Medication Errors Involving Healthcare Students

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ABSTRACT

Students acquire vital clinical experience while participating in patient care, but they can become involved in medication errors. The extent of this problem is relatively unexplored. Analysts reviewed medication-error events mentioning students submitted to the Pennsylvania Patient Safety Authority from July 2010 through June 2015. Of the 711 events identified, 87.3% (n = 621) reached the patient. Analysts also found that students caught or discovered the error in 16.2% (n = 115) of reports. The most common node of origin for the medication error was administration (75.9%, n = 540). The most common event types were extra dose (16.6%, n = 118), dose omission (13.2%, n = 94), and wrong time (11.4%, n = 81). High-alert medications, including insulin, opioids, and anticoagulants, were reported in 40.9% (n = 291) of events. Professional organizations, healthcare facilities, and professional schools can help reduce the risk of student-involved errors by implementing key strategies, including incorporation of didactic and experiential medication safety content into school curricula and on-site training programs. (Pa Patient Saf Advis 2016 Mar;13[1]:18-23.)

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INTRODUCTION

Nursing, pharmacy, medical, and other healthcare students have a large presence in U.S. hospitals while they engage in clinical experiences to meet the requirements of their professional education and learn the principles of clinical practice. Direct patient-care experiences are vital for students to prepare for the real world.[1-2] This hands-on experience places them in a position to be involved in errors as well as catch potential or actual errors. Nursing student errors remain largely unreported,[3] potentially because of fear of liability.[4] The literature about nursing student errors focuses predominantly on the student's ability to perform calculations and numeracy skills, rather than a broader range of practical clinical skills.[1,4] Literature focusing on pharmacy students discusses prevention of medication errors.[5] There is little information on other healthcare student involvement in medication-related events and even less literature about students preventing errors.

Pennsylvania is home to 85 nursing programs, 7 pharmacy schools, and 7 medical schools.[6,7,8] Students from these schools, as well as students from other states, will be involved in the medication-use process. Students ranging in experience from first-year healthcare students to students in their final year before graduation will be involved, either directly or indirectly, in the care of patients in Pennsylvania. Pennsylvania Patient Safety Authority analysts have not previously explored the role students play in contributing to and intercepting medication errors reported through the Authority's Pennsylvania Patient Safety Reporting System (PA-PSRS). This analysis identified events that mention the involvement of students, including those that reached the patient, and some in which the student detected the error.

METHODS

Analysts queried the PA-PSRS database for medication errors that occurred from July 2010 through June 2015 that included the word "student" in the narrative. This query yielded 808 event reports. Events that included students but also mentioned that the instructor was involved in an error were included in the analysis. In this context, an instructor is defined as the healthcare professional overseeing the student's work while in the hospital, whether school faculty or an on-site preceptor.[9] Event reports that mentioned students, but indicated that the student was not involved in the error (e.g., the patient woke up while student was in the room) were excluded, leaving 711 reports for analysis. The medication name, route of administration, patient care area, and harm score, adapted from the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP) harm index,[10] were provided by the reporting facility. When a medication-name data field was left blank but the name was provided in the event description, an analyst adjusted the medication name field. The reports were evaluated to determine the factors associated with medication errors involving students. Analysts classified reports by the type of student involved, node of origin, presence of the instructor, and whether the student caught or was involved in the error. Analysts made note of events involving high-alert medications, based on the Institute for Safe Medication Practices (ISMP) List of High-Alert Medications in Acute Care Settings.[11]

RESULTS

Reports were categorized by harm score; 87.3% (n = 621) of the events reached the patient (harm score = C through I) and only 0.6% (n = 4) of the events resulted in patient harm (harm score = E through F; no events with harm scores G, H, or I were reported; see Figure 1). Overall, 63 unique patient care areas were associated with

