Nursing Student Medication Errors: A Retrospective Review

Lorill Harding, MA, RN; and Teresa Petrick, MN, RN

ABSTRACT

This article presents the findings of a retrospective review of medication errors made and reported by nursing students in a 4-year baccalaureate program. Data were examined in relation to the semester of the program, kind of error according to the rights of medication administration, and contributing factors. Three categories of contributing factors were identified: rights violations, system factors, and knowledge and understanding. It became apparent that system factors, or the context in which medication administration takes place, are not fully considered when students are taught about medication administration. Teaching strategies need to account for the dynamic complexity of this process and incorporate experiential knowledge. This review raised several important questions about how this information guides our practice as educators in the clinical and classroom settings and how we can work collaboratively with practice partners to influence change and increase patient safety.

Received: August 23, 2006

Accepted: January 19, 2007

Ms. Harding and Ms. Petrick are Instructors, BSN Program, Selkirk College, Castlegar, British Columbia, Canada.

Address Correspondence to Lorill Harding, MA, RN, Instructor, BSN Program, Selkirk College, 301 Frank Beinder Way, Castlegar, British Columbia, Canada V1N 3J1; e-mail: LHarding@Selkirk.ca.

During Robert's hospitalization for a hip replacement, the RN responds to his request for pain medication. She gives him 10 mg of morphine intravenously, which is two times the amount prescribed. Robert's wife has difficulty waking him when she visits 15 minutes later. She calls the RN, who notes that Robert is very drowsy and his respirations are slow; he requires the administration of a drug to reverse this effect. Robert's hospital stay is increased because of slower mobilization and recovery. The nurse responsible for the error has mistaken the available supplied dose of morphine (10 mg/mL) for the prescribed dosage (5 mg) on the medication administration record (MAR). In this fictional example, Robert has experienced an adverse event and is one of an estimated 185,000 Canadians who experience adverse events annually while hospitalized.

Adverse events have been defined as unintended harm, injury, or complications that occur to an individual while receiving care within the health care system (Baker et al., 2004; Committee on the Quality of Health Care in America, Institute of Medicine, 2000). The Canadian Adverse Events Study (Baker et al., 2004) estimated that adverse events occur in 7.5% of all acute care hospital admissions and that many adverse events are potentially preventable. Medication errors are one of the most common kinds of adverse events and include drug reactions and the failure to administer a drug as ordered (Committee on the Quality of Health Care in America, Institute of Medicine, 2000; Manno, 2006). The medication process is complex and involves a number of different individuals and disciplines, thereby increasing the risk of error.

Because nurses are directly and consistently involved in the administration phase of the medication process, they experience the distress of potentially committing an error. However, they are also well positioned to prevent errors at both the individual and system levels. Personal and economic costs attributed to adverse medication events are well documented in the literature, but how does this knowledge inform our practice as nurse educators? What practices do nurse educators need to incorporate into nursing programs to support student learning and increase patient safety? In this article, we report the findings of a retrospective review of medication errors committed by students enrolled in a baccalaureate nursing program at a rural community college. Patterns of errors and contributing factors are identified, and strategies for decreasing the frequency of preventable errors are suggested.

Literature Review

During the past decade, patient safety within health care systems has been publicly scrutinized and critically examined from both human and monetary cost perspectives. It is estimated that medical errors are the eighth leading cause of death each year in the United States (Committee on the Quality of Health Care in America, Institute of Medicine, 2000). Canadian statistics suggest that up

to 24,000 individuals experience an adverse event resulting in death each year; this is more than the number of deaths caused from breast cancer, motor vehicle accidents, and HIV combined (Canadian Institute for Health Information, 2004).

Medication errors account for a significant proportion of reported adverse events. In a Canadian study, Baker et al. (2004) found that 24% of reported adverse events were drug related or fluid related. From an economic perspective, preventable drug-related morbidity and mortality in the older adult population costs the Canadian health care system $11 billion per year (MacKinnon, 2002). Increased length of hospital stays secondary to medication errors ranges from 2.2 days (Manno, 2006) to 4.6 days (Ackroyd-Stolarz, Hartnell, & MacKinnon, 2005). The actual rate of medication errors is difficult to accurately determine but has been estimated to be 5 per 100 medication administrations (Hughes & Ortiz, 2005).

It is thought by many that medication errors are underreported for a number of reasons, including undetected errors, inconsistencies in reporting, focus on errors related to medications given rather than not given, perception of unimportance, and emphasis on individual performance and punitive responses (Buerhaus, 2001; Hughes & Ortiz, 2005). Historically, near misses have not been routinely reported, although more attention is being given to this dimension. In a recent study conducted by Balas, Scott, and Rogers (2006), critical care nurses reported more near misses than actual errors. This is important information because it could identify significant aspects of system function that require change.

