Prevention of Medication Errors in the Hospital Setting: The Role of Pharmacy Students

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ABSTRACT

According to a well-known report by the Institute of Medicine in 1999, medical errors accounted for 44,000 to 98,000 deaths per year, and many of these errors could have been avoided. Preventable drug-related morbidity and mortality represent a serious medical problem for which expert and immediate attention is urgently required. The challenge that we face is to provide systems and individuals who can identify these errors and stop them before they occur.

The disciplines of medicine, nursing, and pharmacy all play a major role in preventing medication-related errors. To that end, we designed a project to explore the role of pharmacy students in preventing medication errors in the hospital setting. These students, collaborating with both a teaching hospital and a college of pharmacy and using set guidelines, were responsible for identifying preventable medication errors in the acute-care inpatient setting. Preceptors from both the hospital and the college reviewed the findings for their impact on patient care.

Medication errors were prevented in 82 patient-cases. The results of this study demonstrate the positive role that pharmacy students can and do play in preventing these errors.

INTRODUCTION

Medical and medication-related errors can lead to death for hospitalized patients, and most disturbing is the fact that many of these errors are preventable. Medical errors account for 44,000 to 98,000 deaths per year, making them the eighth leading cause of mortality in the U.S.1,4 These errors are also associated with a tremendous economic cost, between $17 billion and $29 billion annually,5,6 with errors involving medications accounting for the largest percentage.1,3

If one could reduce the number of medication errors through prospective input, this not only would have a positive economic effect on the health care system but ultimately also would have the potential to save thousands of lives. A decrease in the number of medication errors would also help to reduce the length of hospital stays and, in many instances, would preserve the working relationships between patients, physicians, and nurses.

Preventable drug-related morbidity and mortality represent a critical medical problem that urgently demands expert and immediate attention. With today’s hospital environment, in which drug treatment has been elevated to a sophisticated—and, at times, a chaotic—means of treating disease states, the number of possibilities for committing drug-administration errors is infinite.

Medication errors occur in 3.1% to 16.7% of hospitalized patients.2,3,7 One well-controlled study of medication errors in hospitals points to pharmacy-dispensing mistakes in which a wrong drug or an incorrect dosage strength was prescribed.6 However, many other significant areas of concern also exist.

Mortality, morbidity, and economic devastation are the most important by-products of medication errors. These potential problems are associated with extremely detrimental consequences for patients, physicians, and the health care system itself. We face an enormous challenge of providing a means of identifying these errors and preventing them from occurring.

Numerous articles detail how medication errors come about, the extent to which they occur, their associated costs, the various roles played by health care practitioners, and the role of preventing system errors. A recent article in Journal of Medical Systems, for example, reviewed the relationship between pharmacists, the health care system, and medication errors.9 At the same time, only limited information exists about the role of the pharmacy students in preventing these errors.

PURPOSE OF THE STUDY

We designed a study to examine a means of preventing medication errors before they occur. The study analyzed the utilization of pharmacy students and their role in patient units and in the inpatient pharmacy in a hospital. Our goal was to identify a role that students might play in recognizing and preventing potential errors.

METHODOLOGY

Definition of Terms

Terms used in the study are summarized in Table 1.10,11

The Study Database

As part of their experiential education program conducted in the spring semester of 2002, nine sixth-year, entry-level Doctor of Pharmacy students participated in clerkships offered at a 650-bed, acute-care teaching hospital in Manhattan, New York. This advanced-practice experience provided students with the opportunity to participate in team rounds, to direct patient care, and to strengthen their critical thinking and patient-interaction skills.

Ten percent of the clerkship grade was based on students’ participation in this program. These events, as documented by

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Table 1  Medication-Error Prevention Study: Glossary of Terms

1. **Medication error**: "Any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to procedures and systems, including: prescribing; order communication; compounding; dispensing; distribution; administration; education; monitoring; and use.** A medication error may also be defined as an unintended act of omission or commission wherein the act does not achieve the intended outcome or a dose of medication that deviates from the physician’s orders as written in the patient’s chart or from standard hospital policy and practice.

2. **Error of omission**: A prescription may be missing an essential piece of information from the prescriber; such as the dose, the frequency, or the time of day at which the medication is to be given.