Figure 1. Harm Scores for Student-Related Medication Errors, as Reported to the Pennsylvania Patient Safety Authority, July 2010 through June 2015 (N = 711)
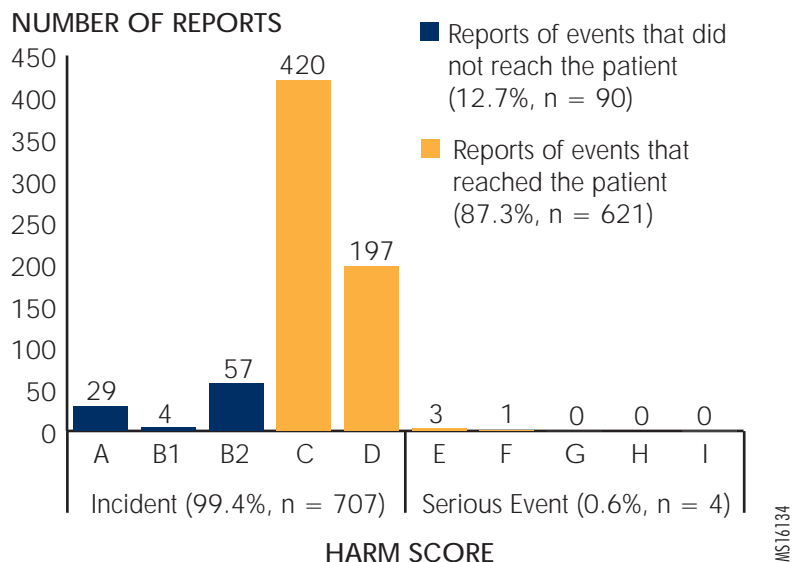
NUMBER OF REPORTS

Reports of events that did not reach the patient (12.7%, n = 90)

Reports of events that reached the patient (87.3%, n = 621)

Harm Score	A	B1	B2	C	D	E	F	G	H	I
Value	29	4	57	420	197	3	1	0	0	0

Incident (99.4%, n = 707)   Serious Event (0.6%, n = 4)

HARM SCORE

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Table 1. Care Areas Most Commonly Reported in Student-related Medication Errors, as Reported to the Pennsylvania Patient Safety Authority, July 2010 through June 2015 (N = 711)

CARE AREA	NO. OF REPORTS	% OF REPORTS
Medical/Surgical unit	203	28.6
Telemetry	87	12.2
Medical unit	48	6.8
Medical/Oncology unit	25	3.5
Emergency department	23	3.2
Orthopedic unit	22	3.1
Medical/Surgical/Oncology unit	20	2.8
Cardiac unit	20	2.8
Pharmacy	19	2.7
Pediatric unit	19	2.7
All other care areas	225	31.6

student-involved events and event reports; the most common areas are shown in Table 1. The most common nodes of origin for the reported events, as identified by the analysts, are shown in Figure 2.

The most common types of events reported by facilities were extra dose (16.6%, n = 118), dose omission (13.2%, n = 94), wrong time (11.4%, n = 81), wrong dose/overdosage (9.8%, n = 70), and wrong patient (5.9%, n = 42). Following are examples of extra dose, wrong dose/overdosage, and wrong patient event reports:*

* The details of the PA-PSRS event narratives in this article have been modified to preserve confidentiality.

Student gave medication at 4:30 p.m. (4 p.m. scheduled dose); however, was unaware that the medication was given previously at 3:30 p.m. causing the next dose (due at 10 p.m.) to appear as given as an off schedule dose. Student nurse and instructor relied on paper MAR [medication administration record], which did not reflect medication signed off as given, without checking the computer system to determine if medication had previously been given. Upon further investigation, found students do not have access into the computer system, they work directly under the supervision of their instructor. Physician notified of incident, patient's vital signs assessed, orders reviewed, 10 p.m. dose of medication held. No harm reached the patient.

The nurse was precepting a nursing student. The nurse handed the student a 30-unit insulin syringe. After seeing this syringe, the student indicated that he gave the prior patient the wrong dose using a 100-unit syringe. The student had administered 90 units instead of 9 units. The attending physician was notified; ordered IV [intravenous] fluids with dextrose and hourly finger-stick glucose checks.