The medication process is complex and includes a number of phases: prescribing, transcribing, dispensing, administering, and monitoring. Errors can occur at all points of this process. Studies conducted in both Canada and the United States have found that the highest rates of error occur in the ordering phase (49% to 56%), followed by the administration phase (26% to 40%) (Ackroyd-Stolarz et al., 2005; Manno, 2006). Many potential errors are identified and intercepted by nurses during the transcription and administration phases of the medication process (Leape et al., 1995).

Medication errors have been examined from a variety of professional perspectives, including those of pharmacists, physicians, and sociologists; but the voice of the nursing profession is not as well represented. There is a paucity of literature specific to nursing education that identifies teaching strategies to address the complex, dynamic system in which students are learning to administer medications. Much of the nursing education literature specific to the prevention of medication errors focuses on teaching strategies for accurately calculating drug dosages. Although there is documentation in the literature of miscalculation contributing to medication errors, the main body of literature does not reflect this as a significant factor. Wolf, Hicks and Serembus (2006) found that inexperience and distraction were the leading factors contributing to student errors. Review of the literature highlights that research findings on medication errors and associated system factors have not significantly informed nursing practice. In addition, it shows there is a lack of active partnerships between nursing education and hospital quality assurance systems.

Medication errors have been examined from a variety of professional perspectives, including those of pharmacists, physicians, and sociologists; but the voice of the nursing profession is not as well represented.

Research supports that many medication administration errors are caused by nonadherence to the rights method (Konkloski, Wright, & Hammett, 2001). The rights method is a standard process that requires the checking of seven rights: right patient, medication, dosage, time, route, reason, and documentation. Examination of medication errors in light of the rights method and in isolation of system factors can result in individual blame (Committee on the Quality of Health Care in America, Institute of Medicine, 2000). This continued individual focus does not consider the complexity of the medication process and the system and organizational factors that lead to errors (Benner et al., 2002; Hughes & Ortiz, 2005; Leape et al., 1995).

Data Collection and Review

Faculty conducted a 3-year retrospective review of 77 medication errors made by nursing students in a community college program. The 4-year baccalaureate program at this college admits 32 students annually. Our analysis included identification of trends and patterns and comparison of these findings to the literature. This review resulted in reflection on practice, the articulation of theory to the practice setting, and many questions for which answers will be found in further research, discussion, and action.

Incident forms completed by nursing students in four cohorts were retrospectively examined for reported medication errors. Medication errors were documented and analyzed related to kind of error, contributing factors, classification of drug, time of occurrence, and semester of the program. These reports did not include documentation of near misses. None of the errors resulted in serious adverse effects to the patients.

Kinds of Errors and Contributing Factors

During the initial analysis, data were categorized as errors of commission (i.e., medication given incorrectly and violating one of the rights of medication administration) (Hughes & Ortiz, 2005; Manno, 2006) and errors of omission (i.e., medication not given). Errors of omission comprised 34% of the errors reported. The most frequent contributing factor to errors of omission was related to some dimension of the MAR. Inexperience in reading or interpreting the MAR correctly accounted for 42% of the omission errors. Students reported that busyness and distraction during the administration process contributed to 27% of the omission errors, whereas failing to give medications scheduled at less common times accounted for 15% of errors of omission and wrong time. The wrong route and the wrong patient each accounted for 6% of the errors of commission.

Closer examination of the errors in which the wrong dosage of a drug was given revealed that failure to read or understand the medication label (e.g, supply versus ordered amount) explained the majority of these errors. Factors related to the system of medication administration used at individual agencies and, in turn, students' familiarity with and accurate interpretation of the MAR were associated with 24% of the reported errors. Five of the dosage errors may have been prevented if the students had adhered to the college's written policies about checking physicians' orders (narcotic analgesics) and checking insulins and anticoagulants with an RN prior to administering the drugs. None of the reported dosage errors were related to incorrect math calculations.

Examination of events contributing to the wrong drug demonstrated similar patterns to the wrong dosage. System factors and nonadherence to written policies and procedures for safe medication administration accounted for 79% of these errors. Examples of system factors were illegibility of the MAR, failure to notice transcription errors, and drug names that sound alike. Other examples were not adhering to best practices for administering medications (e.g., simultaneously preparing medications for two patients) and failure to follow college policies of checking drugs such as insulin and anticoagulants.

Reported medication errors were also examined related to the classification of the drug given. Errors involving analgesics occurred most frequently, followed by antibiotics and antihypertensive agents. This dimension of the analysis revealed the necessity to improve the documentation on the reporting form because the name of the drug was often not stated, resulting in incomplete data collection. However, the data that were captured were consistent with the trends identified in the literature.

