

# Preventable Adverse Drug Events in Canadian Emergency Departments

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## INTRODUCTION

- Adverse drug events (ADEs) are unintended and harmful events associated with medication use or misuse. ADEs remain a leading cause of emergency department (ED) visits and unplanned hospitalizations, even though up to 70% are deemed preventable.<sup>1</sup>
- Administrative data sources that are commonly used in ADE research contain limited information about ADE preventability and risk factors contributing to their development.<sup>2</sup>
- A Dutch study indicated that 27% of patients admitted to hospital for an ADE were re-exposed to the culprit medication within only 6 months of discharge, indicating that repeat ADEs may be an important target for prevention.<sup>3</sup>

## OBJECTIVES

- To determine the proportion of preventable ADEs, and describe patient, system, and event characteristics associated with preventability.

## METHODS

- We completed a large retrospective chart review of patients who had been diagnosed with an ADE in one of three prospective observational studies:
  - Study 1:** Clinical Decision Rule Derivation Study (2008-09; n=1,591): Vancouver General & Saint Paul's Hospitals, Vancouver, BC
  - Study 2:** ADE Screening Evaluation (2010-12; n=10,807): Vancouver General & Lions Gate Hospitals, North Vancouver, BC
  - Study 3:** Clinical Decision Rule Validation Study (2013-14; n=1,529): Vancouver General, Lions Gate & Ottawa Civic Hospitals, Ottawa, ON
- The primary studies enrolled incoming patients using a systematic sampling algorithm to generate representative samples. All enrolled patients were seen by a clinical pharmacist and a physician in the ED.
- All cases for which the pharmacists' and physicians' diagnoses were concordant were considered final. All uncertain and discordant cases were adjudicated by an independent committee.

## METHODS (cont)

- For the present study, a clinical pharmacist and physician independently reviewed the research and hospital records of all ADE cases from the prior studies. They excluded case in which an alternative diagnosis to the ADE had since been identified.
- After a training and pilot period, reviewers used an explicit, structured electronic data collection form, and applied three preventability definitions.<sup>4,5,6</sup>
- The main outcome was a probably or definitely preventable ADE, defined as avoidable by adhering to best medical practice, appropriate monitoring, compliance with recommended therapy, and avoidance of error.<sup>4</sup> Reviewers discussed any disagreements about preventability until reaching consensus. When consensus could not be reached, a third reviewer adjudicated the case.
- We calculated kappa statistics ( $\kappa$ ), along with 95% confidence intervals (CI) as a measure of inter-rater reliability. We used multivariable regression analyses to determine the relationship between patient characteristics and preventability.

## RESULTS

- We diagnosed 1,234 patients with 1,356 ADEs, of which 869 (869/1356; 64.1%, 95% CI: 61.5-66.6) were preventable (Table 1).

**Table 1.** ADE preventability and inter-rater reliability, by definition.

Definition Used	Probably or Definitely Preventable ADE n(%) [ 95% CI]	Kappa [95% CI]
Hallas et al.	869 (64.1%) [95% CI: 61.5-66.6]	0.53 [95% CI: 0.48-0.59]
Schumock & Thornton	930 (68.5%) [95% CI: 66.1-71.1]	0.55 [95% CI: 0.49-0.60]
Health Canada	873 (64.3%) [95% CI: 61.8-66.9]	0.55 [95% CI: 0.50-0.60]

## RESULTS (cont)

- The most common types of preventable events were ADEs due to non-adherence (27.8%, 242/869, 95% CI: 24.8-30.8%), adverse drug reactions (24.2%, 210/869, 95% CI: 21.3-27%), and events due to low dose (13.5%, 117/869, 95% CI: 8.7-12.9%).
- Most preventable ADEs were moderate in severity (65.9%, 573/869, 95% CI: 62.8-69.1%). The top three culprit medications for preventable events were warfarin (9.4%, 110/1166, 95% CI: 7.7-11.1%), hydrochlorothiazide (4.4%, 52/1166, 95% CI: 3.3-5.6%), and furosemide (4.0%, 47/1166, 95% CI: 2.9-5.2%).
- Having previously experienced an ADE to the same drug (OR 2.9, 95% CI: 2.1-3.9, p<0.001), mental health illness (OR 1.8, 95% CI: 1.2-2.5, p=0.002), and diabetes (OR 1.7, 95% CI: 1.2-2.4, p=0.003) were associated with experiencing a preventable ADE after adjusting for age, sex, comorbidity, and presenting hospital.

## CONCLUSION

- The majority of ADEs presenting to EDs were preventable.
- Strategies to reduce preventable ADE-related ED visits should target repeat events that occur due to re-exposure to culprit medications, and patients with diabetes, mental health illness, non-adherence, and those on high-risk medications.

## REFERENCES

- Zed PJ, Abu-Laban RB, Balen RM, et al. Incidence, severity and preventability of medication-related visits to the emergency department: a prospective study. *CMAJ*. 2008;178(12):1563-1569.
- Hohl CM, Kuramoto L, Yu E, et al. Evaluation adverse drug event reporting in administrative data from emergency departments: a validation study. *BMC Health Serv Res*. 2013;13:473
- van der Linden CMJ, Kerskes MCH, Bijl AMH, et al. Represcription after adverse drug reaction in the elderly: a descriptive study. *Arch Intern Med*. 2009;166(15):1666-1667
- Hallas J, Harvald B, Gram LF, et al. Drug related hospital admissions: the role of definitions and intensity of data collection, and the possibility of prevention. *J Intern Med*. 1990; 228(2):83-90
- Schumock GT, Thornton JP. Focusing on the preventability of adverse drug reactions. *Hosp Pharm*.1992;27(6):538
- Health Canada. Adverse Reaction Information.2012. Available at: <http://www.hc-sc.gc.ca/dhp-mps/medeff/advers-react-neg/index-eng.php>. Accessed May 13<sup>th</sup>, 2016