



Identification of the Top-Ten Problematic Pediatric Medications

HyeJin Son, B.S.¹, Forrest L. Smith, Ph.D.¹, Jeanie M. Smith, Pharm.D.¹, Ashley E. Earley, Pharm.D.¹,
Kalen B. Manasco, Pharm.D., BCPS², Kenneth M. Yates, M.S., D.V.M.¹ and Julie C. Kissack, Pharm.D., BCPP¹

Harding University College of Pharmacy, Searcy, AR¹
University of Georgia College of Pharmacy, Augusta, GA²

INTRODUCTION

No high alert medication list like the Institute for Safe Medication Practices (ISMP) List of High-Alert Medications has been developed for pediatric patients. According to Wolsoncroft, pediatric patients represent the second largest population that uses medications. ISMP states pediatric patients may suffer significant harm when treated with many of the same medications on their list. ISMP encourages clinicians to use special safeguards to reduce the risk of errors with these medications. Several ISMP high alert medications have caused significant harm to pediatric patients from medication errors according to Franke et al. This supports the need for a pediatric-specific high alert medication list.

The goal of this study is to obtain a consensus of expert opinion ranking medication categories from least to most problematic regarding pediatric patient safety and to identify the top-ten most problematic pediatric medications.

METHODS

Upon review of the Institute for Safe Medication Practice's (ISMP) List of High-Alert Medications and medication alerts/reviews of pediatric literature, a list of potentially problematic medications was developed. A Survey Monkey® survey was sent to 624 ACCP Pediatric Practice and Research Networks (PRN) members. The survey was limited to pharmacist only. Participants ranked 11 medication categories as least, moderately and most problematic regarding patient safety. The medications were then ranked from least to most problematic based on participant Rating Average (Table 1). Participants next ranked the top-ten from a list of 50 medications in three areas: problems in dosing, adverse drug events (ADEs) and medication errors. Scores for each medication and area were summed and ranked from 1 to 50 to identify the top-ten list (Table 2). Largest individual medication contributors in each column were identified by participant scores (e.g., Problems with dosing = 42; warfarin).

RESULTS-DISCUSSION

The survey was completed by 10.7% (67) of 624 ACCP Pediatric PRN pharmacist members. Participants represented mostly clinical pharmacists (75%), working in children's hospitals (61%) or pediatric units (25%), from 25 states and 3 Canadian provinces. Seventy-percent of the participants are also Pediatric Pharmacy Advocacy Group members.

Table 1. Ranking of medication categories from least, moderately and most problematic regarding overall patient safety in pediatric patients by survey participants.

Medication Categories	Least Problematic	Moderately Problematic	Most Problematic	Rating Average	Response Count
ANTICOAGULANTS (e.g., heparin, warfarin)	0	14	35*	2.71	49
OPIOIDS (e.g., fentanyl, morphine)	2	21	26	2.49	49
ELECTROLYTES (e.g., potassium, calcium)	2	21	25	2.48	48
ANTIARRHYTHMICS (e.g., amiodarone, digoxin)	0	16	24	2.60	40
SEDATIVES (e.g., chloral hydrate, midazolam)	3	26	12	2.22	41
ADRENERGIC AGONISTS (e.g., dopamine, epinephrine)	3	25	10	2.18	38
ANTICONVULSANTS (e.g., carbamazepine, phenobarbital)	4	27*	7	2.08	38
ANTI-INFECTIVES (e.g., ampicillin, gentamicin)	21	19	5	1.64	45
ANTIEMETICS (e.g., metoclopramide, promethazine)	23	10	3	1.44	36
ANTI-INFLAMMATORIES (e.g., hydrocortisone, prednisolone)	26	12	1	1.36	39
GASTROINTESTINALS (e.g., lansoprazole, ranitidine)	52*	4	0	1.07	56
**Other Medications (please specify)					6

**Other Medications: 1. clonidine, clonazepam; 2. psych drugs, immunosuppressant agents; 3. desmopressin; 4. chemotherapy; 5. antivirals acyclovir, immunosuppressant agents, TPN; 6. immunosuppressant agents

*Ranked highest by survey participants in each respective category

Table 2. Top ten medications ranked on the summation of participant scores on problems with dosing, adverse drug events and medication errors.

Rank	Medication	Problems with Dosing	Adverse Drug Events (ADEs)	Medication Errors	Top 10 By Sum
1	Insulin	33	39	47	119
2	Warfarin	42	41	33	116
3	Heparin	32	33	43	108
4	Vancomycin	36	36	34	106
5 [†]	Digoxin	37	19	35	91
5 [†]	Gentamicin	28	32	31	91
6	Potassium Chloride	31	28	30	89
7	Morphine sulfate	20	34	30	84
8	Methadone	31	20	23	74
9 [†]	Fentanyl	16	29	22	67
9 [†]	Potassium Phosphate	28	13	26	67
10	Calcium Chloride	18	18	27	63

[†]ties in ranks based on sum of scores

RESULTS-DISCUSSION Continued

Top-Ten Problematic Pediatric Medications

- ACCP pediatric pharmacists identified the top-ten problematic medications, which included two tied scores in medication ranking (Table 2).
- The top-ten included four of thirteen medications (23%) found in ISMP 2011's High-Alert Medication List (i.e., insulin, potassium chloride and potassium phosphate).
- Similarly, ACCP pediatric pharmacists identified four of the five medications (80%) published by ISMP Canada 2009 as causing harm in pediatric patients from medication errors (i.e., insulin, potassium chloride, morphine sulfate, fentanyl).
- Finally, in one of the only known publications on high-alert pediatric medications, Franke et al. in 2009 compiled a top-ten list from an open survey of physicians, nurses and pharmacists from 5 Chicago institutions. Our survey participants identified seven of Franke's top-ten medications (70%) (i.e., 1-potassium, 2-heparin, 3-insulin, 4-digoxin, 6-calcium, 8-morphine, and 9-fentanyl).

Ranking of Medication Categories

- In regard to patient safety, ACCP pediatric pharmacists ranked anticoagulants as most problematic (Table 1), anticonvulsants as moderately problematic, and gastrointestinal medications as least problematic category.
- Although our survey participants ranked insulin as the highest by sum due to an extremely high medication error score, warfarin was ranked the highest with regards to dosing and ADE problems, which correlates with the fact that anticoagulants were selected as the most problematic drug category. This supports the need for further evaluation of specific issues related to each of the top ten medications.

CONCLUSION

1. ACCP Pediatric PRN Pharmacists identified many of the same high-alert drugs published in ISMP and elsewhere.
2. This survey supports the need to develop an ISMP List of High-Alert Pediatric Medications.

References upon request: byates@harding.edu