The most frequent contributing factor to errors of omission was related to some dimension of the MAR. Inexperience in reading or interpreting the MAR correctly accounted for 42% of the omission errors.

Incident reports were also examined for patterns related to time of day and semester of the program. Most of the errors occurred at times of the day during which the largest number of medications were scheduled to be given (i.e., 8:00 a.m.), and during the second year of the program (39%), followed by the third year (34%) and fourth year (17%). Of note, these data represent only one cohort of fourth-year students. The incidence of errors increased during consolidated practice experiences (CPEs) at the end of the second, third, and fourth years of the program. These CPEs are characterized by an increased number of hours in the clinical agency in which students work between 168 to 220 hours during a 5-week to 6-week period. Of the errors during the second year (n = 30), 70% occurred during the CPEs.

Although all errors could be categorized as a kind of rights violation, further analysis allowed reviewers to identify the influence of system factors and students' knowledge and understanding. Twenty-three of the errors were a direct result of a rights violation (e.g., failure to check a patient's identification band), and 28 of the errors were associated with limited knowledge and understanding. However, the majority of reported errors resulted from the interplay between knowledge and system factors. For example, in one situation where the wrong drug was given, two similarly named drugs were on the same MAR (e.g., dimenhydrinate and dimenhydramine) but were not clearly differentiated. This example demonstrates that the wrong drug was given as a result of system factors (MAR) and the student's limited experiential knowledge in identifying the difference between the drugs and the risk for error. Thirty-four of the written reports identified system factors, such as incorrect labelling of medication, failure to "flag" a one-time dosage as per protocol, standing orders not processed by the night shift, interpretation of MAR, transcription discrepancies, differences in policies and MARs between agencies, workload, and distraction at the medication cart.

Discussion and Implications for Practice and Education

On review of the data, the interconnectedness of each of the contributing factors and the inability to separate individual performance from the context was clarified.

Rights Violations

The regulatory body for RNs in British Columbia mandates the use of the rights method for medication administration; this method is taught in educational institutions and practiced in clinical settings. The review of these data gave rise to some reflective questions: Are we teaching the right method outside of a system's context? Does it set up students for narrow thinking that does not consider the breadth and complexity of the system? This static view of the seven rights of administration is provided to students who do not have the experience of how the system parts articulate or the depth of knowledge to allow them to question the system or synthesize components that are taught separately.

System Factors

In this article, the system refers to the full context of the work setting where medication is administered. For example, the system includes the physical setup of the nursing unit, the ways the pharmacy interacts with the physician and the nursing unit, and the entire process of medication administration (Leape et al., 1995). This is an area that requires further exploration, and these findings represent only a small fraction of system components that play a role in medication administration.

Many of the errors within the retrospective review that were linked to a system factor often related to some dimension of the MAR. This document is a dynamic, complex form representing one aspect of the medication administration system. For example, when a physician orders a medication, it is entered into the pharmacy system by paper or computer; the unit clerk transcribes the order onto the MAR; the pharmacy may generate another computer entry that will override or replace this entry; and the RN, licensed practical nurse, or nursing student refers to the MAR to administer the appropriate medication and document these actions. It is evident that there are many points in the interaction with the MAR at which errors can occur. Also, there is little attention paid to the fact that nursing students are regularly interacting with the system and the various effects this may have on patient safety. The MAR is introduced to students in a laboratory setting as part of required documentation; thus, this narrow perspective minimizes the complexity of medication administration and the interaction of the system with the MAR. Teaching strategies, such as problem-based learning, may be a more effective and useful way to incorporate the MAR into students' learning. This approach may provide a method that would better emphasize the complex context in which medications are administered.

Due to errors seldom being attributed to one single action by an individual, the systems information emphasizes the importance of building closer relationships with our practice agencies to gather data and collaboratively plan preventive strategies.

The data and the literature review both suggest that, historically, individual blame and judgment or punishment have been brought to bear following a medication error, rather than the error being viewed as a learning opportunity and a chance to recommend system changes (Hughes & Ortiz, 2005). For example, in our institution, it was procedure to have the student document the error in full. After signed by both the instructor and school chair, this report would be placed in the student's personal record. After a review of the data, the policy has been changed so that the completed incident reports are put into a general incident file and reviewed for trend identification and quality assurance purposes. Also, meetings have occurred with practice partners to share the data and to plan a way of jointly reviewing all medication errors within the agencies. In much of the literature, student performance and errors were collected and analyzed separately. This approach does not consider nursing students as part of the system and does not include them as both contributing factors and possible solutions. Due to errors seldom being attributed to one single action by an individual, the systems information emphasizes the importance of building closer relationships with our practice agencies to gather data and collaboratively plan preventive strategies.

