The Joint Commission

Sentinel Event Alert

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Preventing pediatric medication errors

Errors associated with medications are believed to be the most common type of medical error and are a significant cause of preventable adverse events. Experts agree that medication errors have the potential to cause harm within the pediatric population at a higher rate than in the adult population. For example, medication dosing errors are more common in pediatrics than adults because of weight-based dosing calculations, fractional dosing (e.g., mg vs. Gm), and the need for decimal points.

"Research shows that the potential for adverse drug events within the pediatric inpatient population is about three times as high as among hospitalized adults," (1) says Stu Levine, PharmD, informatics and pediatric specialist, Institute for Safe Medication Practices, an organization which serves as a resource for information on how to improve medication practices. "For this reason, health care providers must pay special attention to the specific challenges relating to the pediatric population."

A new study—the first to develop and evaluate a trigger tool to detect adverse drug events in an inpatient pediatric population—identified an 11.1 percent rate of adverse drug events in pediatric patients. This is far more than described in previous studies. The study also showed that 22 percent of those adverse drug events were preventable, 17.8 percent could have been identified earlier, and 16.8 percent could have been mitigated more effectively. (2)

Children are more prone to medication errors and resulting harm because of the following:

- Most medications used in the care of children are formulated and packaged primarily for adults. Therefore, medications often must be prepared in different volumes or concentrations within the health care setting before being administered to children. The need to alter the original medication dosage requires a series of pediatric-specific calculations and tasks, each significantly increasing the possibility of error.
- Most health care settings are primarily built around the needs of adults. Many settings lack trained staff oriented to pediatric care, pediatric care protocols and safeguards, and/or up-to-date and easily accessible pediatric reference materials, especially with regard to medications. Emergency departments may be particularly risk-prone environments for children. (3)
- Children—especially young, small and sick children—are usually less able to physiologically tolerate a medication error due to still developing renal, immune and hepatic functions.
- Many children, especially very young children, cannot communicate effectively to providers regarding any adverse effects that medications may be causing.

During calendar years 2006-2007, USP's MEDMARX® database shows nearly 2.5 percent of pediatric medication errors led to patient harm. The most common types of harmful pediatric medication errors were: improper dose/quantity (37.5 percent), omission error (19.9 percent), unauthorized/wrong drug (13.7 percent), and prescribing error (9.4 percent), followed by wrong administration technique, wrong time, drug prepared incorrectly, wrong dosage form, and wrong route. Medication errors involving pediatric patients were most often caused by: performance deficit (43.0 percent), knowledge deficit (29.9 percent), procedure/protocol not followed (20.7 percent), and miscommunication (16.8 percent), followed by calculation error, computer entry error, inadequate or lack of monitoring, improper use of pumps, and documentation errors. The MEDMARX Data Report (4) reveals that approximately 32.4 percent of pediatric errors in the operating room involve an improper dose/quantity compared with 14.6 percent in the adult population and 15.4 percent in the geriatric population. A recent study indicates that children are particularly at risk for chemotherapy medication errors. (5)

Risk reduction strategies

Pediatric-specific strategies for reducing medication errors include:

Standardize and identify medications effectively, as well as the processes for drug administration.

- Establish and maintain a functional pediatric formulary system with policies for drug evaluation, selection and therapeutic use. (6)
- To prevent timing errors in medication administration, standardize how days are counted in all protocols by deciding upon a protocol start date (e.g., Day 0 or Day 1).
- Limit the number of concentrations and dose strengths of high alert medications to the minimum needed to provide safe care.
- For pediatric patients who are receiving compounded oral medications and total parenteral nutrition at home, ensure that the doses are equivalent to those prepared in the hospital (i.e., the volume of the home dose should be the same as the volume of the hospital prepared products).
- Use oral syringes to administer oral medications. The pharmacy should use oral syringes when preparing oral liquid medications. Make oral syringes available on patient care units when "as needed" medications are prepared. Educate staff about the benefits of oral syringes in preventing inadvertent intravenous administration of oral medications.

Ensure full pharmacy oversight—as well as the involvement of other appropriate staff—in the verifying, dispensing and administering of both neonatal and pediatric medications.

- Assign a practitioner trained in pediatrics to any committee that is responsible for the oversight of medication management.
- Provide ready access, including website access, to up-to-date pediatric-specific information for all hospital staff. This information should include pediatric research study data, pediatric growth charts, normal vital sign ranges for children, emergency dosage calculations, and drug reference materials with information about minimum effective doses and maximum dose limits.
- Orient all pharmacy staff to specialized neonatal/pediatric pharmacy services in your organization. (7)
- Provide a dosage calculation sheet for each pediatric critical care patient, (8), (9) including both emergency and commonly used medications. (7)
- Develop preprinted medication order forms and clinical pathways or protocols to reflect a standardized approach to care. Include reminders and information about monitoring parameters.
- Create pediatric satellite pharmacies or assign pharmacists and technicians with pediatric expertise to areas or services such as neonatal/pediatric critical care units and pediatric oncology units. (1), (7) At a minimum, pediatric medications should be stored and prepared in areas separate from those where adult medications are stored and prepared.

