ISMP Canada

National Collaborative: Top five drugs reported as causing harm through medication error in pediatrics

By Marg Colquhoun, RPh, BScPhm, FCSHP, Elaine Orrbine, Ian Sheppard, BSc (Pharm), Lisa Stromquist, Christine Koczmara, RN, BSc, Roger Cheng, RPh, BScPhm, PharmD, Julie Greenall, BScPhm, MHSc, FISMPC, Bonnie Salsman, RPh, BSC (Pharm), FCSHP, and Shirley Sabovitch, RN, BScN, FISMPC

Abstract

The Canadian Association of Paediatric Health Centres (CAPHC) and the Institute for Safe Medication Practices Canada (ISMP Canada) are working collaboratively to enhance the safety of pediatric medication use. Eleven CAPHC member organizations submitted data on more than 4,000 medication incidents to ISMP Canada for the period October 2005 to June 2008, 305 of which were reported as resulting in harm. From this, the top five drugs causing harm through medication error and contributing factors to the incidents were identified. In this article, we intend to inform critical care practitioners of the medication incident analyses and the collaborative pediatric patient safety initiatives underway.

The Canadian Association of Paediatric Health Centres (CAPHC) and the Institute for Safe Medication Practices Canada (ISMP Canada) are working collaboratively to enhance the safety of pediatric medication use. The treatment of acutely ill infants, children and youth presents unique challenges in the realm of medication safety. A variety of factors, including the age, size, and physiological status of these patients, can increase the likelihood that medication incidents[1], particularly those involving high-alert medications[2], will result in harm (Levine et al., 2001). This collaborative project, guided by a national advisory committee of content experts, practitioners, and researchers is being undertaken in two phases. In this article we share, with permission, information from an ISMP Canada Safety Bulletin highlighting an overview of phase one, which includes the top five medications most frequently involved in errors reported as causing harm in pediatric patients, and some of the contributing factors (ISMP Canada, 2009).

Background

Seventeen CAPHC member organizations were invited to submit reports of medication incidents involving pediatric patients to ISMP Canada. Eleven facilities submitted data on more than 4,000 pediatric incidents for the period October 2005 to June 2008. Six of the 11 facilities submitted detailed data that included free-text descriptions. The remaining five facilities submitted quantitative data that identified the medication involved and the level of patient harm.

Project findings

Of the reported incidents, 305 had an outcome of harm[3]. An incident was excluded from analysis if it was deemed to be an adverse drug reaction or if the clarity of the data was poor (e.g., medication class rather than medication name provided, medication name misspelled beyond recognition). Of the 305 reports of incidents causing harm, 294 reports involving a total of 320 medications met the criteria for analysis. From this group, the top five medications causing harm were identified (see Table One).

The medication most frequently cited as causing harm was morphine, representing 8.8% of the reports of incidents causing harm. Incidents involving fentanyl represented 3.4% of the harmful incidents. Together, these two opioids represented 36 (12.2%) of the 294 reports of medication incidents causing harm and accounted for just greater than 50% of the incidents for the top five drugs (36 of 71 reports).

It is impossible to infer or project the probability of specific types of incidents on the basis of these data, which come from voluntarily shared reports. However, a previous review of the ISMP Canada medication incident database also identified morphine, insulin, and fentanyl among the top five medications reported as causing harm in both adult and pediatric patients, as a consequence of medication error (ISMP Canada, 2006).

Contributing factors identified

A qualitative analysis of these top five medications was conducted. The objective was to gain insight into factors contributing to the incidents and to identify potential interventions for improving system safety. Data for the qualitative analysis were limited to the detailed incident reports received from six of the facilities, as described above. Specifically, all of the 482 detailed medication incident reports involving the top five medications, both those causing harm and those not causing harm, were reviewed to capture valuable insights that might also be gained from near-miss and other no-harm reports.