Knowledge and Understanding

Knowledge gaps in theory and policy appeared to be at the root of some of the errors that were made. This information helped to inform educators about some specific areas of learning. For example, students did not have a clear understanding of the differences in morphine preparations (i.e., instant release versus sustained release) and did not consistently follow college policy regarding insulin administration (i.e., checking physician's original order and double checking with an RN).

Conclusion

After a review of the literature and an analysis of the data, several actions were identified that could incorporate different teaching strategies and strengthen practice partnerships. The faculty is planning to incorporate problem-based learning strategies and high-fidelity simulation into the teaching of medication administration, which will place this task into its complex context. The findings of

the review were presented to students and faculty at identified points in the program during which a significant number of medication errors were made (e.g., prior to CPEs). The practice of purposefully incorporating medication safety knowledge throughout connected theory and practice courses will be continued. The possibility of using only the agency's incident form is being explored. The form would capture the same data and has been formatted to include the rights of medication administration and contributing factors. Its use would facilitate joint initiatives toward system improvement. These plans underscore the fact that the process of medication therapy involves a team of individuals working within a complex system and, therefore, a singular approach to one aspect of the process will not solve the problem.

This article highlights the interconnectedness of contributing factors, particularly as they relate to rights violation, systems, and knowledge and understanding. It seems appropriate to fit Robert's story into this context. Robert's nurse did not attend to the rights method, as the wrong dosage of morphine was administered (10 mg instead of 5 mg). The right dosage was easy to mistake because the MAR was formatted in such a way that the supplied dosage (10 mg/mL) was the first line of text, and the ordered dosage (5 mg) was the second line of text (system factor). The RN was very busy (workload) and unfamiliar with the unit and practice context (knowledge and understanding). The repercussions of this incident for the RN are unknown; however, if common procedure was followed, this nurse would have documented the error, informed the physician, and taken full responsibility. Individual accountability is appropriate, but if the action stops there, experiential learning is not shared to shape and change systems to create safer patient care environments (Benner et al., 2002).

References

Ackroyd-Stolarz, S., Hartnell, N., & MacKinnon, N.J. (2005). Approaches to improving the safety of the medication use system. *Healthcare Quarterly, 8,* (Spec. no.), 59-64. Retrieved February 28, 2006, from http://www.longwoods.com/product.php?productid=17664&cat=399&page=1

Baker, G.R., Norton, P.G., Flintoft, V., Blais, R., Brown, A., Cox, J., et al. (2004). The Canadian adverse events study: The incidence of adverse events among hospital patients in Canada. *Canadian Medical Association Journal*, *170,* 1678-1686.

Balas, M.C., Scott, L.D., & Rogers, A.E. (2006). Frequency and type of errors and near errors reported by critical care nurses. *Canadian Journal of Nursing Research, 38*(2), 24-41.

Benner, P., Sheets, V., Uris, P., Malloch, K., Schwed, K., & Jamison, D. (2002). Individual, practice, and system causes of errors in nursing: A taxonomy. *Journal of Nursing Administration, 32,* 509-523.

Buerhaus, P.I. (2001). Follow-up conversation with Lucian Leape on errors and adverse events in health care. *Nursing Outlook, 49,* 73-77.

Canadian Institute for Health Information. (2004). *Health care in Canada: Fifth annual report*. Ottawa, Ontario: Author.

Committee on the Quality of Health Care in America, Institute of Medicine (2000). *To err is human: Building a safer health system* (Kohn, L.T., Corrigan, J.M., & Donaldson, M.S., Eds.). Washington, DC: National Academies Press.

Hughes, R.G., & Ortiz, E. (2005). Medication errors: Why they happen, and how they can be prevented. *American Journal of Nursing, 105* (Suppl. 3), 14-23.

Konkloski, M., Wright, L.E., & Hammett, B.C. (2001). Mistakes, I've made a few: Student medication errors. *Nurse Educator, 26,* 166-167.

Leape, L.L., Bates, D.N., Cullen, D.J., Cooper, J., Demonaco, H.J., Gallivan, T. (1995). Systems analysis of adverse drug events. ADE Prevention Study Group. *Journal of the American Medical Association, 274,* 35-43.

MacKinnon, N.J. (2002). Early warning system: How vigilant pharmacists can prevent drug related morbidity in seniors. *Pharmacy Practice, 18*(8), 40-44.

Manno, M.S. (2006). Preventing adverse drug events. *Nursing* 2*006, 36*(3), 56-61.

Wolf, Z.R., Hicks, R., & Serembus, J.F. (2006). Characteristics of medication errors made by students during the administration phase: A descriptive study. *Journal of Professional Nursing, 22,* 39-51.