Medication Error Reporting Systems: A Survey of Canadian Intensive Care Units

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ABSTRACT

Background: Patients in the intensive care unit (ICU) have complex problems and experience many medical errors. Currently, little is known about the measurement of medication errors and adverse drug events in Canadian ICUs.

Objective: To investigate methods of measuring medication errors and adverse drug events in ICUs in Canada.

Methods: A questionnaire was constructed and uploaded to an online survey tool, SurveyMonkey. Through the mailing list software of the Critical Care Pharmacy Specialty Network of the Canadian Society of Hospital Pharmacists, the survey was sent by e-mail to 146 pharmacists working in 79 ICUs across Canada; 2 reminder e-mails followed. The survey was open from July 18 to September 18, 2007.

Results: A total of 34 individual responses were received from 31 (39%) of the 79 ICUs. Responses were from academic hospitals (11/31 [35%]), community teaching hospitals (9/31 [29%]), and community nonteaching hospitals (11/31 [35%]). Twenty-six (84%) of the 31 responding ICUs had a process for tracking medication errors and adverse drug events: non-anonymous voluntary reporting (19 or 73%), direct observation (14 or 54%), anonymous voluntary reporting (12 or 46%), chart review (6 or 23%), computerized system (3 or 12%), trigger tools (2 or 8%), pharmacist intervention (2 or 8%), and weekly ICU “safety huddles” (1 or 4%). Fourteen (54%) of the 26 ICUs that had a method of measuring medication errors and adverse drug events had implemented changes to address identified problems.

Conclusions: Most respondents were measuring the frequency of medication errors and adverse drug events, but a wide variety of methods were in use. Only about half of the ICUs had implemented changes as a result of these measurements. There is an opportunity to improve standardization of the measurement of medication errors and adverse drug events in Canadian ICUs.

Key words: medication safety, intensive care unit, reporting system

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RÉSUMÉ

Contexte : Les patients à l’unité de soins intensifs (USI) ont des problèmes complexes et sont victimes de nombreuses erreurs médicales. On connait actuellement peu de choses sur la mesure des erreurs de médication et des événements indésirables liés aux médicaments dans les USI au Canada.

Objectif : Étudier les méthodes de mesure des erreurs de médication et des événements indésirables liés aux médicaments dans les USI au Canada.


Résultats : Trente-quatre pharmaciens de 31 (39 %) des 79 USI ont répondu au sondage. Les réponses provenaient d’hôpitaux d’enseignement universitaire (11/31 ou 35 %), d’hôpitaux d’enseignement communautaires (9/31 ou 29 %) et d’hôpitaux communautaires sans vocation d’enseignement (11/31 ou 35 %). Vingt-six (84 %) des 31 USI disposaient d’un processus pour faire le suivi de erreurs de médication et des événements indésirables liés aux médicaments : les déclarations volontaires non anonymes (19 ou 73 %), les observations directes (14 ou 54 %), les déclarations volontaires anonymes (12 ou 46 %), l’examen des dossiers médicaux (6 ou 23 %), un système informatisé (3 ou 12 %), les outils d’alerte (2 ou 8 %), les interventions des pharmaciens (2 ou 8 %) et les « caucuses de sécurité » hebdomadaires de l’USI (1 ou 4 %). Quatorze (54 %) des 26 USI qui disposaient d’une méthode pour mesurer les erreurs de médication et les événements indésirables liés aux médicaments avaient mis en œuvre des changements pour rectifier les problèmes décélés.

Conclusions : La plupart des répondants mesuraient la fréquence des erreurs de médication et des événements indésirables liés aux médicaments, mais utilisaient diverses méthodes. Seulement près de la moitié des USI avaient mis en œuvre des changements par suite de ces mesures. Il y a une occasion d’améliorer la standardisation des mesures des erreurs de médication et des événements indésirables liés aux médicaments dans les USI du Canada.