Morphine incidents. A total of 176 detailed reports of morphine incidents were received, of which 20 were categorized as resulting in patient harm. Incidents involving a wrong dose accounted for more than half of all the morphine incidents analyzed (97/176) and also more than half of those that resulted in patient harm (12/20). Most of these incidents involved IV administration (intermittent doses and continuous infusions) and patient-controlled analgesia. Misinterpretation of orders was associated with a high number of multi-fold overdose incidents. In two cases, morphine 1.5 mg IV was ordered, and misinterpreted as morphine 7.5 mg resulting in

Table One: Top five medications reported as causing harm in pediatric patients as a consequence of medication error (Based on reports from 11 CAPHC member organizations)

Medication	Number (%) of incidents (n = 294)
morphine	26 (8.8)
potassium chloride	14 (4.8)
insulin	11 (3.7)
fentanyl	10 (3.4)
salbutamol	10 (3.4)

five-fold overdoses. There were six cases reporting 10-fold overdoses, and misinterpretation of the decimal place was a contributing factor in some cases. Other contributing factors to incidents included dosing unit mix-ups and incorrect pump programming. In three cases, IV infusions ordered as micrograms per kilogram per hour were programmed into the pump as milligrams per kilogram per hour.

Potassium chloride incidents. A total of 204 detailed incident reports were received for potassium chloride, seven of which were associated with patient harm. None of the reported incidents involved the use of concentrated potassium chloride vials. Almost half of all potassium incidents involved the incorrect selection of premixed bags of potassium chloride (either the incorrect infusion solution or the incorrect concentration of potassium chloride). The complexity of pediatric IV fluid regimens was identified as one of the main contributing factors in these incidents.

Insulin incidents. A total of 41 detailed incident reports involving insulin were received and analyzed, eight of which were reported as resulting in patient harm. Of the eight reports of harm, six were due to wrong-dose errors. The wrong dose was also the most commonly reported incident type among all detailed reports (18/41 reports). This problem occurred with both IV infusions and subcutaneous administration of insulin. A mix-up of IV lines was an important contributing factor to incidents involving IV infusion of insulin. A common contributing factor in incidents involving subcutaneous administration of insulin was misinterpretation of orders.

Fentanyl incidents. A total of 30 detailed incident reports involving fentanyl were analyzed, five of which were reported to have resulted in patient harm. The majority of fentanyl incidents and all those resulting in harm involved wrong-dose errors. Contributing factors to these wrong-dose incidents included misinterpretation of the order, in particular misreading of the decimal place during dispensing and administration. For example, in one case an order for fentanyl 550 micrograms to be admixed in 50 mL normal saline and infused at 0.5 mL per hour was misinterpreted, and fentanyl 55 micrograms was admixed resulting in an underdose. In addition, various problems related to IV pump programming were reported to have contributed to fentanyl overdose incidents.

Salbutamol incidents. A total of 31 detailed incident reports involving salbutamol were received, five of which were reported as resulting in patient harm. Salbutamol is frequently used as a rescue medication for asthma exacerbations, and dose omissions led to patient harm in three instances. Misinterpretation of the order was a significant contributing factor. Wrong-dose incidents constituted the majority of all of the detailed reports, two of which were reported to have caused harm. Contributing factors included mix-ups between units of measurement (e.g., 5 mL versus 5 mg), dose miscalculations because the wrong patient weight was used, and miscommunication between disciplines (e.g., miscommunication between a nurse and a respiratory therapist led to the duplicate administration of a patient's inhaler medication, resulting in overdose).

Next steps

Phase two of this project on medication safety in pediatrics is now underway. Based on phase one findings, phase two will focus on identifying system solutions for enhanced opioid safety. The risk of harm to children from medication incidents involving opioids has previously been reported (Hicks, Becker, & Cousins, 2006), and the analysis reported here emphasizes that enhancing opioid safety can enhance medication safety in pediatrics. Next steps will use both human factors and practitioner expertise to identify practices and medication system safety strategies to be included in a resource toolkit for Canadian pediatric opioid safety.