Use technology judiciously.

- Use methods to ensure the accuracy of technology that measures and delivers additives for intravenous solutions, such as for total parenteral nutrition.
- If dose and dose range checking software programs are available in hospital or pharmacy information systems, enable them to provide alerts for potentially incorrect doses.
- Medications in automated dispensing cabinets that do not undergo appropriate pharmacist review should be limited to those needed for emergency use and/or to those medications under the control of a licensed independent prescriber, as specified in Joint Commission standard MM 4.10.
- Recognize that the use of infusion pumps, or smart pumps, is not a guarantee against medication errors. Appropriate education for nurses, pharmacists and other caregivers regarding these technologies is important for all institutions caring for pediatric patients.
- To prevent adverse outcomes or oversedation, use consistent physiological monitoring – particularly pulse oximetry (10) – while children are under sedation during office-based procedures. Use age- and size-appropriate monitoring equipment and follow uniform procedures under the guidance of staff appropriately trained in sedation, monitoring and resuscitation.
- Providers are encouraged to develop bar-coding technology with pediatric capability. Potential errors should be carefully considered while adapting this technology to pediatric processes and systems. For example, a pediatric bar-coding solution must be able to provide readable code for small-volume, patient-specific dose labels.

Existing Joint Commission requirements

As part of National Patient Safety Goal 2B, Joint Commission accredited organizations are required to follow The Joint Commission's Official "Do Not Use" Abbreviations List. In addition, Goal 3 (Improve the safety of using medications) and Goal 8 (Accurately and completely reconcile medications across the continuum of care) establish several medication standardization, identification and communication requirements that are especially important in pediatrics and neonatology. Three Sentinel Event Alerts also address specific issues relating to pediatric medication errors. (11), (12), (13)

Other Joint Commission suggested actions

The Joint Commission offers the following suggested actions to prevent pediatric medication errors and their related adverse events in pediatric care settings:

1. Since patient weight is used to calculate most dosing (either as weight-based dosing, body surface area calculation, or other age-appropriate dose determination), all pediatric patients should be weighed in kilograms at the time of admission (including outpatient and ambulatory clinics) or within four hours of admission in an emergency situation. Kilograms should be the standard nomenclature for weight on prescriptions, medical records and staff communications.
2. No high risk drug should be dispensed or administered if the pediatric patient has not been weighed, unless it is an emergency.
3. On inpatient medication orders and outpatient prescriptions, require prescribers to include the calculated dose and the dosing determination, such as the dose per weight (e.g., milligrams per kilogram) or body surface area, to facilitate an independent double-check of the calculation by a pharmacist, nurse or both. (7) Exceptions to this are medications that do not lend themselves to weight-based dosing, such as topicals, ophthalmics, and vitamins.
4. Whenever possible, use commercially available pediatric-specific formulations and concentrations. When this is not possible, prepare and dispense all pediatric medications in patient-specific "unit dose" or "unit of use" containers, rather than in commercially available adult unit doses. (7) For oral liquid preparation medications, use oral syringes to ensure correct dosage.
5. Clearly differentiate from adult formulations all products that have been repackaged for use in pediatric populations. (14) Use clear, highly visible warning labels. To prevent overdoses, keep concentrated adult medications away from pediatric care units. Avoid storing adult and pediatric concentrations in the same automated dispensing machine/cabinet drawer.
6. Ensure comprehensive specialty training for all practitioners involved in the care of infants and children, as well as

continuing education programs on pediatric medications for all health care providers. Training and education should include information on how adverse effects should be reported. (6), (15)

7. Communicate verbally and in writing information about the child's medication to the child, caregivers and parents/guardians, including information about potential side effects. Ask the caregiver/parent/guardian to repeat back their understanding of the drug and how it is to be administered. Encourage the asking of questions about medications.
8. Have a pharmacist with pediatric expertise available or on-call at all times.
9. Establish and implement medication procedures that include pediatric prescribing and administration practices.

Should a serious error or adverse event occur, the organization should conduct a root cause analysis and develop and implement a corrective action plan which should be monitored to assure that it is effective. The Joint Commission also encourages apology and transparency about the error with both staff and the families involved.

In addition, The Joint Commission encourages pharmaceutical manufacturers to develop pediatric-specific formulations as well as to standardize the labeling and packaging for all types of medications. (14) Researchers are encouraged to conduct additional research on interventions to reduce pediatric medication errors, especially in emergency departments, ambulatory clinics and home environments. (13)

In conclusion, since parents and caregivers play an extremely important role in the health care of children, The Joint Commission encourages parents and caregivers to seek out information and ask questions about their child's medications and to repeat back instructions to clinicians in order to ensure understanding about the drug, dosages, timing and routes of administration. This is done both to reassure staff that parents or caregivers have a true understanding of the medications the child is taking and, most importantly, to ensure that everyone involved can safely administer medications to this most vulnerable population.

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