Mots clés : sécurité des médicaments, unité de soins intensifs, système de déclaration
INTRODUCTION

A medication error is a failure of a planned action to be completed as intended or the use of an incorrect plan to achieve an aim at any stage of the medication process, including ordering, transcribing, dispensing, administering, or monitoring. Serious medication errors either cause harm or have the potential to do so. Adverse events are incidents that occur during the process of providing health care and result in patient injury or death. The Canadian Adverse Events Study showed that adverse events due to medication errors and other causes occur in 7.5% of hospital admissions involving Canadian adults and are associated with a 20% risk of death and longer duration of hospital stay.

Intensive care units (ICUs) house the most critically ill patients, who have the most complex medical problems, little physiologic reserve, and the highest mortality rates. These patients are subjected to numerous risky medications and invasive medical procedures. It is not surprising that the rates and consequences of medical errors are much greater among ICU patients than among other patients. Some Canadian hospitals report adverse events as part of their risk management strategies and accreditation requirements, and some report to the Canadian Medication Incident Reporting and Prevention System (sponsored in part by the Canadian Institute for Health Information) and the Canadian Adverse Event Reporting and Learning System (sponsored by the Canadian Patient Safety Institute). However, there is no standard method of measuring medication errors and adverse drug events, and very little information is available about reporting systems for medication errors in Canadian ICUs. The objective of this study was to characterize local reporting of medication errors and adverse drug events in Canadian ICUs.

METHODS

The study was approved by the Research Ethics Board of Providence Health Care.

Collection of Data

A questionnaire was developed to learn how medication errors and adverse drug events are measured in Canadian ICUs. Face and content validity of the survey were assessed by reviewing each item on the proposed questionnaire with a critical care pharmacist, 2 critical care physicians, and 2 medical students who were conducting other research on adverse medication events. No quantitative tests of content validity were conducted. The final version of the survey consisted of a total of 16 questions, with each respondent answering from 8 to 16 of the questions, depending on responses to previous questions. The survey was uploaded to SurveyMonkey, an online survey tool.

The survey was designed so that users were directed to certain questions on the basis of their responses to previous questions (see online Appendix 1, at www.cjhp-online.ca/index.php/cjhp/issue/view/72/showToc). Response options were to choose one answer, choose all answers that apply, or fill in the field (for open-ended questions).

A cover letter describing the purpose and origin of the survey (and including a link to the online survey) was distributed by e-mail to all 146 members of the Critical Care Pharmacy Specialty Network (PSN) of the Canadian Society of Hospital Pharmacists. These potential respondents worked in a total of 79 ICUs. It is pertinent to note that not all Canadian ICU pharmacists are members of this PSN, and not all members of the PSN are ICU pharmacists. Furthermore, a total of 208 Canadian hospitals (excluding hospitals in Quebec and Nunavut) report that they have an ICU (information provided by Canadian Institute for Health Information). Reminder e-mail messages were sent at 1 and 2 weeks after the initial invitation. The survey remained open for 2 months, from July 18 to September 18, 2007.

Analysis

Responses were compiled by the SurveyMonkey software. The request to identify the centre (question 1) was used to ensure that the responses represented a variety of centres and allowed duplicate responses from the same centre to be eliminated. Results were summarized descriptively.

RESULTS

Responses were received from 34 pharmacists working in 31 ICUs. The survey response rate was 39% (31/79) in terms of the number of ICUs or 23% (34/146) in terms of the number of respondents. Response rates by question, according to number of individuals responding, were 100% (34/34) for questions 1, 4, 5, and 6; 91% (31/34) for question 2; 97% (33/34) for question 3; 100% (2/2) for questions 7 and 13; 94% (32/34) for question 8; 100% (28/28) for questions 9, 10, 11, and 14; 100% (4/4) for question 12; and 50% (14/28) for question 15. For ICUs with more than one respondent, only the single most complete survey was analyzed.