Instructor and student nurse administered a dose of Neurontin® [gabapentin] 400 mg to the wrong patient. Attending physician alerted. Per the student nurse and instructor, name band checked.

High-alert medications pose an increased risk of patient harm when involved in medication errors.[11] High-alert medications were reported in 40.9% (n = 291) of events. Insulin (33.3%, n = 97), opioids (24.1%, n = 70), and anticoagulants (15.8%, n = 46) were the three most common drug classes involved in events. These three classes represented 73.2% (n = 213 of 291) of all events involving a

high-alert medication (see Figure 3, available exclusively online with this article at http://patientsafetyauthority.org/ ADVISORIES/AdvisoryLibrary/2016/ Mar;13(1)/Pages/home.aspx) and 30.0% (n = 213 of 711) of all reported events.

More than two-thirds (69.8%, n = 496) of reported events occurred during peak academic periods – February, March, and April and September, October, and November (see Figure 4).
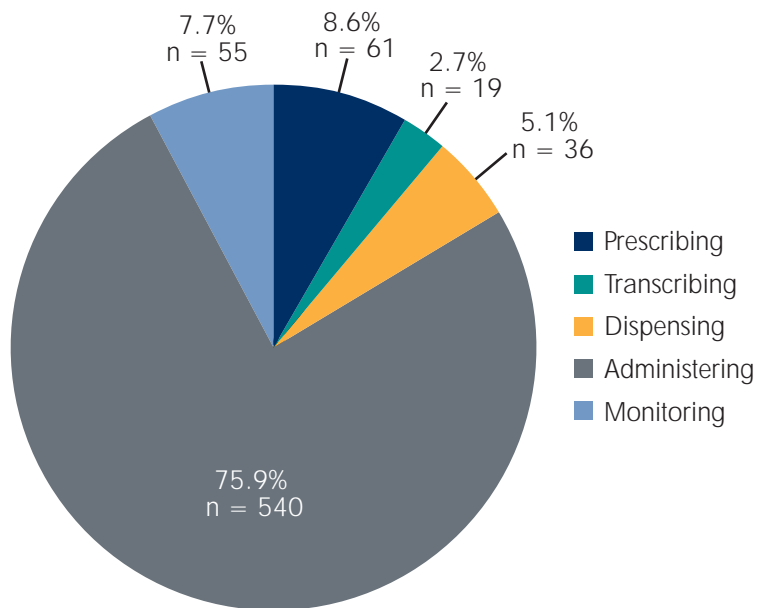
The majority of students involved in errors were nursing students (see Table 2). Nearly 4% (n = 28) of reports did not involve students, but rather involved instructors. Following are examples of events involving instructors and nursing or pharmacy students:

> Nursing instructor removed the wrong patient's medication and tubing from the patient medication bin, and the student nurse scanned the dose [barcode], flushed the syringe pump tubing, and connected the Rocephin® (cefTRIAXone) dose to the IV. Instructor noted the wrong patient name on another medication removed from bin and stopped the Rocephin [infusion]. Syringe pump with wrong tubing was running for approximately two to three minutes at 0.3 mL/min before being stopped and the correct tubing applied. Both patients were receiving same dose of Rocephin.

> One Percocet® [oxyCODONE and acetaminophen] tablet was given to the wrong patient by an unattended nursing student. Physician notified. Medication policy was reviewed with the student nurses.

> Primary nurse administered the patient's 10 a.m. medications [and did not complete] computer documentation that this occurred. Student nurse assigned to the patient administered 10 a.m. medications. The patient was confused and unable to

Figure 2. Nodes of the Medication-Use Process in Which Student-Related Medication Errors Originated, as Identified in Events Reported to the Pennsylvania Patient Safety Authority, July 2010 through June 2015 (N = 711)

Legend:
- Prescribing
- Transcribing
- Dispensing
- Administering
- Monitoring

7.7% n = 55
8.6% n = 61
2.7% n = 19
5.1% n = 36
75.9% n = 540

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communicate that she received duplicate medications.

