

Acute Care

ISMP Medication Safety Alert!®

Educating the Healthcare Community About Safe Medication Practices

Results of pediatric medication safety survey (Part 2)

Comparing data subsets points out areas for improvement



Preventing medication errors in pediatric patients poses unique challenges for healthcare providers. Pediatric patients are three times more likely than adults to experience a harmful medication error¹ or adverse drug reaction² given their size, immature renal and hepatic functions, inability to communicate symptoms of adverse effects, and other risk factors. Children are particularly vulnerable to errors if they are younger than 2 years, in the neonatal intensive care unit or emergency department, receiving chemotherapy or other IV medications, or if their weight has not been documented.³

In March and April 2015, ISMP conducted a survey to learn about the frequency with which healthcare providers employ key error-prevention strategies and “best practices” when caring for pediatric patients. We received responses from 1,463 clinicians, mostly nurses, pharmacists, and physicians, working in both inpatient and outpatient settings.

In our June 4, 2015 newsletter, we presented the aggregate survey results as **Part 1** of our analysis. We also compared the findings to a similar survey we conducted 15 years ago. In **Part 2**, we compare subsets of the survey data based on the participants’ practice site and professional designation (results in **Table 1**, page 3). Although the results confirm some logical assumptions about the implementation of medication safety best practices in pediatrics, there are areas of exception worth noting.

Practice Site Comparisons

General practices. The majority of survey participants are weighing patients only in metric units and documenting weights using only the metric system. Most participants in pediatric hospitals (87%) and adult-pediatric hospitals (76%) said they always express doses of liquid medications in the metric system, but only 67% of outpatient facilities reported the same. The lowest scoring general strategies included standardizing and limiting the concentrations and dosage strengths of high-alert medications, particularly in outpatient facilities (60%), and separating adult and pediatric medications in storage areas, particularly in adult-pediatric hospitals (49%).

Prescribing practices. Best practices associated with prescribing pediatric medications were reported in higher frequency in both inpatient and outpatient facilities that treat *only* pediatric patients. Adult-pediatric hospitals tended to report lower compliance. However, approximately one-third or more of all participants did not report full compliance for any prescribing best practices, suggesting the need for improvement.

For example, prescribers consistently include both the basis for the dose (e.g., mg per kg) and the calculated amount per dose in medication orders or prescriptions in just 40% of pediatric hospitals, 41% of outpatient facilities, and 33% of adult-pediatric hospitals. Prescribers consistently order pediatric liquid medication doses in metric doses, not volume alone, in only about half of all participant facilities. The patient’s weight in kg or g is entered into the computerized prescriber order entry (CPOE) system *before* medication

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NANALERT

Use dosing cups with mL markings only

A fatal event was reported to ISMP in which a nurse confused two dosing scales on a commonly available plastic oral liquid dosing cup. The nurse measured a dose of morphine sulfate oral solution 20 mg/mL incorrectly for an opioid-naïve hospice patient. The nurse misread the scale marked drams as mL and administered 1 dram of the medication, mistakenly believing she was to give 1 mL. One dram is 3.7 mL, so the patient received close to 75 mg of morphine. The patient was found dead a few hours later.

Medication cups with more than one dosing scale can lead to confusion. In place of cups, oral syringes that measure only in mL should be used for oral liquid medications when possible. If a dosing cup must be used, ideally it should only measure in mL. You may need to rely on cups with mL and household measures until mL-only cups can be supplied. The full alert can be viewed at: www.ismp.org/NAN/default.asp. It has also been posted on the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) website (www.nccmerp.org).

■ Won't you please help?

Medication safety would be very different today without ISMP. The nonprofit organization has worked closely with regulatory authorities, standards organizations, professional and industry groups, and you, to improve safety. As a result, thousands of product and practice changes have occurred since our founding in 1994. We recently launched an annual fund to ensure that our lifesaving work will continue. Please consider donating to this year’s fund. To view a short video about us, or to contribute, please go to: www.ismp.org/support/default.aspx. Thank you!

> **Pediatric survey**—continued from page 1

orders are entered in 61% of pediatric hospitals, 63% of outpatient facilities, and 54% of adult-pediatric hospitals. Dose range checking software was reported by 65% of pediatric hospitals, 64% of outpatient facilities, and 55% of adult-pediatric hospitals. Among practice sites where parenteral nutrition (PN) or other complex electrolyte solutions were prescribed, only about two-thirds reported that prescribers order the total amount of each ingredient as dose/kg/day (e.g., mg/kg/day, mcg/kg/day) for younger children, and only about half reported ordering the total amount of each ingredient per day for older children.