Demographic Characteristics

Responses were received from all provinces except Quebec, Prince Edward Island, and Newfoundland and Labrador. The 31 ICUs represented were fairly evenly split among academic hospitals (11 or 35%), community teaching hospitals (9 or 29%), and community nonteaching centres (11 or 35%). The majority of ICUs represented were mixed medical/surgical (23/31 [74%]); other types of ICU represented were neurologic, coronary, pediatric, medical, and a joint unit providing trauma,
neurologic, burn, and cardiothoracic care. Thirteen (42%) of
the 31 responding ICUs had 1–10 beds, 12 (39%) had 11–20
beds, and 6 (19%) had 21–30 beds. Twenty-seven (87%)
of the responding ICUs had a pharmacist who was familiar with the
patients’ conditions and who reviewed the patients’ drug therapy
with the ICU team at least 5 days per week during daytime
hours. Most ICUs (29/31 [94%]) did not have computerized
physician order entry. Of the 2 (6%) hospitals that did have this
capability, only 1 (50%) also had decision support software.

**Measurement of Medication Errors and Adverse Drug Events**

Twenty-six (90%) of the 29 ICUs that responded to this
question had a method for tracking medication errors and
adverse events. Of these, 24 (92%) used the same method
throughout the hospital; the remainder used a method that was
specific to the ICU. Non-anonymous and anonymous voluntary
reporting and direct observation were the most common
methods used to measure medication errors and adverse drug
events in these ICUs (Figure 1). Other methods were chart
review, trigger tools, tracking of pharmacist interventions, and
ICU “safety huddles”. Twenty (77%) of the 26 ICUs that had a
method for measuring errors and adverse drug events reported
using more than one method. The most common combinations
of methods were non-anonymous and anonymous voluntary
reporting, voluntary reporting and direct observation, and
voluntary reporting, direct observation, and chart review.

**Voluntary Reporting**

Paper reports were the most popular method (16/26
[62%]) for voluntary reporting of medication errors (Figure 2).
Other methods were intranet, phone calls, and Internet (Figure 2).
Netsafe, Meditech EMR, and Risk MonitorPro were reported
as the web-based systems in use. An internal e-mail system built
into the computer system was reported by one ICU.

**Trigger Tools**

All ICUs that used trigger tools for chart review included
voluntary reporting of medication errors as a trigger signal.
Other trigger signals were abnormal drug levels, antidote use,
use of allergy medications, low serum glucose level, other
abnormal laboratory values, abrupt medication stop, and
abnormal electrolyte concentrations.

**Actions Taken as a Result of Measuring Medication Errors and/or Adverse Drug Events**

Of the 26 ICUs that had a process for measuring medication
errors, only 14 (54%) had implemented changes on the
basis of this information, according to the ICU pharmacist
respondents. Reported changes are listed in Box 1.

**DISCUSSION**

This survey was the first to systematically examine the
reporting of medication errors and adverse drug events in
Canadian ICUs. Responses came from a wide variety of
Canadian ICUs, and only 3 provinces were not represented.
Responses were obtained almost equally from academic,
community teaching, and community nonteaching hospitals.
In a similar recently reported survey of ICUs in the United
States, most respondents were from nonteaching community
institutions. Because of this difference in the responding
population, the findings from the US survey may not be
applicable to Canadian ICUs and may explain differences such
as the rate of use of voluntary reporting systems (94.7% in the
US study compared to 73% in this Canadian survey).

The majority of Canadian ICUs that responded to this
survey reported having a pharmacist who was familiar with the
patients’ conditions and who reviewed the patients’ drug
therapy with the ICU team at least 5 days per week. Having a
critical care pharmacist who fulfills these roles has been associated with better outcomes for patients. Although a pharmacist was present in the majority of responding ICUs, only a few of the units used pharmacist interventions as a method of tracking medication errors. This suggests that critical care pharmacists are not being used to their full potential, which may include the detection, interception, reporting, and resolution of medication errors and adverse drug events.