> Patient told pharmacy student that she was taking fluticasone nasal spray. Pharmacy student accidentally logged fluticasone as fluticasone 50 mcg inhalation powder instead of the nasal spray. Student was unaware that there is an inhaler and nasal spray both with a 50 mcg strength. Student picked the first 50 mcg product she saw. When the physician reconciled [the patient's medications], because fluticasone inhaler is not a formulary item, the physician chose a therapeutic alternative of Flovent® [fluticasone propionate] 220 mcg/inhalation BID. Pharmacist caught error when she was reviewing medication history for another issue.

Students were involved in the medication error in 79.9% (n = 568 of 711) of the events. When a healthcare professional student was found to have been involved

in the error, the instructor or preceptor was noted to be involved or present 28.9% of the time (n = 164 of 568). In the subset of nursing students, instructors were commonly present when these students were involved in medication errors (92.1%, n = 151 of 164). When a student was found to be involved in the error, the most common node in which the event originated was administration (84.2%, n = 478 of 568) followed by monitoring (8.5%, n = 48). Following are examples of reports of student-involved events:

> Patient received medication in error. Medication was ordered for another ED patient. Patient medicated improperly by nursing student working under this RN's supervision.

> Nursing student documented giving oxyCODONE but the documentation was not co-signed by the instructor. When this occurs, no one can document medications on that order. There was a delay

Figure 4. Student-Related Medication Error Events by Month, as Reported to the Pennsylvania Patient Safety Authority, July 2010 through June 2015 (N = 711)
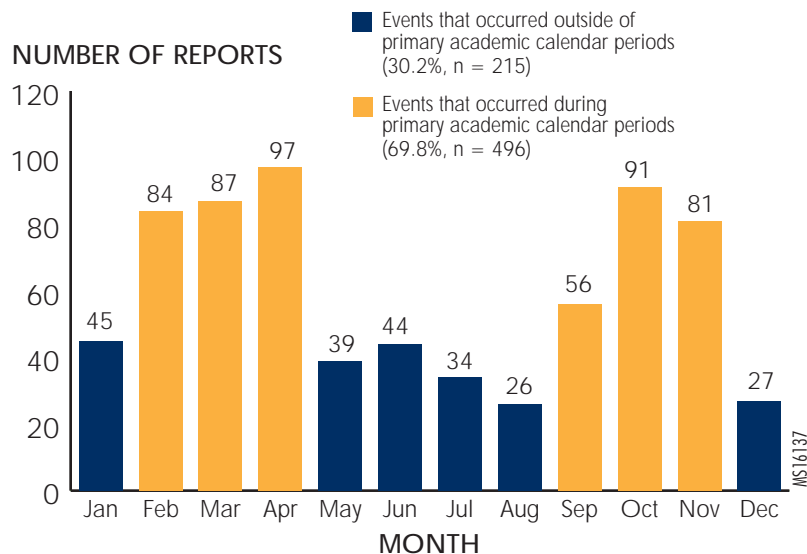

Table 2. Type of Student Identified in Student-related Medication Error Reports, as Reported to the Pennsylvania Patient Safety Authority, July 2010 through June 2015 (N = 711)

TYPE OF STUDENT	NO. OF REPORTS	% OF REPORTS*
Nursing	597	84.0
Pharmacy	44	6.2
Medical	21	3.0
Other students	21	3.0
Not a student (i.e., instructor or preceptor)	28	3.9

*Does not equal 100 because of rounding.

in documenting the next dose of oxyCODONE.

Of note, analysts identified that students caught or discovered the error in 16.2% (n = 115 of 711) of reports. Most errors were caught by nursing students (60.9%, n = 70 of 115), followed by pharmacy students (33.0%, n = 38; see Figure 5, available exclusively online with this article at http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2016/Mar;13(1)/Pages/home.aspx). Analysts identified that the most common nodes of origin for student-caught errors were prescribing (35.7%, n = 41) and administering (32.2%, n = 37; see Figure 6).

