• Physicians	• Social workers
• Nurses	• Quality and safety specialists
• Case managers	• System engineers
• Admitting and registration staff	• Human factors experts
• Information technologists	

Table 1: Understanding the necessary disciplines for a medication safety improvement team

☐ **Understand what is currently happening and why.** Reviewing objective data and trends is a good place to start to understand the current state, and teams should spend a good amount of time analyzing data (and validating the sources), but the most important action here is to go to the point of care and observe. Even if team members work in the area daily, examining existing processes from every angle is generally an eye-opening experience. The team should ask questions of the frontline during the observations that allow them to understand each step in the process and identify the people, supplies, or other resources needed to improve patient outcomes.

Create a process map once the workflows are well understood that illustrates each step and the best practice gaps the team has identified (IHI, 2015). Brainstorm with the advisory team to understand why the gaps exist, using whichever root cause analysis tool your organization is accustomed to (IHI, 2019). Review the map with the advisory team and invite the frontline to validate accuracy.

MEDICATION SAFETY PROCESSES TO CONSIDER ASSESSING	
• Medication reconciliation during transitions of care • Medication preparation environment • Allergy assessment • Drug to drug interaction assessment • Assessment of over the counter drugs • Medication reconciliation upon discharge	• Continuation of patient's routine medication upon admission or documentation to defend its cessation or change • Documentation and transcription • Communication upon discharge and transfers • Deprescribing • Monitoring after administering necessary toxic medications

Table 2: Consider assessing these processes to understand where the barriers contributing to medication errors may be in your organization.

☐ **Prioritize the gaps to be addressed and develop an action plan.** Consider the cost effectiveness, time, potential outcomes, and realistic possibilities of each gap identified. Determine which are priorities of focus for the organization. Be sure that the advisory team supports moving forward with the project plan so they can continue to remove barriers. Design an experiment to be trialed in one small area for a short period of time and create an action plan for implementation.

The action plan should include the following:

- Assess the ability of the culture to change and adopt appropriate strategies
- Revise policies and procedures
- Redesign forms and electronic record pages
- Clarify patient and family education sources and content
- Create a plan for changing documentation forms and systems
- Develop the communication plan
- Design the education plan
- Clarify how and when people will be held accountable

TYPICAL GAPS IDENTIFIED IN MEDICATION SAFETY
• Known allergies are not communicated across the continuum. • Patients do not understand their medication instructions upon discharge or when receiving a new medication. • Poor human centered design in the medication prescribing, dispensing, and administration process • It is easy for care team members to inadvertently pull the wrong medication during preparation or administration. • Medication side effects or symptoms due to error are mistaken for other symptoms • There are defects in the medical record that make medication errors more likely. • Providers don't know all of the medications the patient is taking. • It is difficult to perform independent double checks when short staffed. • Staff members are interrupted/distracted during medication preparation. • Toxic medications (e.g., nephrotoxic medications) may be necessary for the patient's care, but they are not monitored appropriately.

Table 3: By identifying the gaps in medication safety compliance, organizations can tailor their project improvement efforts more effectively

☐ **Evaluate outcomes, celebrate wins, and adjust the plan when necessary.** Measure both process and outcome metrics. Outcome metrics include the rates outlined in the leadership checklist. Process metrics will depend upon the workflow you are trying to improve and are generally expressed in terms of compliance with workflow changes. Compare your outcomes against other related metrics your organization is tracking.

Routinely review all metrics and trends with both the advisory and project teams and discuss what is going well and what is not. Identify barriers to completion of action plans, and adjust the plan if necessary. Once you have the desired outcomes in the trial area, consider spreading to other areas (IHI, 2006).

It is important to be nimble and move quickly to keep team momentum going, and so that people can see the results of their labor. At the same time, don't move so quickly that you don't consider the larger, organizational ramifications of a change in your plan. Be sure to have a good understanding of the other, similar improvement projects that are taking place so that your efforts are not duplicated or inefficient.

Read this paper from the Institute for Healthcare Improvement to understand how small local steps

MEDICATION SAFETY METRICS TO CONSIDER ASSESSING

- Allergic reactions
- Bar code medication administration adherence rates
- Adverse events reporting process
- Reports of medication errors through the organizational incident reporting system
- Medical record overrides
- Medication cabinet overrides
- Smart pump use
- Near miss medication errors
- Medication errors involving high risk medications, such as, but not limited to, opioids, sedatives, and anticoagulants.

Table 4: Consider evaluating related metrics to better understand medication safety presence and contributing factors. 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). Consider delineating metrics by demographic to understand socioeconomic trends in medication errors.

What We Know About Medication Errors

Of the 6,800 prescription medications available in the US, nearly half of all US individuals are taking at least one prescription medication and nearly a quarter are prescribed three or more (Tariq et al., 2020; CDC, 2020). Since the 1990s, prescription drug spending has been increasing significantly around the world, with the US in particular spending more on prescription drugs than any other nation (Sarnak et al., 2017). With the increase in prescription drug availability and polypharmacy in the aging population, medication errors continue to increase in prevalence. In addition, the practitioner must be aware of the over-the-counter or naturopathic remedies patients may be taking in tandem with their prescriptions. The compilation of all of these factors increases the risk for adverse events and interaction between the drugs.

