

Information Statement

Prevention of Medication Errors

This Information Statement was developed as an educational tool based on the opinion of the authors. It is not a product of a systematic review. Readers are encouraged to consider the information presented and reach their own conclusions.

Introduction

Medication errors typically arise from a combination of human error and system shortcomings. Pharmacists, drug manufacturers, information systems (hardware/software, personnel), and hospital personnel can help reduce medication errors.

The American Academy of Orthopaedic Surgeons (AAOS) understands that to err is human and supports establishing a non-punitive reporting system to help develop and champion processes and systems that can catch errors before they cause harm.

The American Academy of Orthopaedic Surgeons (AAOS) supports the following tools for medication safety: computerized physician order entry (CPOE); computerized decision support systems (CDSS); computerized monitoring of adverse drug events; prescription drug monitoring programs (PMDP); pharmacist assisted rounds; high-risk drug protocols; and verbal order verification.

I. Prescribing

Computerized Physician Order Entry (CPOE)

CPOE eliminates illegible handwriting and ambiguous abbreviations. It also requires completion of all essential data fields. It can also be tied to decision support. Errors related to missing data such as dose, route, and frequency of administration are avoided with the use of CPOE. Several studies have demonstrated CPOE's ability to decrease the rate of medication errors and increase compliance with recommended prescribing regimens.^{2,3,4,5}

A shared and accessible medical record provides more complete and timely patient information. Alert functions can be used to highlight pertinent data, such as allergies.

Computerized Decision Support Systems (CDSS)

CDSS reviews orders as they are written. The computer can check for duplicate or related orders, identify possible drug interactions, inform clinicians about appropriate dosing schedules, and alert clinicians about pertinent lab results. CDSS can also recommend less expensive alternative medications.

Pharmacist-assisted rounds

Pharmacists familiar with the institution's formulary can assist physicians in selecting medications from among those drugs that are stocked. For patients taking multiple medications and for patients with organ failure or other conditions that make prescribing a challenge, pharmacists can offer their expertise in selecting medications that will limit adverse drug events. Nowadays, much of this is

included in CDSS and occurs seamlessly.

Standardized order sets

Standard order sets decrease physician-to-physician variations, and in some studies reduced hospital length of stay and improved the quality of care. Ideally, surgeons in a given specialty use a limited set of agreed on order sets that are reviewed by pharmacists and updated at least once a year.

Verbal order verification

Verbal orders should be avoided, if possible. If a verbal order is given, the hospital should implement a "read- back and verify" protocol to ensure proper interpretation of the order.

II. Dispensing

Automated dispensing

Automated dispensing cabinets--now in common use--can help avoid errors related to dosing and to "look alike" and "sound alike" drugs.

High-risk drug protocols/policies

National patient safety organizations recommend monitoring safety practices regarding particularly dangerous medications. Concentrated electrolytes, including but not limited to sodium chloride, potassium chloride, and potassium phosphate greater than 0.9%, should be removed from patient care units. Additionally, heparin, warfarin, insulin, lidocaine, magnesium, muscle relaxants, chemotherapeutic agents, dextrose injections, narcotics, adrenergic agents, theophylline, and immunoglobulin are all considered high-risk medications. Hospitals should recommend that pharmacies reduce the number, concentrations, and volume of high-alert medications in their formulary.

Bar coding

Bar code systems facilitate improved scheduling of medications, fewer missed doses of medications, more efficient drug monitoring, improved medication records, and better communication between health care staff. Some barcode drug systems also produce cost efficiencies. Bar coding facilitates identification of the right patient, the right drug, and the right dosage.

Unit dose packaging

Packaging pharmaceuticals in unit dose applications, used in concert with bar code readers and computer systems enhance the administration of the proper drug and dose to the correct patient.

III. Administering/Monitoring

The electronic medical record--including dispensing units--provide data related to errors and near misses, which can be valuable tools for education and leading indicators of processes that contribute to medication errors.