Following are examples of events caught or discovered by students:

MetroNIDAZOLE 500 mg IV q8h order not profiled by pharmacy on the [appropriate] therapy order. Missed order recognized by medical student while pre-rounding on patient. Medical student notified pharmacy of error and MetroNIDAZOLE order was promptly profiled.

Nursing student was preparing to hang meropenem dose and noticed that the wrong patient name and

wrong dose was on the previously administered meropenem dose.

Patient who was on peritoneal dialysis was started on enoxaparin 30 mg q12. The pharmacy reviewed and approved this dose. A pharmacy student was on the team and identified the dosing error prior to the patient getting the second dose and therefore the patient received the appropriate amount based on renal status. Patient had no harm.
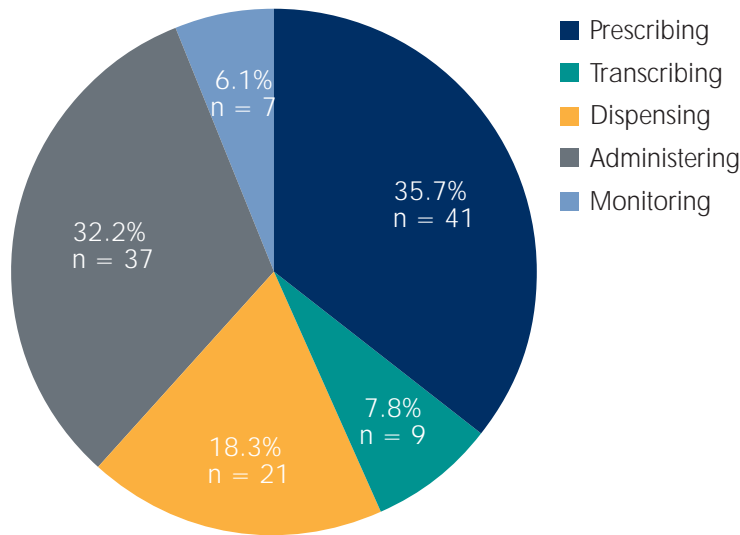
DISCUSSION

Although healthcare students may not intend to harm a patient, they are sometimes involved in medication errors that require intervention. Reid-Searl et al. validated that almost one-third of nursing students reported involvement in a near miss or actual medication error.[3] A study published in 2006 by Wolf et al. examining data reported to MEDMARX®, the U.S. Pharmacopeia's (USP's) medication-error reporting database, found fewer than 3% of errors involving students resulted in patient harm and 2.1% of student nurses' errors resulted in patient harm.[4] This is similar to the finding herein that 0.6% (n = 4) of reported errors caused patient harm.

The level and depth of a student's experience and academic preparation may play a role in some of the events reported to the Authority. It has been reported that students' inexperience and distractions contribute to medication errors.[4,12] Students have also reported being inadequately prepared for medication administration.[13]

The number of error reports mentioning students was higher in the months of February, March, and April as well as September, October, and November. These three-month time periods coincide with the academic calendar.

It is standard for healthcare students to be overseen by faculty or preceptors during their clinical experiences.[2,14] However,

Figure 6. Medication-Use Process Node in Which Student-Caught Medication Errors Originated, as Identified in Reports Submitted to the Pennsylvania Patient Safety Authority, July 2010 through June 2015 (N = 115)

the involvement of pharmacy students in catching errors.[5] On an internal medicine service, pharmacy students clarified 67% of orders with a medication or dose omission.[5] In the data set analyzed for this article, analysts identified that students, including nursing, pharmacy, and medical students, caught the error in 16.2% (n = 115 of 711) of reports.

To address students' involvement in medication errors and error prevention, one institution provided students with a "Medication Safety Day." Nursing students received education on causes of medication errors, along with awareness of the numerous contributing factors in such errors.[17] This initiative aimed to raise awareness of causes and risk of medication errors, along with prevention strategies among student nurses.[17]

Limitations

The retrospective review of reported errors is limited by the information reported through PA-PSRS, including the event descriptions and explanations. As with all reporting systems, the type and number of reports collected depend on the degree to which facility reporting is accurate and complete. The reporting cultures and patterns in each facility, and their interpretations of what occurrences are reportable, can lead to reporting variations.