In the US alone, between 7,000 and 9,000 individuals die as a result of medication errors annually. One out of every 2 surgeries has a medication error or an adverse drug event (Nanji et al., 2016). It was estimated that, among the 237 million medication errors in England per year within primary and secondary care settings, 66 million had potentially clinically significant errors. Within these same settings, the interception of errors ranged in cost savings from €67.93 for inhaler medication to €6,927,078.96 for litigation claims associated with anesthetic error (Elliott et al., 2018). The cost to the UK's NHS for avoidable adverse drug reactions in only primary and secondary care settings is £98.5 million, 181,626 beddays, and 712 deaths per year (Elliott et al., 2018). In Europe, 3-10% of hospital admissions are due to adverse drug reactions, associated with a cost of 2.5-8.4 million annually. 2.1-6.5% of hospitalized patients experience an adverse drug reaction, costing 1.8-5.5 million annually (Brussels, 2008).

In summary, medication errors cost $42 billion per year worldwide (Tariq et al., 2020).

While the evidence of medication errors varies significantly by location, culture, and population, changes to the medication regimen and administration of the medication have been found to be the cause of a majority of errors related to adverse events (Assiri et al., 2018).

Medication errors are major causes of inpatient harm and death. Medication errors are preventable adverse events resulting from wrong medication use including:

- Prescribing
- Omission
- Duplication
- Unauthorized drug
- Monitoring error
- Compliance error
- Wrong preparation or formulation
- Wrong medication
- Wrong dose
- Wrong route
- Wrong time
- Wrong patient
- Wrong documentation of medication

Medication errors are most common when indicating specific medication, route, dose, and frequency. These errors at the ordering and prescribing stages account for nearly 50% of all medication errors (Tariq et al., 2020).

Although the advent of EHR systems was speculated to correlate to a decrease in medication errors, skepticism of its effectiveness on clinical outcomes, increased workload, decreased interaction with the patient, and problems with integration into the existing workflow have been cited as barriers to its complete adoption (Agrawal, 2009). However, the interception capability inherent in most electronic medication management systems offers promising potential to decrease medication errors. See Table 1 for a description of the steps in a common medication management process, the approximate error for each step, and the 'true' error rate based on the likelihood of interception of the error (Agrawal, 2009).

Medication errors risk factors include (Agency for Healthcare Research and Quality, 2019):

- Polypharmacy
- Being within the pediatric population bracket
- Low health literacy
- Administration of high-alert medications (See ISMP's List of High-Alert Medications in Acute Care Settings)

Resources

Resources for Medication Safety Improvement:

- ACOG: Improving Medication Safety
- WHO: Medication Errors
- Medication Error Prevention
- AHRQ: Medication Errors and Adverse Drug Events
- AHRQ: Medication Reconciliation
- What is the epidemiology of medication errors, error-related adverse events and risk factors for errors in adults managed in community care contexts? A systematic review of the international literature
- Preventing Medication Errors (Video)
- Computerized Prescriber Order Entry Medication Safety (CPOEMS): Uncovering and Learning from Issues and Errors
- Institute for Safe Medication Practices

For General Improvement:

- CMS: Hospital Improvement Innovation Networks
- IHI: A Framework for the Spread of Innovation
- The Joint Commission: Leaders Facilitating Change Workshop
- IHI: Quality Improvement Essentials Toolkit
- SIPOC Example and Template for Download
- SIPOC Description and Example

Endnotes

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. Workgroup members are required to disclose any potential conflicts of interest.

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Appendices

Appendix A: Checklist for Improving CDS for Drug Allergy Interactions. Adapted from Partnership for Health IT Patient Safety's Drug Allergy Toolkit.

Leaders in hospitals should improve clinical decision support for drug allergy interactions to ensure proper documentation and early assessment.

Improve allergy documentation.
- Document the drug/substance using the most specific information.
- Document the reaction(s) with the most specific description.
- Document the adverse drug reaction type (allergy, intolerance, contraindication, and side effect).
- Fill out structured data entry fields.
- Avoid free-text data entry.
- Reconcile drug allergy information with the patient at every encounter.
- Remove inaccurate or outdated allergy information.

Establish a reliable alert system.
- Develop an oversight team in order to develop an alert tiering system, determine drug allergy firing parameters, and ensure the 'five rights' of clinical decision support are considered.

Establish a reliable system for alert monitoring.
- Continuously monitor and evaluate alerts.
- Continuously monitor override rates and document reasons for overrides.
- Implement appropriate performance improvement strategies based on the data collected.

Empower patients and encourage a person-centered culture of safety.
- Involve patients in the improvement efforts.
- Implement patient-facing technology to communicate drug allergy information and changes between patient and members of the care team.

Appendix B: Considerations for High-Risk Medications

- Opioids
  - Consider all pain medicines as potential alternatives to opioid use, including over the counter.
  - Consider complementary and alternative therapies.
  - Consider potential referrals to pain management clinic.

- Antidiabetics
  - Metformin should be held after contrast administration for 48 hours. If kidney function is adequate after 48 hours, Metformin can be resumed.
  - Adjust insulin based on food intake.

- Anticoagulation/Antiplatelet
  - Monitor PT/INR, renal function, and over the counter medication use (NSAIDs).
  - Monitor for bleeding.

- Antibiotics
  - Ensure appropriate duration of therapy.
  - Ensure appropriate antibiotic for patient's condition (i.e. obtain specimen for culture and sensitivity).
  - Observe for complications (C. diff, allergic reactions etc.)
  - Practice safety antimicrobial administration (Antibiotic Stewardship Actionable Patient Safety Solution).

Ensure thorough patient education for all medications administered, changed, removed, or added. See "Education for Patients and Family Members" section.