3. **Error of commission**: A prescription may contain incorrect information concerning the drug therapy, or it may duplicate existing therapy (e.g., ordering two penicillin medications for the same patient).

4. **Sound alike/look-alike error**: The use of a drug whose spelling or sound is similar to that of another agent may result in an error.

5. **Medical abbreviation error**: The medical community uses many abbreviations to communicate information. Unfortunately, many of these abbreviations are not standardized and are sometimes misinterpreted. Each institution should have a list of acceptable and unacceptable abbreviations to use in writing an order. An order written for q.d. (once daily) can be confused with one written for q.i.d. (four times a day).

6. **Medication misadventure**: A misadventure is an inherent risk when medication therapy is indicated. The error results either through omission or commission by the administration of a medication that results in potential harm to the patient, with effects ranging from mild discomfort to fatality. The outcome may be independent of the pre-existing pathology or disease process. It may, however, be attributable to error (human or system) or immunological, or it may be an idiosyncratic response. The outcome is unexpected or undesirable.†

7. **Adverse drug event (ADE)**: An injury (or a lack of an intended effect) may result from a medication (e.g., an anaphylactic reaction to penicillin).‡

8. **Adverse drug reaction (ADR)**: An adverse reaction may be any unexpected, unintended, undesired, or excessive response to a medicine. The patient may need to remain in the hospital or may require emergency care or another type of treatment. Consistent with this definition, an **allergic reaction** (an immunologic hypersensitivity occurring as the result of unusual sensitivity to a medicine) or an **idiosyncratic reaction** (an abnormal susceptibility to a medication that is peculiar to the individual) is also considered to be an ADR.‡

9. **Unauthorized drug**: A dose of medication that was not ordered for the patient is administered.

10. **Extra dose**: A dose may be given in excess of the total number of times ordered by the physician, such as a dose given on the basis of an expired order, after a drug had been discontinued, or after a drug’s administration had been put on hold. For instance, a drug is ordered to be administered in the morning, but it is repeated in the evening.

11. **Wrong dose**: The dose of the prescribed medication differs from that requested by the physician. This error may apply to tablets, capsules, injectable solutions, creams, ointments, suppositories, or drops.

12. **Wrong route**: Medication is sometimes given by a route different from the one ordered (e.g., the oral administration of a drug ordered to be given by injection).

13. **Wrong form**: A dose might be administered in a form different than that ordered by the physician when the form was specified (e.g., enteric-coated aspirin is ordered, but plain aspirin is given).†

14. **Wrong technique**: A wrong technique involves the exclusion of, or the incorrect performance of, a procedure ordered by the prescriber immediately before administration of each dose of medication (e.g., failure to verify the heart rate or blood pressure measurement before giving a dose).†

15. **Wrong time**: The dose is given more than 60 minutes before or after the scheduled administration time. A window of 30 minutes is used when medications are ordered before or after a meal.

The students, were evaluated as part of the study. Because the students were novices, they were working in a structured program under the supervision of their preceptors. All students were given a data-collection form (Figure 1) to guide them through the patient-information and event-description processes.

The Medication-Error Retrieval Process

As part of their clerkship rotation at the hospital, students went on rounds and monitored patients on the medical-surgical units. The opportunities to identify potential errors were broad and were not limited to a specific type of patient. As the students reviewed the patients’ medical records as well as current prescription orders, laboratory tests, and physician progress notes, they screened the records for possible medication errors. If a potential error was discovered, the students researched it and made an evaluation. The students filled out the form and discussed the recommendation with their preceptor. If the error was considered to be preventable, the health care provider was contacted and the situation was fully discussed. The physician then made the final determination regarding patient care.

The students also recorded whether the medical house staff accepted the recommendation. A review committee evaluated this information and the clinical impact of the intervention upon completion of the study.
The Review Committee

The Medication Error Review Committee evaluated all of the student-submitted medication-error reports for appropriateness and accuracy. The committee also assigned a category to the preventable errors, such as “minimal,” “moderate,” or “significant.” The committee members consisted of the Director of Pharmacy, the Assistant Director of Pharmacy for Clinical Services, and the preceptor. The clinical impact review process was open to the participation of attending physicians, specialists, nurses, pharmacists (staff and clinical), and other health care professionals.