[Patient education](#) can also decrease medication errors. Empowering patients to ask questions about their care, including medications, tests, and procedures is essential to cultivating an environment of safety. Well-informed patients are better able to participate in their own care and contribute to better outcomes.

Most states now recommend and some mandate checking a prescription drug monitoring program for scheduled medications. This is intended to keep people with an established or

potentially developing misuse disorder from getting medications from more than one provider.

Electronic prescribing sends the script directly to the pharmacy when the order is entered in the electronic medical record. Many states allow, and some now mandate, the electronic prescribing of opioids. Electronic prescribing allows patients and surgeons to plan to use fewer opioids and then talk about it during recovery, potentially prescribing more (within agreed maximum total strength and number of pills during the entire recovery). This allows for smaller initial prescriptions rather than a large prescription to avoid inconvenience.

Medication Administration Record (MAR)

Medication administration records are mechanisms that record the time, date, and route of administration of ordered medications, in addition to the identity of the prescribing health care provider. The system can be programmed to require a co-signer for high-risk medications, such as anticoagulants or opioids. A computerized MAR can reduce confusion about whether a dose was administered, when it was administered, and other details of administration.

Environmental Factors

Fatigue, excessive workload, and environmental factors such as poor lighting, interruptions, and noise significantly contribute to medical errors. Hospitals and ambulatory surgical centers should evaluate and monitor environmental factors to ensure that work flow is optimized for the health care professional, and distractions are kept to a minimum.

In the event a medication error occurs, hospital administration, quality assurance, risk management, and physicians should investigate the contributing causes of the error regardless of the severity of harm. Medication errors should be analyzed to determine trends and systems should be adjusted and improved.

IV. Medication Reconciliation

Medication reconciliation attempts to optimize drug therapy by accurately and completely reconciling medication, while reducing adverse drug events at transition points across the continuum of care. A medication list of what the patient is currently taking and those that are subsequently prescribed are tracked. Medications to be considered include prescriptions, over-the-counter drugs, vitamins, herbal supplements, and any product designated by the FDA as a drug. The Joint Commission requires that a Home Medications list be obtained within 24 hours of admission as part of the initial assessment. Home medications are characterized as medication taken prior to the patient's entry into the hospital. Through electronic records, medications are more easily tracked, and medication reconciliation is more efficient. Studies have shown a significant decrease in adverse medication events as the result of medication reconciliation.

V. Electronic Medical Records (EMRs)

The AAOS believes that patient safety must be a top priority in healthcare. The provision and maintenance of a safe working environment is the most cost-effective tool for achieving this standard. Some technologies may be cost prohibitive for some hospital systems. However, cost-efficient, low technology tools are available and should be used to ensure the safest medication practices in the absence of more technologically advanced options.

Although CPOE, EMRs, CDSS, barcoding, and other medical technological advances have shown evidence of a decrease in medication errors, studies have revealed that errors have occurred due to faulty computer interface, miscommunication with other systems and lack of sufficient decision support. Medication related adverse events in the age of electronic prescribing includes renewing outdated medications, inaccurate medication lists, inappropriate medications on electronic order sets. Malfunctions or errors must be considered when using this equipment or following procedures. There still remains the chance that an error can occur in any situation. The medical

arena will continue to advance technologically in hopes to improve patient care and patient safety, but it must be recognized that every solution will present unintended new risk. Safety relies on a continually evolving understanding of both the presentation of new risk (largely through nonpunitive incident reporting), and the impact of new policies, procedures, and technology on workflow.

References:

1. Kohn LT, Corrigan, JM, Donaldson MD, eds. *To err is human: building a safer health system*. Washington, D.C.: National Academy Press, 2000.
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. 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.
4. Kuperman GJ, Gibson RF: Computer physician order entry: Benefits, costs, and issues. *Ann Intern Med* 2003; 139: 31-39.
5. Teich JM, Merchia PR, Schmiz JL, Kuperman GJ, Spurr CD, Bates DW: Effects of computerized physician order entry on prescribing practices. *Arch Intern Med* 2000; 160: 2741-2747.

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