

SUPPLEMENTARY INFORMATION

Medication errors and error chains involving high-alert medications in paediatric hospital setting: A qualitative analysis of self-reported medication safety incidents

Drugs - Real World Outcomes

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Characteristics of the medication safety incident reports (n=426) and high-alert medications (n=467) within the study sample.

Characteristic	n (%) of incident reports
Nature of the event	
Reached the patient	242 (56.8)
Near miss	112 (26.3)
Other patient safety observation ¹	72 (16.9)
Total	426 (100.0)
Case notifier	
Registered nurses	365 (85.7)
Physicians	21 (4.9)
Practical nurses	5 (1.2)
Allied healthcare team members (e.g., pharmacists)	5 (1.2)
Others	5 (1.2)
Not known	25 (5.8)
Total	426 (100.0)
Type of unit where the incident happened	
Paediatric wards	216 (50.7)
Neonatal intensive care unit	75 (17.6)
Paediatric intensive care and monitoring unit	51 (11.9)
Anaesthesia and surgery	37 (8.7)
Home hospital	20 (4.7)
Day hospital and outpatient clinics	14 (3.3)
Paediatric emergency departments	8 (1.9)
Others	5 (1.2)
Total	426 (100.0)
Consequences for the patient²	
No harm	200 (46.9)
Minor harm	66 (15.5)
Moderate harm	17 (4.0)
Severe harm	3 (0.7)
Not known	55 (12.9)
Not reported	85 (20.0)
Total	426 (100.0)
High-alert medications (n=467) involved in the study sample of medication safety incident reports (n=426)	
Antineoplastic agents (L01)	100 (23.4)
Vincristine (IV)	25 (5.9)
Methotrexate (IV/IT/PO ³)	21 (4.9)
Cytarabine (IT/IV)	16 (3.8)
Pegaspargase (IM/IV)	7 (1.6)
Cytarabine (IT) and methotrexate (IT)	6 (1.4)

Doxorubicin (IV)	5 (1.2)
Mercaptopurine (PO)	5 (1.2)
Vinblastine (IV)	4 (0.9)
Daunorubicin (IV) and vincristine (IV)	3 (0.7)
Doxorubicin (IV) and vincristine (IV)	3 (0.7)
Thioguanine (PO)	3 (0.7)
Daunorubicin (IV) and doxorubicin (IV)	1 (0.2)
Pegaspargase (IM) and vincristine (IV)	1 (0.2)
Analgesics (N02)	83 (19.5)
Morphine (IV/PO)	40 (9.4)
Oxycodone (IM/IV/PO)	34 (8.0)
Tramadol (IV/PO)	7 (1.7)
Fentanyl (SL)	1 (0.2)
Morphine (IV) and oxycodone (IV)	1 (0.2)
Antithrombotic agents (B01)	65 (15.2)
Heparin (IA/IV)	36 (8.5)
Enoxaparin (SC)	26 (6.0)
Warfarin (PO)	3 (0.7)
Cardiac therapy (C01)	51 (12.0)
Milrinone (IV)	13 (3.1)
Epinephrine (epidural/IM/IV)	11 (2.6)
Dopamine (IV)	10 (2.4)
Norepinephrine (IV)	7 (1.6)
Levosimendan (IV)	5 (1.2)
Amiodarone (IV)	3 (0.7)
Dopamine (IV) and norepinephrine (IV)	1 (0.2)
Milrinone (IV) and norepinephrine (IV)	1 (0.2)
Psycholeptics (N05)	34 (8.0)
Midazolam (buccal/PO/IV)	13 (3.1)
Dexmedetomidine (IV)	6 (1.4)
Diazepam (IV/PO)	6 (1.4)
Lorazepam (PO/IV)	6 (1.4)
Diazepam (PO) and midazolam (PO)	2 (0.5)
Dexmedetomidine (IN) and midazolam (PO)	1 (0.2)
Anesthetics (N01)	32 (7.5)
Fentanyl (IV)	16 (3.8)
Propofol (IV)	9 (2.1)
Esketamine (IV)	3 (0.7)
Ropivacaine (epidural)	3 (0.7)
Fentanyl (IV) and propofol (IV)	1 (0.2)
Drugs used in diabetes (A10)	26 (6.1)
Insulin aspart (SC/IV)	11 (2.6)
Insulin (human, biosynthetic; IV)	9 (2.1)

Insulin detemir (SC)	4 (0.9)
Insulin aspart (SC) and insulin detemir (SC)	2 (0.5)
Antimycotics for systemic use (J02)	16 (3.8)
Liposomal amphotericin B (IV)	16 (3.8)
Antihistamines for systemic use (R06)	3 (0.7)
Promethazine (IV)	3 (0.7)
More than one ATC 2nd level therapeutic subgroup involved	16 (3.8)
Dopamine (C01; IV) and fentanyl (N01; IV)	4 (1.0)
Dopamine (C01; IV) and Insulin (human, biosynthetic; A10; IV)	2 (0.6)
Milrinone (C01; IV) and morphine (N01; IV)	2 (0.6)
Dexmedetomidine (N05; IV) and levosimendan (C01; IV)	1 (0.2)
Dopamine (C01; IV), fentanyl (N01; IV), and norepinephrine (C01; IV)	1 (0.2)
Esketamine (N01; IV) and midazolam (N05; IV)	1 (0.2)
Esketamine (N01; IV), milrinone (C01; IV), and norepinephrine (C01; IV)	1 (0.2)
Esketamine (N01; N/A) and oxycodone (N/A)	1 (0.2)
Fentanyl (N01; IV) and heparin (B01; IV)	1 (0.2)
Fentanyl (N01; IV) and morphine (N01; IV)	1 (0.2)
Heparin (B01; IV) and milrinone (C01; IV)	1 (0.2)
Total	426 (100.0)
Administration routes of the high-alert medications (n=467) involved in the study sample of medication safety incidents (n=426)	
IV	304 (65.1)
PO	60 (12.8)
SC	43 (9.2)
IT	21 (4.5)
IM	8 (1.7)
IA	6 (1.3)
buccal	4 (0.9)
epidural	4 (0.9)
PEG	2 (0.4)
sublingual	1 (0.2)
IN	1 (0.2)
N/A	13 (2.8)
Total	467 (100.0)

ATC = anatomical therapeutic chemical, IA = intra-arterial, IM = intramuscular, IN = intranasal, IT = intrathecal, IV = intravenous, PEG = Percutaneous endoscopic gastrostomy, PO = oral, SC = subcutaneous

¹ In the HaiPro system, the "Other patient safety observation" category is designated for preventive medication safety observations concerning potential safety risks. While these incidents may not directly pertain to the treatment of a specific patient—like a dispensing error occurring during the stocking of an automated dispensing cabinet in a ward medication room—they are essential for effectively managing risks within the MMU process.

² Defined following a systematic classification system established in HaiPro by the professionals responsible for managing incident data within each care unit (for further information regarding this process, please refer to Kuitunen et al., 2023).

³ Methotrexate PO (L04; n=2) is reported together with other methotrexate preparations (IV/IT; L01; n=19), as the inclusion criteria were defined at the level of drug substance (not ATC code).