Dispensing practices. Overall, pediatric hospitals reported higher frequencies of implementing best practices associated with dispensing medications than adult-pediatric hospitals or outpatient pediatric facilities.

Automated compounding devices are used to prepare solutions much more often in pediatric hospitals (84%) and adult-pediatric hospitals (71%), compared to outpatient facilities (46%). Pediatric hospitals also reported higher compliance with dispensing oral liquid doses in cups or oral syringes and more consistent implementation of entering PN or other complex electrolyte solutions into the pharmacy computer and compounding software exactly as each ingredient is prescribed. Outpatient facilities scored as high as or higher than pediatric hospitals and adult-pediatric hospitals with requiring entry or verification of the patient's age before medication orders are entered in the pharmacy computer.

Of particular concern is that only 41% of pediatric hospitals, 43% of adult-pediatric hospitals, and 19% of outpatient facilities require the components of pediatric/neonatal compounded sterile preparations to be verified by a pharmacist *prior* to adding them to a solution. The lowest scoring practices for all practice sites were associated with the pharmacist's time spent on units; for example, a clinical pharmacist is consistently available in patient care areas in just 16% of adult-pediatric hospitals, 24% of outpatient facilities, and 30% of pediatric hospitals.

Administration practices. Participants from pediatric hospitals reported a higher frequency (78%) of requiring nurses to undergo specialized training and to demonstrate clinical competency than adult-pediatric hospitals (58%) and outpatient pediatric facilities (65%). Pediatric hospitals also reported higher compliance with making available specially designed oral syringes to administer oral/enteral liquid medications. Both pediatric hospitals and outpatient facilities reported higher compliance with providing patient-specific doses of emergency drugs and commonly used medications on each pediatric patient's chart.

Although smart pumps with an active drug library were consistently used to administer pediatric solutions containing high-alert medications in 59% to 63% of all work places, outpatient facilities were more likely to require an independent double check of high-alert medication solutions to verify the patient, drug, strength/dose, line attachment, and smart pump settings, than adult-pediatric hospitals or pediatric hospitals. Bedside barcode medication administration was fully implemented for medications and breast milk feedings in 58% and 48%, respectively, of pediatric hospitals, in 69% and 47% of adult-pediatric hospitals, and 43% and 13% of outpatient facilities.

Practitioner Type Comparisons

Prescribing practices. Physicians and nurses tended to report higher (and similar) rates of full compliance with prescribing best practices, while pharmacists—who see prescribed orders daily—tended to report lower compliance. For example, physicians and nurses reported 41% and 45% compliance, respectively, with prescribers including the mg/m² or mg/kg dose and the final calculated dose with pediatric drug orders, but

Table 1 on page 3, text continued on page 4—**Pediatric survey** >

SAFETY briefs

Update on Bloxiverz and Vazculep confusion. We are still receiving reports of potentially harmful mix-ups between **BLOXIVERZ** (neostigmine) 10 mg and pharmacy bulk packages of **VAZCULEP** (phenylephrine) 50 mg, despite earlier warnings about packaging and labeling similarities. The warnings were published in our February 12, 2015 issue, and a **National Alert Network (NAN)** was also released in March 2015 (www.ismp.org/NAN/files/NAN-20150320.pdf).

A mix-up between these drugs could be problematic either way. As noted in the NAN Alert, if someone inadvertently gave Vazculep instead of Bloxiverz, and prepared 5 mL (50 mg) of phenylephrine injection, this would lead to a 100-fold overdose of phenylephrine if based on the highest dose recommended for a patient in shock (500 mcg), or a 1,250-fold overdose of phenylephrine if based on the low range of the recommended dose for a patient with hypotension during anesthesia (40 mcg). That much phenylephrine could cause cardiac arrest, or extreme hypertension and a cerebral vascular accident or death. Also, if the reverse happened, and patients on phenylephrine for hypotension were receiving a paralytic, neostigmine could reverse the neuromuscular blocker if accidentally given. Most recently, a hospital reported that a Vazculep 50 mg vial was sent to the operating room (OR) instead of Bloxiverz. Fortunately, someone from anesthesia immediately identified the error and notified pharmacy.

