Transferring Medication Order Entry from Pharmacists to Pharmacy Technicians

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INTRODUCTION

Over the past 25 years pharmacy has been increasingly challenged to expand its conventional role of providing medications to one that also includes the provision of optimal pharmacotherapy. The advent and promotion of the philosophy of pharmaceutical care has been the latest thrust in this direction. The transition of pharmacy practice to one in which the pharmacist has more direct contact with patients has not always been easy. Several barriers have been identified that can limit the success of a pharmacy department's progress towards the goal of providing pharmaceutical care to its patients.[1,2] One of these barriers is pharmacists' involvement in the technical aspects of drug distribution, which can leave little time for direct patient care. In an effort to maximize the time that pharmacists have to provide direct patient care, there has been an increasing trend to transfer to pharmacy technicians the responsibility for the technical components of drug distribution.[3,4]

In January 1996, the Ottawa Hospital had 445 tertiary acute care beds. Pharmacy services included a centralized unit-dose drug distribution system complemented by a full centralized intravenous (IV) admixture service. The pharmacy used a pharmacy software system running on a mainframe computer for information support of this operation. When assigned to the central pharmacy, pharmacists were responsible for reviewing drug orders and verifying medication orders entered into the pharmacy computer system by pharmacy technicians. A total of 4.5 full-time equivalent (FTE) pharmacists were assigned to drug-order review and verification of order entry.

In an effort to maximize the time available for pharmacists to provide direct patient care, it was decided to consider having pharmacy technicians enter medication orders at "verified status," which would eliminate the need for a pharmacist to check this step of the process. "Verified status" refers to entry of orders without subsequent review by another person. It was planned that pharmacists would continue to perform centralized review of drug orders by reviewing all new orders against the patient's medication profile. It was anticipated that this change could eliminate 1.0 FTE pharmacist from the central pharmacy without increasing the number of technicians. Thus, the objectives of this study were 2-fold: to determine if pharmacy technicians could be trained to perform medication order entry at verified status without a significant increase in the number of errors in the order-entry process; and to develop a quality assurance process to ensure that the performance of the order-entry function met acceptable standards.

METHODS

The first step was to define an error in the context of entry of medication orders. The following 8 errors were identified as significant:

- incorrect patient selected
- adverse drug reaction status not recorded or inaccurately recorded on the patient's profile
- incorrect dosage form entered, for example, oral instead of IV
- medication order missed
- incorrect medication entered
- incorrect strength of medication entered
- incorrect dose instructions entered
- incorrect frequency of administration entered.

The next step was to determine the error rate during a baseline period, when entry of orders by technicians was verified by pharmacists. This baseline error rate was obtained by having a group of pharmacists audit a convenience sample of medication order entries in February 1996. The "convenience sample" consisted of a sample of readily available data rather than randomly selected groups of data.

A training and evaluation program for pharmacy technicians, who had been selected to perform computerized order entry, was then developed and implemented. Those who successfully completed this program then participated in a study of order entry at verified status using actual medication orders to determine if their performance was within an acceptable range. Over a 10-day period in February and March 1996 (hereafter referred to as the pilot period), all orders entered by technicians at verified status were audited by pharmacists, and the error rate was determined. Throughout this stage and to the time of writing, technician order entry has not included orders for chemotherapy, total parenteral nutrition, or epidural infusions, because for these medications the pharmacist must perform calculations during the order-entry procedure.

Finally, it was agreed that if the pilot project was successful, there would be at least quarterly audits to ensure that the vital step of order entry was done accurately. These audits are hereafter referred to as quality assurance audits.

For all audits, errors were detected by comparing the order entered against the physician's original order by means of a standardized review process. Every error detected was reviewed, described, and classified by type. The rates of order-entry errors at baseline and for the pilot period were compared with the χ^2 test for independent data. Results for the subsequent quality assurance audits are presented by means of descriptive statistical analysis.

Table I. Error Rates for Order Entry

Period	No. of Orders Audited	No. (and %) of Errors	
Baseline* (April 1996)	1362	29	(2.1)
Pilot study† (May 1996)	8549	217	(2.5)
Quality assurance audit			
July 1996	715	47	(6.6)
October 1996	710	27	(3.8)
December 1996	533	15	(2.8)
March 1997	616	14	(2.3)
May 1997	889	22	(2.5)
July 1997	611	14	(2.3)
November 1997	288	7	(2.4)
March 1998	1019	16	(1.6)

*Pharmacist verified order entry.

†Technician order entry at verified status.

RESULTS

The error rate during the baseline period, when medication order entry by technicians was verified by pharmacists, was 2.13% (29 errors for 1362 orders audited), whereas the error rate during the pilot period was 2.54% (217 errors for 8549 orders audited). This difference was not statistically significant ($p > 0.2$, χ^2 test). On the basis of these results, we decided to proceed with order entry by technicians at verified status. Table I summarizes the error rates of all quality assurance audits done for order entry by technicians at verified status. Table II profiles the frequency and types of errors throughout the study period. For information purposes, a description of the types of errors detected in our most recent audit is shown in Table III.