RISK REDUCTION STRATEGIES

Professional organizations, healthcare facilities, and professional schools can strive to identify system-based causes of errors involving healthcare students and instructors and implement effective types of risk-reduction strategies to prevent harm to patients. Consider the strategies described below, which are based on a review of current literature, events reported to the Authority, and observations from ISMP.

– Ensure students participating in the medication-use process are appropriately supervised by faculty or preceptors during their clinical

Reid-Searl et al. reported in 2010 that many students do not receive appropriate supervision while performing clinical responsibilities.[3] The same study reported that preceptors cannot always be physically present with a student because they supervise multiple students. When the preceptor is with another student, the responsibility of supervision often falls to the staff nurse.[3] This responsibility, added to typical patient care responsibilities, may create situations in which direct student supervision may not be realistic. Even though medication errors have occurred when the preceptor is in the room with the student, medication errors are more likely to occur when the proper supervision is not provided.[3]

Patients who are assigned to student nurses are also assigned to staff nurses; these dual assignments can cause confusion. Communication breakdowns regarding who will administer the prescribed medications, what medications have been administered, and which medications should be held, have resulted in dose omissions and the administration of extra doses. Communication

between students, nursing instructors, and facility staff needs to be planned carefully to ensure a model that considers the safety hazards associated with dual assignments.[15]

Numerous additional conditions exist in the hospital setting that may contribute to medication errors involving students. A few include communication and documentation issues, monitoring issues, preparing drugs for multiple patients, and medication administration records (MARs) not referenced.[12,15-16] Improper or limited access to the electronic health record (EHR) may limit students' ability to read about or document patient-care activities. Inconsistent use of the MAR, whether due to limited access or other reasons, can introduce risk when preparing and administering medications.[15] Because of a lack of experience, knowledge, or guidance, students may not be aware of vital signs or laboratory values that must be checked prior to administering or verifying a medication.

Healthcare students can and do play a role in catching and uncovering medication errors. A retrospective study confirmed

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rotations.[3,4] This includes having the instructor or preceptor present at the bedside during the time of medication administration.

– Verbally confirm actions of medication administration in presence of instructor or preceptor.

– Ensure that staff complete documentation in a timely fashion if students are involved in patient care. Provide students with the ability to review and document medication-administration information in the paper or electronic MAR.[15]

– Share the facility's list of high-alert drugs and associated error-reduction strategies with instructors and students to ensure the same level of attention to safe systems and practices occurs when students handle these drugs.[15]

– Incorporate medication safety throughout student curriculums.[4,12] Employ both didactic and experiential methodologies.

– Design healthcare professional education programs to include multidisciplinary clinical simulation training before clinical rotations to develop the ability to work in teams and reduce medication errors.[3,4,18]

– Establish an orientation and training process for students and faculty. Include a review of relevant electronic systems (e.g., EHR, barcode scanning, automated dispensing cabinets). Also include review of the location (e.g., patient care area) where they will be involved in the medication-use process.[4]

– Establish a non-punitive reporting culture to encourage discussion of

error-prone conditions with students and preceptors.[4,15]

CONCLUSION

To develop their clinical reasoning abilities, students engage in experiential training in U.S. hospitals.[4] Students not only learn how to care for patients and operate as a member of a team, but often enrich the patient's experience during hospitalization.[15] Any participation in the medication-use process places students in a position to be involved in medication errors, as well as a position from which to identify potential or actual errors.[5] Professional organizations, healthcare facilities, and professional schools should work collaboratively to address factors that may contribute to errors involving students (and instructors) while maximizing the students' ability to intercept and prevent errors.

NOTES

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PENNSYLVANIA PATIENT SAFETY ADVISORY

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