It's critically important for pharmacy and OR staff to be aware of potential errors with these products. Pharmacy bulk packages must never leave the pharmacy. Recently, Eclat Pharmaceuticals, the manufacturer of Vazculep and Bloxiverz, announced a forthcoming container label change for Vazculep to address the current similarities. Vazculep 50 mg per 5 mL vials that currently have a red box similar to Bloxiverz will now have a gold box, and the words "Pharmacy Bulk Package" will be highlighted with a yellow background

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> Pediatric survey

Table 1. Survey Results by Practice Site and Practitioner Type (N = 1,463)

Pediatric Medication Error-Prevention Strategies	Practice Site (%)			Practitioner Type (%)		
	Full Implementation >99%					
	Pediatric Hospital	Adult-Pediatric Hospital	Outpatient Facility	Physician	Pharmacist	Nurse
General Best Practices						
Pediatric patients are weighed using metric units of measure (kg, g).	87	73	80	63	75	85
Metric units of measure (kg, g) are standard nomenclature for pediatric weights documented on medical records and prescriptions.	94	82	87	82	86	89
The volume of liquid pediatric medication doses is expressed in the metric system (e.g., mL, not tsp).	87	76	67	89	81	79
Concentrations/strengths of high-alert drugs are standardized and limited.	66	63	60	66	61	61
Adult, pediatric, and neonatal medications are not stored near one another.	57	49	69	70	47	58
Best Practices When Prescribing Medications						
Prescribers include both the mg/kg or mg/m ² dose (or other basis for the dose) <u>and</u> the calculated amount per dose for pediatric drug orders.	40	33	41	41	26	45
Prescribers order pediatric liquid medications in metric doses, not volume only.	55	47	49	49	44	56
Prescribers order each ingredient of PN/complex electrolyte solutions as dose/kg/day (e.g., mg/kg/day, mcg/kg/day) for younger children.	62	65	63	76	53	76
Prescribers order the total amount of each ingredient of PN/complex electrolyte solutions per day for older children.	51	55	50	47	42	65
Patient's weight in kg or g is entered in the computerized prescriber order entry (CPOE) system before orders are entered.	61	54	63	68	43	73
Dose range checking software is available and enabled in the CPOE system.	65	55	64	77	50	73
Best Practices When Dispensing Medications						
Pharmacists verify the mg/kg or mg/m ² dose used (or other basis for the dose) to calculate the final dose of a drug before preparing/dispensing medications.	66	61	71	50	59	46
Pharmacists recalculate the dose before preparing/dispensing medications.	63	60	67	64	54	32
The pediatric patient's weight in kg or g is entered/verified in the pharmacy computer before entering/verifying medication orders.	71	60	66	54	59	49
The pediatric patient's age is entered/verified in the pharmacy computer before entering/verifying medication orders.	46	55	59	50	41	56
Dose range checking software is available and enabled in the pharmacy computer.	60	53	62	64	50	65
PN/complex electrolyte solutions are entered into the pharmacy computer exactly as each ingredient is prescribed (no unit conversions).	72	64	55	67	64	76
PN/complex electrolyte solutions are entered into compounding software exactly as each ingredient is prescribed (no unit conversions).	78	65	63	67	69	82
Automated compounding devices are used to prepare PN/complex electrolyte solutions (or solutions are outsourced).	84	71	46	75	80	79
Preparation of IV/oral liquid doses includes barcode verification of ingredients.	42	39	46	67	29	47
The pharmacy dispenses patient-specific doses of liquid oral/enteral medications in cups or specially designed oral/enteral syringes.	78	66	64	57	74	15
Pharmacists verify components of pediatric/neonatal sterile preparations <u>prior</u> to adding them to the solution (syringe pull-back method afterwards is <u>not</u> acceptable).	41	43	19	57	28	71
Pharmacists/technicians who prepare pediatric parenteral solutions have undergone specialized training and have demonstrated competency.	53	40	35	75	37	75
Pharmacists who prepare or check pediatric parenteral solutions spend time in the neonatal/pediatric units to observe prescribing and administration.	24	16	22	36	11	67
A clinical pharmacist is present on patient care units to participate in rounds and provide input when prescribing/administering medications.	30	16	24	20	23	30
Best Practices When Administering Medications						
A smart infusion pump with an activated drug library is used to administer pediatric parenteral solutions that contain (or are) high-alert medications.	63	61	59	48	59	3
Nurses who administer medications to pediatric patients have undergone specialized training and have demonstrated competency.	78	58	65	67	59	3
Before administering high-alert parenteral drugs, a second nurse independently verifies the patient, drug, dose, line attachment, pump settings, and infusion rate.	65	63	80	48	61	4
Before administration of pediatric infusions, nurses trace the line from the medication/solution to the patient (or vice versa) to verify attachment.	52	57	54	53	50	5
Oral syringes that do not connect to IV tubing are available in patient care units.	87	77	70	68	83	3
Doses for emergency drugs and common medications have been calculated for each pediatric patient and are available for reference.	77	66	76	63	63	5
Bedside barcode scanning is used to verify patients and medications/solutions before administration.	58	69	43	50	57	2
Bedside barcode scanning is used to verify patients and breast milk before each feeding.	48	47	13	38	45	20