RESULTS

Four students participated in the training program from January through April 2002, and five students participated from April to May 2002. The students spent approximately 2.5 hours each day on the patient units, making rounds with the medical team and researching questions generated during these rounds or through chart reviews.

Nine students collected data on 82 patients. The average age of these patients was 69.6 ± 15 years (range, 54.6 to 84.6 years). The median age was 73, and the mode was 81 years. There were 47 women (57%) and 35 men (43%). Most of the medication errors (66%) fell into the “Clinical Appropriateness” category (Table 2), which included errors related to therapeutic duplication, drug interactions, contraindications, allergies, and monitoring of laboratory values.

The nine students spent 20 hours, 40 minutes over a 15-week period on these cases. This accounted for an average of 2 hours, 18 minutes per student, and a time of 15.1 ± 9.3 minutes per intervention (range, 5.8 to 24.4 minutes). The Medication Review Committee's assessment of these interventions is pre-
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Table 2 Mediation Errors Detected by Pharmacy Students: Distribution by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>No. (%)</th>
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<tbody>
<tr>
<td>Clinical Appropriateness</td>
<td>54 (66%)</td>
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</tr>
<tr>
<td>Administration</td>
<td>18 (22%)</td>
<td></td>
</tr>
<tr>
<td>Ordering</td>
<td>16 (20%)</td>
<td></td>
</tr>
<tr>
<td>Procedure</td>
<td>7 (9%)</td>
<td></td>
</tr>
<tr>
<td>Dispensing</td>
<td>4 (5%)</td>
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* Because some interventions fell under several categories of medication error—prevention types, the number of reports and the percentages do not add up to 82 and 100%, respectively.

Table 3 Assessment of Interventions by Medication Review Committee

<table>
<thead>
<tr>
<th>Clinical Impact</th>
<th>No. of Interventions (%)</th>
<th>Physician Acceptance Rate (%)</th>
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<tbody>
<tr>
<td>Significant</td>
<td>5 of 82 (6%)</td>
<td>5 of 5 (100%)</td>
</tr>
<tr>
<td>Moderate</td>
<td>31 of 82 (38%)</td>
<td>24 of 31 (77%)</td>
</tr>
<tr>
<td>Minimal</td>
<td>46 of 82 (56%)</td>
<td>33 of 46 (72%)</td>
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The physician acceptance rate of these significant interventions was 100%.

DISCUSSION

Medication errors were prevented in 82 patient-cases. The results of this study demonstrate the positive role that pharmacy students can and do play in preventing medication errors. The average age of these patients was 69.6 years; 47 women (57%) and 35 men (43%) were involved.

The categories and the number of errors prevented were as follows: (1) Clinical Appropriateness, 54 (66%); (2) Administration, 18 (22%); (3) Ordering, 16 (20%); (4) Procedure, 7 (9%); and (5) Dispensing, 4 (5%). Five (6%) interventions had a significant impact, with a physician acceptance rate of 100%. There were 31 (38%) moderate and 46 (56%) minor interventions, with a physician acceptance rate of 77% and 72%, respectively.

Our study results show the positive role that pharmacy students can play in preventing medication errors. With the investment of a minimal amount of time and little experience, these students were able to prevent some of these errors; 41% of the errors were deemed significant or moderate.

The overall acceptance rate (76%) by the physician was impressive. This mirrors an acceptance rate of 78.7% of the recommended clinical interventions (the interventions were not focused on medication-error prevention) provided by second-year post-baccalaureate Doctor of Pharmacy candidates.12

CONCLUSION

Senior pharmacy students are indeed capable of preventing medication errors, and they can contribute to positive patient outcomes. These results are important not only for the welfare of patients and the economics of the health care system but also for the future role of pharmacy personnel in hospitals.13

Having highlighted the importance of pharmacy students in this report, we look forward to corroboration of these results with additional research. This study also broadens the opportunity for similar trials and strengthens the idea of the positive value that pharmacists can bring to optimal patient care. We hope that these results will lead to fewer medication errors and will result in notable improvements in patient outcomes.

REFERENCES

8. Proulx SM. Medication errors: Steps pharmacists can take to safeguard against dosage errors computers may not catch. Pharmacist 1997;22(12):73.