

TIME CRITICAL MEDICATION DOSE OMISSIONS AFTER ELECTRONIC MEDICATION MANAGEMENT IMPLEMENTATION

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WHO Flagship area: High-risk medicines

Background

Medication dose omissions are some of the most frequently reported medication errors. Omission of 'time critical' medications can be especially significant, leading to poor patient outcomes, such as seizures, sepsis and thromboembolism. There are few publications about the influence of Electronic Medication Management (EMM) systems on timely medication administration.

This 800-bed Australian metropolitan tertiary referral health service implemented EMM in October 2018 and Automated Dispensing Cabinets (ADCs) in 2021

Objectives

To evaluate the influence of an EMM systems on time critical dose omissions 6 and 18 months after implementation

Methods

Data of dose omissions of regular inpatient medication orders was obtained retrospectively from electronic medication records (EMR) over one week in March 2019 and four weeks in March 2021.

An *omission* was defined as a regular medication dose not administered before the next dose was due.

Reasons for omission were collated from nursing documentation and classified as 'preventable' and non-preventable' according to the drop-down options in the EMR selected by nursing staff prior to dose administration.

Dose omissions were either preventable or clinically justified.

The health service's time critical list was used, [Table 1]

Table 1: Time critical medications [Alfred Health guideline]

Medication	Examples	Possible Complication if dose omitted
Anticoagulants	Heparin, warfarin, enoxaparin, apixaban, dabigatran, rivaroxaban.	Deep vein thrombosis, pulmonary embolism
Anticonvulsants	Diazepam, phenytoin, levetiracetam	Seizure activity, especially if omitted peri-operatively
Antidotes (May be a STAT order)	Naloxone, digoxin-specific antibody, Resonium, protamine, folic acid, Acetylcysteine	Toxicity, overdose related events
Antimicrobials	Intravenous antibiotics, antivirals, antifungals	Sepsis, prolonged infection
Intravenous and oral corticosteroids	Prednisolone, cortisone	Acute asthma attack, delayed symptom control.
Clozapine	Clozapine	Re-titration, recurrence of symptoms
Chemotherapy		Incomplete remission, prolong hospital stay to finish course. Exacerbation of symptoms
Hypoglycaemic agents	Insulin, immediate release sulfonylurea	Ketoacidosis, hyperglycaemia
Immunosuppressant	Cyclosporine, tacrolimus	Transplant rejection, exacerbation of symptoms
Antiparkinson medications	Levodopa combinations, bromocriptine, cabergoline	Exacerbation of symptoms, rigidity, falls
Opioid Replacement Therapy	Buprenorphine, methadone liquid	Aggressive patient, withdrawal symptoms

Evaluation

In 2019 and 2021, 620 and 2,524 patients with 44,756 and 146,940 scheduled medication doses were reviewed. Of these, 4,385 (9.8%) and 19,610 (13.3%) doses were omitted. Time critical doses were omitted in 593 (1.3%) and 1811 (1.2%, p=0.124) administrations.

Antimicrobials were the most common class of time critical dose omissions (43.1% of omissions in 2021). [Table 2]

The most common reason for omission was patient refusal (17.4% in 2021, non-preventable). Overall, 34.9% of dose omissions were classified as preventable in 2021. Preventable time critical dose omission decreased from 0.5% (n=227) doses in 2019 to 0.4% (n=632, p=0.03) in 2021.

Wards with ADCs had a significantly lower rate of time critical dose omissions compared to those without (1.1% vs 1.3%, p=0.014).

Discussion

We found that, while the EMM system did not decrease overall dose omission rates, time critical omissions decreased over time. ADCs appear to have an impact in decreasing time critical dose omissions. EMM systems present opportunities for review of large quantities of medication specific data. As incidents of dose omissions causing harm to patients continue to be reported, examination of patient outcomes will be considered in future projects.

Planned improvement strategies include: simplification of 'drop-down' menus to encourage accurate documentation [Table 3]; integrating time-critical medication examples into nursing, pharmacy and medical education; and roll-out of ADCs across the hospital network. An audit dashboard is being developed, which will enable regular assessment of time critical omitted dose rates to target areas for improvement.

Table 2: Time-critical dose omission by class

Time Critical Medication	2019 n (%) n=593	2021 n (%) n =1811	p-value
Antiparkinson	6 (1.0%)	19 (1.0%)	0.94
Anticoagulants	148 (25.0%)	469 (25.9%)	0.77
Anticonvulsants	9 (1.5%)	117 (6.5%)	< 0.0001
Antidotes	0	0	1
Antimicrobials	254 (42.8%)	780 (43.1%)	0.98
Antipsychotics	0	0	1
Corticosteroids	21 (3.5%)	57 (3.1%)	0.75
Cytotoxics	0	2 (0.1%)	0.42
Hypoglycaemics	138 (23.3%)	352 (19.4%)	0.12
Immunomodulator	17 (2.8%)	15 (0.8%)	0.0005



Table 3: Simplifying documentation from 23 to 7 options

Proposed 'Drop-Down' options
<ul style="list-style-type: none"> Clinically inappropriate Medication Unavailable – contact pharmacy Other: Refused by patient Self-administered Task Duplication Withhold per Medical Officer

Reference: Gaudins LV, et al. Multicentre study to develop a medication safety package for decreasing inpatient harm from omission of time-critical medications. *Int J Qual in Health Care.* 2014;27(1):67-74.

Acknowledgments: EMR data: Jarrod Donovan, Pharmacy Digital Health Lead. **Data collation:** Monash University 4th Year Pharmacy students: Verity Boustead, Cody Cheung, Jessica Evans, Jamie Katz, Zi Shuen Ngiam.

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