> **Pediatric survey**—continued from page 2

pharmacists reported just 26% compliance with the practice. More than two-thirds of physicians and nurses reported that the pediatric patient's weight must be entered or verified in the CPOE system before medications can be entered, but only 43% of pharmacists agreed. Seventy-six percent of physicians and nurses reported full implementation of prescribing each ingredient of PN and other complex electrolyte solutions as dose/kg/day for younger children, while only 53% of pharmacists agreed.

Dispensing practices. More pharmacists reported full compliance than nurses or physicians for several dispensing practices, which may be due to professions outside of pharmacy not being aware of exactly what the pharmacist does. But one practice stands out: 74% of pharmacists reported full compliance with dispensing patient-specific doses of liquid oral/enteral medications for pediatric patients in cups or oral syringes; only 15% of nurses reported that the pharmacy dispenses these medications in cups or oral syringes.

Pharmacists did report less compliance than the other two professions for some specific tasks, suggesting the possibility that nurses and physicians may rely on pharmacy to complete these tasks without realizing they are not being carried out. Examples include:

- Available and enabled dose range checking software in the pharmacy computer
- Barcode scanning to verify the ingredients of pediatric IV and oral liquid doses during preparation
- Verification of components and amounts of pediatric and neonatal compounded sterile preparations *prior* to adding them to a solution
- Providing specialized training and requiring demonstrated clinical competency before pharmacists/technicians can prepare or check pediatric parenteral solutions

Administration practices. Nurses were much more reluctant than physicians or pharmacists to report full compliance for most of the best practices associated with drug administration, although they frequently indicated full compliance for prescribing and dispensing best practices. Even if we combine full compliance with partial compliance frequencies for comparison, nurses still reported lower compliance than pharmacists or physicians for many administration best practices. The most significant differences included:

- Use of a smart pump with an enabled library to administer pediatric IV parenteral solutions
- Conducting an independent double check of a solution against the medication administration record or order to verify the patient, drug, strength/dose, line attachment, and pump settings
- Providing specialized training and requiring demonstration of competency for nurses who administer medications to pediatric patients
- Availability of oral syringes in patient care units to administer all liquid oral/enteral medications
- Barcode scanning at the bedside for patient identification and medication verification
- Barcode scanning for patient identification and verification of breast milk prior to feeding

Patient Care Unit Comparisons

Pediatric inpatient units. When comparing implementation of medication safety best practices among different patient care units, we found that pediatric inpatient units in a pediatric hospital scored higher than pediatric units in a general hospital. There was one exception: entry or verification of the patient's age before entering or verifying orders in the pharmacy, for which 60% of pediatric units in general hospitals reported full implementation compared to 47% of pediatric units in pediatric hospitals.

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(Figure 1). A 10 mL (100 mg) pharmacy bulk package will also have that notation in a yellow background. The changes will be intro-



Figure 1. Current container labeling for Bloxivert and Vazculep (left) alongside a revised Vazculep label that is expected on the market once stock becomes available (right).

duced to the market as soon as stock is available. Eclat recently sent a letter to healthcare providers (http://vazculep.com/82584_Vazculep_Ltr.pdf) to notify them about reported issues, along with a supply of alert stickers. Eclat is asking providers to add the stickers to current and future stock of the Vazculep 50 mg/5 mL products. The hope is that these changes will help practitioners recognize the potential for mix ups and highlight the criticality of verifying the product name and strength before use.