Critical care practitioners providing care to infants, children and youth have an important role to play in safe medication management, not only within the critical care setting, but also when responding to calls as part of the rapid response teams. It is hoped that the information derived from phase one of the CAPHC–ISMP Canada national collaborative empowers critical care practitioners to be alert to the possibility of medication incidents reviewed, and also increases awareness regarding the broader medication safety initiatives planned.

This article was written using materials from ISMP Canada, with permission (ISMP Canada Safety Bulletin. August 31, 2009. 9(6):1–2. Available from: http://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2009-6-NationalCollaborative-Top5DrugsReported.pdf).

All ISMP Canada Safety bulletins are available from http://www.ismp-canada.org/ISMPCSafetyBulletins.htm

ISMP Canada is an independent national not-for-profit organization committed to the advancement of medication safety in all health care settings. ISMP Canada maintains a national voluntary medication incident and "near miss" reporting program founded for the purpose of sharing the learning experiences from medication errors. Our collaborative goal is implementation of preventive strategies and system safeguards to decrease the risk of error-induced medical incidents.

ISMP Canada is a key partner in the Canadian Medication Incident Reporting and Prevention System (CMIRPS).

Medication Incidents (including near misses) can be reported to ISMP Canada: (i) through the website http://www.ismp-canada.org/err_report.htm or (ii) by phone: 416-733-3131 or toll free: 1-866-544-7672.

ISMP Canada guarantees confidentiality and security of information received, and respects the wishes of the reporter as to the level of detail to be included in publications.

The Canadian Association of Paediatric Hospitals (CAPH) was co-founded in 1968 by the leaders of the Children's Hospitals in Canada. Over the subsequent three decades, many child and youth health care organizations across Canada underwent fundamental operational and structural changes creating a new landscape of health care delivery for children, youth and families. To better respond to these emerging health care challenges, CAPHC was established and incorporated in 2001 through a transformative process of organizational renewal of the Canadian Association of Paediatric Hospitals.

Today, CAPHC is proud to support its 43 member organizations, representing multidisciplinary health professionals who provide health service delivery to children,

youth and their families within acute care hospitals (all children's hospitals in Canada), community health centres, rehabilitation centres and home care provider agencies.

CAPHC supports a communication network that enables knowledge transfer of leading-edge research from contributors across the globe. Along with its members and partners, CAPHC is a strong national advocate for change and quality improvement to enhance health care services for all children and youth.

Patient Safety and Quality Improvement is one of CAPHC's national priorities. CAPHC's Patient Safety Collaborative supports a framework for partnership and collaboration that supports national pediatric patient safety and quality improvement programs. Examples of these programs include the CAPHC-Paediatric Trigger Tool, the CAPHC Paediatric Medication Reconciliation Collaborative and the High-Alert Medication Delivery in Paediatrics–Implementing Leading Practice initiative.

[1] Medication incident: a term widely used to refer to the preventable subset of potential and actual adverse drug events; also recognized as an alternative term for medication error (ISMP Canada, 2009).

[2] High-alert medications: drugs that bear a heightened risk of causing significant patient harm when they are used in error (ISMP, 2008).

[3] Harm: any error meeting or exceeding the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) criteria for a category E error (i.e., categories E to I inclusive); category E is defined as "an error that may have contributed to or resulted in temporary harm to the patient and required intervention" (NCC MERP, 2001).

Acknowledgement

Reporting is the first step in enhancing medication safety. CAPHC and ISMP Canada express sincere appreciation to the many health care professionals for their initiative, efforts, and demonstrated support for a culture of safety exemplified by their willingness to share information about medication incidents and related findings.

This collaborative project (phase one and phase two) is supported by the Canadian Patient Safety Institute, Medbuy Corporation and Baxter Corporation.