Table II. Types of Order-Entry Errors

Type of Error	No. (and % of Errors) Baseline Period (*n* = 1362)		Pilot Study Period (*n* = 8549)		QA Audit Period (*n* = 5381)	
Incorrect patient selected	0	(0)	6	(0.07)	2	(0.04)
ADR not recorded or inaccurate	5	(0.37)	8	(0.09)	25	(0.46)
Incorrect dosage form	0	(0)	11	(0.13)	14	(0.26)
Medication order missed	12	(0.88)	96	(1.12)	57	(1.06)
Incorrect medication	3	(0.22)	17	(0.20)	4	(0.07)
Incorrect strength	1	(0.07)	15	(0.18)	7	(0.13)
Incorrect dose	3	(0.22)	33	(0.39)	22	(0.41)
Incorrect frequency	5	(0.37)	31	(0.36)	31	(0.58)
Overall error rate	29	(2.13)	217	(2.54)	162	(3.01)

QA = quality assurance, ADR = adverse drug reaction.

DISCUSSION

The results of this study clearly show that pharmacy technicians can be trained to perform computerized medication order entry at verified status without pharmacists checking their order entry. This has allowed our department to maximize the proportion of time that pharmacists can devote to direct patient care.

As indicated by the results shown in Table I, the audit performed immediately after completion of the pilot study revealed a substantial increase in the error rate, from 2.5% to 6.6%. An analysis of these errors indicated that technicians were rushing the process of order entry and had forgotten some of the principles that they had been taught in the orientation program. All technicians underwent another orientation session, and it was decided to perform audits frequently over the next 6 months to ensure that the error rate returned to an acceptable level. Once the error rate was consistently below 2.5%, the frequency of the audits was reduced to quarterly.

As indicated in Table II, there has been an increase in error rate, from 2.13% during the baseline period to 3.01% during the period of quality assurance audits. Although this represents an overall increase of 41% in the error rate, this increase is primarily due to the results of the first 2 quality assurance audits. The combined error rate during the ensuing 6 audits was 2.22%, which reassures us that order entry by technicians at verified status is a safe alternative in our institution.

In December 1997 a new pharmacy computer system was implemented, and technicians underwent training for order entry. It was reassuring to find that the error rate has further decreased since this time (Table I).

Unfortunately, there are no comparative data in the literature or from other institutions to help determine whether our error rate of 2% to 3% is acceptable. However, we are confident that order entry by technicians is safe and effective for the following reasons. First, the error rate with technician order entry at verified status is similar to that with technician order entry followed by a pharmacist check. Also, the vast majority of errors appear to have little or no adverse consequences for patients, as illustrated by the description of errors in Table III. In addition, the nurses at the Ottawa Hospital generate separate medication administration records from physician orders, which provides an additional mechanism to check for pharmacy errors before administration of drugs. Finally, ongoing audits will allow us to detect and address errors, with the aim of further decreasing the error rate. The results of the most recent audit suggest that this trend may be emerging.

Table III. Specific Errors Detected in the March 1998 Audit

Type of Error	Description of Specific Error
ADR status not recorded or inaccurate (*n* = 1)	Notification of patient's diabetes missing from profile
Incorrect dosage form (*n* = 1)	$NaHCO_3$ sent as syringe and not in IV bag
Medication order missed (*n* = 5)	Insulin sliding scale not entered
	Order to discontinue IV KCl not entered
	Order for oral KCl not entered
	Order for oral lorazepam not entered
	Order for SC heparin not entered
Incorrect dose (*n* = 2)	Meperidine 50-75 mg entered as 50 mg
	Isosorbide dinitrate 30 mg entered as 10 mg
Incorrect frequency (*n* = 7)	Three orders missing prn status
	Meperidine q4h entered as q4-6h
	Acetaminophen q3h entered as q4h
	Oxazepam qhs entered as qhs prn
	Salbutamol inhaled q4h + q2h prn entered as q2h prn

ADR = adverse drug reaction, KCl = potassium chloride, $NaHCO_3$ = sodium bicarbonate.

The implementation of this change in our operation has required an enormous commitment by pharmacy staff at all levels. Pharmacy management took the initiative to develop this proposal, which many pharmacists might consider revolutionary. Pharmacists developed the training program for technicians and had to relinquish a task that many felt could be done only by a pharmacist. Technicians took on additional responsibility without additional compensation.

When interpreting our results it is important to bear in mind 2 key points that may limit their applicability to other institutions. First, we are reporting the results of a series of quality improvement audits rather than a scientifically designed research study. The use of a historical control group for comparison allows for the possibility of unmeasured influences that may have developed over the study period. Second, the error rates reported are those associated with our setting. The results could be affected by the type of pharmacy information system, the qualifications and

training of staff, the work environment, and other factors, and cannot be extrapolated to other settings.

Our hospital has realized many benefits from this initiative. The audits have allowed us to define an error rate for order entry in a pharmacy department. This information could not be found in the literature, so our data should be useful to other institutions. We have demonstrated that pharmacy technicians can perform order entry at verified status with an acceptable error rate. The ongoing quality improvement program has allowed us to effectively identify and address errors and to ensure that our staff are meeting acceptable standards. To provide feedback on their performance in this area, the results of each audit are presented at staff meetings and are circulated to our team of order-entry technicians. Also, we have defined an error rate for our institution that will be useful as we look at other alternatives to technician order entry in the future (such as computerized order entry by physicians). Finally, and most importantly, we have been able to take an additional step in the evolution towards the provision of pharmaceutical care by shifting yet another technical task from pharmacists to technicians.

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