The wide range of methods of measuring medication errors and adverse drug events reported by the respondents to this survey indicates that there is no standard for such measurement in Canadian ICUs. As well, reliance on voluntary reporting may indicate that rates of medication errors and adverse events in Canadian ICUs are underestimated. Jha and others reported that chart review or computer-based monitoring led to the identification of more medication errors than did voluntary reporting. This may relate to lack of time to complete voluntary reports or fear of punitive action after voluntary reporting.

One of the more surprising results from this study was that 10% (3/29) of responding ICUs did not have any method for tracking medication errors and/or adverse events. Farley and others reported similarly that 13% of the hospitals they surveyed did not have a patient safety program. These results suggest that some ICUs do not address medication errors and adverse drug events at all. This situation is particularly alarming given that the rates and severity of adverse drug events are more severe among ICU patients than among patients in other areas of the hospital. Although the majority of ICUs used a method to measure medication errors and adverse drug events, only 54% had made changes in response to reports of such events.

Areas where changes could be made include technical and organizational strategies. Technical strategies include choices and restriction of antibiotics, nomograms for the use of heparin and insulin, and sedation protocols. Organizational strategies include using checklists of safety tasks during ICU rounds, preventing fatigue among providers by implementing sensible call schedules, utilizing the expertise of ICU pharmacists as described above, and having a systematic approach to quality improvement based on reports of medication errors and adverse events. Changes in both technical and organizational strategies are often required to prevent medication errors, and a combined approach may be superior to making changes in only one of these areas. Unfortunately, it may be difficult to implement changes in both areas, but the incentive of accreditation may be helpful. In addition to the difficulty of implementing changes in ICUs, reports of errors do not always provide guidance for prevention. Weinert and others reported that even when guidance for change was provided, in the form of findings from a randomized controlled trial, the implementation of change was often slow. These difficulties in implementation may explain the finding in our study that only about half of responding ICUs had made changes in reaction to reports of medication errors and adverse drug events. There is clearly great room for improvement in the measurement of medication safety in Canadian ICUs.

One limitation of this study was that the survey response rate at the level of the ICU (39%) was lower than that in other national surveys involving critical care, which had response rates of 76% and 60%. These Canadian surveys were sent to critical care physicians using postal mail and involved a second mailing of the survey and telephone calls to prompt participation. Hebert and others also sent a reminder postcard before the second mailing of the survey. However, other surveys using e-mail and online methods have had response rates similar to ours. For example, Barger and others had a response rate of 18.5% from medical interns. Jones and Pitt compared methods used for health surveys and reported that postal surveys produced a 72% response rate, whereas e-mail surveys yielded a 34% response rate. Phone calls may be more effective than e-mail messages in prompting participation in mail surveys. The response rate in the current study might have been greater if the survey had also been available in French, as the
unilingual presentation of the survey might have been a factor discouraging responses from Quebec. The implications of a low response rate include threats to generalizability of the findings.

A second limitation of the study involved the method of survey delivery. The survey was delivered only to ICUs that had a member of the Critical Care PSN of the Canadian Society of Hospital Pharmacists. This meant that Canadian ICUs that did not have a critical care pharmacist and those that had a pharmacist who was not a member of the PSN would not have been reached by the survey and thus would not have been represented. Furthermore, some members of the PSN might not have responded because they did not work in an ICU. A third limitation of the study was the collection of data using a self-report survey format, rather than direct observation. Although collection of data by direct observation would have been superior, it was not feasible for this study.

The strengths of this study include the development of the survey and its assessment for face and content validity by a multidisciplinary team, representation of a variety of ICUs from across Canada in the survey results, and identification of opportunities for improvement in the processes of reporting and acting on medication errors and adverse drug events. Many of these opportunities could be actualized by existing ICU pharmacists.

In summary, most ICUs in Canada that responded to this survey had a method for measuring medication errors, with voluntary reporting by hard-copy (paper) documentation being the most popular method. Although most ICUs had a dedicated ICU pharmacist, only half of the ICUs that measured medication errors and adverse drug events had made changes based on the information from these reports. These findings indicate that there is room for improvement in the standardization of measurement of medication errors and adverse drug events in Canadian ICUs.

References