About the authors

Marg Colquhoun, RPh, BScPhm, FCSHP, is a Project Leader with the Institute for Safe Medication Practices Canada (ISMP Canada). Marg is the co-lead of the National Paediatric High Alert Medication Delivery Project being led by Canadian Association of Paediatric Health Centres (CAPHC) and ISMP Canada. She is also the medication reconciliation intervention lead for Safer Healthcare Now! E-mail: ***mcolquhoun@ismp-canada.org***

Elaine Orrbine is President and CEO of the Canadian Association of Paediatric Health Centres (CAPHC). Elaine brings 25 years of experience within child and youth health research, advocacy, knowledge translation, quality improvement, patient safety and health administration and is nationally recognized as a change agent. Elaine is a member of the Canadian Patient Safety Institute—Safer Healthcare Now! Campaign National Steering Committee, the lead on the national paediatric medication reconciliation collaborative, and a member of the CAPHC—Paediatric Trigger Tool Quality Improvement Steering Committee. E-mail: ***eorrbine@caphc.org***

Ian Sheppard, BSc (Pharm), is a consultant to the National Paediatric High Alert Medication Delivery Project. Ian is also the pharmaceutical bar coding project lead for ISMP Canada and the Assistant Pharmacy Director at B.C. Children's and B.C. Women's Hospitals.

Lisa Stromquist is Patient Safety Liaison for CAPHC and the Paediatric Chairs of Canada. She is a graduate of Algonquin College's Pharmacy Assistant Program and has more than 15 years of experience in community and hospital pharmacy. Lisa is the National Project Coordinator for Phase 2 of the Paediatric High Alert Medication Delivery—Opioid Safety project.

Christine Koczmara, RN, BSc, is a Senior Medication Safety Analyst with ISMP Canada. She also holds a casual position as a bedside nurse in an intensive care unit (ICU).

Roger Cheng, RPh, BScPhm, PharmD, is a Medication Safety Analyst with ISMP Canada.

Julie Greenall, BScPhm, MHSc, FISMPC, is a Project Leader with the ISMP Canada. She also holds a casual position as a staff pharmacist in a community hospital.

Bonnie Salsman, RPh, BSC (Pharm), FCSHP, is a Consultant Pharmacist with ISMP Canada.

Shirley Sabovitch, RN, BScN, FISMPC, is a Medication Safety Specialist with ISMP Canada.

References

Hicks, R.W., Becker, S.C., & Cousins, D.D. (2006). Harmful medication errors in children: A five-year analysis of data from the USP's Medmarx program. **Journal of Pediatric Nursing, 21**, 290–298.

Institute for Safe Medication Practices Canada. (2009). **Definitions of terms**. Retrieved from http://www.ismp-canada.org/definitions.htm

Institute for Safe Medication Practices Canada. (2009). National collaborative: Top five drugs reported as causing harm through medication error in paediatrics. **ISMP Canada Safety Bulletin, 9**(6), 1–2. Retrieved from http://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2009-6-NationalCollaborative-Top5DrugsReported.pdf

Institute for Safe Medication Practices. (2008). **ISMP's list of high-alert medications**. Retrieved from http://www.ismp.org/Tools/highalertmedications.pdf

Institute for Safe Medication Practices Canada. (2006). Top 10 drugs reported as causing harm through medication error [Electronic version]. **ISMP Canada Safety Bulletin, 6**(1), 1–2. Retrieved from http://www.ismp-canada.org/download/safetyBulletins/ISMPCSB2006-01Top10.pdf

Levine, S.R., Cohen, M.R., Blanchard, N.R., Frederico, F., Magelli, M., Lomax, C., et al. (2001). Guidelines for preventing medication errors in pediatrics [Electronic version]. **Journal of Pediatric Pharmacology and Therapeutics, 6**, 426–442. Retrieved from http://www.ismp.org/Newsletters/acutecare/articles/20020601.asp

National Coordinating Council for Medication Error Reporting and Prevention. (2001). **NCC MERP index for categorizing medication errors.** Retrieved from