Errata 1. In **Part 1** of the pediatric survey results in our June 4, 2015 newsletter, we mistakenly implied in the text and table that prescribers should order each ingredient of parenteral nutrition for older children in the total amount/liter. The survey data we collected asked whether prescribers order the total amount of each ingredient per day, not per liter. We apologize for reporting the results incorrectly. To clarify, the best practice is to prescribe each ingredient for older children, who may approach adult weights, per day (<http://pen.sagepub.com/content/38/3/296.full>). We have corrected the newsletter and the article posted on our website.

Errata 2. In our June 18, 2015, article on fluorouracil infusion overdose, the dose given for the antidote, uridine triacetate, was listed as 10 mg when it should have been 10 g. Uridine triacetate must be given promptly in a dose of 10 g orally every 6 hours for 20 doses. Thanks to several readers who pointed out this mistake.

> **Pediatric survey**—continued from page 4

Emergency departments (EDs). When comparing practices in EDs, we found that the best practices were reported most frequently in pediatric hospital EDs than in EDs in general hospitals. But again, there was one exception: availability and activation of dose checking software in the CPOE system—there was 53% full implementation in EDs in general hospitals, compared to 41% in EDs in pediatric hospitals.

Oncology units. Participants who worked in pediatric outpatient oncology units reported a higher frequency of implemented practices associated with prescribing and drug administration. But implementation of dispensing best practices was reported more frequently in inpatient oncology units, especially practices associated with preparing PN and other complex electrolyte solutions or sterile compounds, preparing doses of liquid oral/enteral medications in oral syringes or dose cups, and use of barcoding to verify the ingredients.

Neonatal nurseries. When comparing the different units providing neonatal care, those working in level II nurseries reported a higher frequency of implementing best practices in most areas except the presence of a clinical pharmacist; 30% of participants who worked in level III or IV nurseries reported a consistent clinical pharmacist on the unit, compared to 21% in level II nurseries.

Conclusions

Overall, ISMP's survey shows that improvements are still needed to protect pediatric patients from harmful medication errors. And all facilities and units that treat pediatric patients have something to learn from each other.

Not unexpectedly, pediatric hospitals rank higher in implementing many best practices associated with medication use than hospitals that treat both adult and pediatric patients and outpatient pediatric facilities. But the survey reveals some notable exceptions. It also uncovers areas of variation between practitioners and patient care units, including the fact that physicians, nurses, and pharmacists report different levels of compliance with best practices, which offers insight into how each discipline views their own and others' contributions to pediatric medication safety.

ISMP hopes that all healthcare providers who care for pediatric patients will assess their practices, using **Table 1** (on page 3) as a guide, and develop a plan to improve implementation. Although partial adoption of the surveyed best practices is safer than none at all, any variance in practice can lead to an error—particularly if staff expect a strategy to be in place when it is not. Providers should examine their exceptions and settle for nothing less than full compliance in order to better protect children receiving medical care in any setting.

References

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- 2) Horen B, Montastruc JL, Lapeyre-Mestre M. Adverse drug reactions and off-label use in paediatric outpatients. *Br J Clin Pharmacol*. 2002;54(6):665-70.
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Special Announcements

Bilingual volunteers needed

ISMP is seeking health professionals to volunteer to help us with a Spanish translation for several high-alert drug patient education handouts. The translations will be made available on the ISMP website and our consumer website, *Consumermedsafety.org*. ISMP created the handouts under a research grant provided by the Agency for Healthcare Research and Quality. They can be found at: www.consumermedsafety.org/tools-and-resources. Translation to additional languages will be considered once Spanish translations are completed. If you can help, please contact us at: ismpinfo@ismp.org.

ISMP webinar

Join us on **July 30** for *Missed Safety Opportunities with Subcutaneous Insulin: Addressing the Often Unknown Safety Challenges with Insulin*. A 2014 ISMP survey suggests that pharmacists and nurses believe hospitalized patients are more vulnerable to errors with subcutaneous insulin than errors with any other high-alert medication. Join us as we discuss standardizing basal/bolus insulin doses and managing risks associated with subcutaneous insulin and patient education/adherence. For details, please visit: www.ismp.org/sc?id=349.

Unique 2-day program

Attend one of the **ISMP Medication Safety INTENSIVE** workshops being held in 2015: Bellevue, WA (near **Seattle**) on September 17-18; and **New Orleans** on December 4-5. This workshop provides hands-on experiences with event investigation, error analysis, error-reduction strategies, and more! For details, please visit: www.ismp.org/educational/MSI.

If you would like to subscribe to this newsletter, visit: www.ismp.org/sc?id=382



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