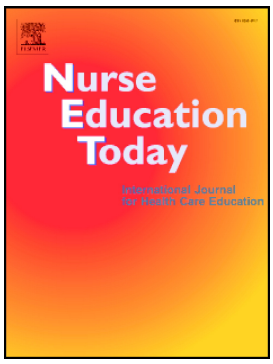

Nursing student perceptions of pharmacology education and safe medication administration: A qualitative research study

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NURSING STUDENT PERCEPTIONS OF PHARMACOLOGY EDUCATION AND SAFE MEDICATION ADMINISTRATION: A QUALITATIVE RESEARCH STUDY

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BACKGROUND

The current state of the science in nursing education suggests that new graduate nurses are lacking in adequate pharmacological knowledge (Dilles, Stichele, Bortel, & Elseviers, 2011; Manias & Bullock, 2002a; Manias & Bullock, 2002b; Sulosaari, Suhonen, & Leino-Kilpi, 2010). A lack of competence in pharmacology has been shown to lead to increased medication errors and inadequate patient teaching (Sears, Goldsworthy, & Goodman, 2010; Vaismoradi, Jordan, Turunen, & Bondas, 2014). In their white paper report "Preventing Medication Errors: Quality Chasm Series" (2006), the Institute of Medicine called upon healthcare providers to address the national crisis of medical errors caused by medications. More recently the Joint Commission in their 2014 National Patient Safety Goals, prioritized safe administration of medications as a major area for focus in improving health quality and safety. To date, there is no consistent recommendation for curriculum design for pharmacology in nursing education. Consequently, pharmacology content varies across nursing programs as schools struggle to prepare students for practice. Some schools integrate the content in nursing courses while others teach the content in a separate course. Nurses have identified feelings of poor educational preparedness in pharmacology knowledge, medication administration, and for patient medication teaching. These reports by nurses are not new and thus cannot be correlated with recent changes in the healthcare arena. Additional research of educational strategies to improve undergraduate knowledge of pharmacology is needed to improve the quality of clinical practice and to support the prevention of medication errors.

LITERATURE REVIEW

There is a lack of literature in the area of pharmacology preparation, curriculum design and nursing performance. A limited number of published accounts support the assumption that

nurse educators and RNs feel pharmacology education inadequately prepares students for clinical practice. Smith and Crawford (2003) found that 19 percent of BSN and 30.9 percent of ADN students felt poorly prepared by their education to administer medications to 10 or more patients. In a similar study performed 5 years later, Candela and Bowles (2008) examined the perceptions of recent nursing graduates and their reported feeling of preparedness for the workplace. In this study, 51 percent of the 352 RN graduates surveyed reported they did not feel adequately prepared in pharmacology (Candela & Bowles).

Similar to these American studies, research in Australia has found both great variation in the delivery of pharmacology content and nursing graduates expressed dissatisfaction with pharmacological preparation (Bullock & Manias, 2002). Bullock and Manias surveyed Australian nursing instructors to evaluate their perceptions of pharmacology education for undergraduate nursing students. Questionnaires were distributed to 13 universities but only 34% were returned. Data measured and compared the varying contact hours of pharmacology between institutions, placement in the curriculum, teaching methods, and whether it was taught by nursing or biosciences faculty, revealing great variation in the delivery of pharmacology content for nursing students. Additionally, 57% of instructors responded that there should be an increase in the number of pharmacology teaching hours, demonstrating the desire for more hours of pharmacology education to improve students' understanding of content.

In addition to studies revealing current dissatisfaction with nursing pharmacology education, a few published studies present strategies for improvement. In India, Devi, Mayya, Bairy, George and Mohan (2013) concluded that pharmacology teaching in the clinical area was preferred over monotonous lectures that lacked active learning. Devi et al. performed a quasi-experimental study with 167 second-year BSN students to compare live demonstration teaching

and a recorded video form of teaching pharmacology, both accompanying a lecture. The experimental group who received the video demonstration had statistically significant higher scores on all competencies (oral medication administration, nebulization, metered dose inhaler, peak flow meter) and patient understanding of medications. Kaylor (2013) recommended cognitive load theory as a successful and effective framework for teaching undergraduate pharmacology. Lastly, in a retrospective nonexperimental descriptive exploratory study by Zellner, Boerst, and Semling (2003) two methods of teaching pharmacology to nursing students were compared: teaching pharmacology integrated into the curriculum during junior and senior year versus teaching a separate three-credit pharmacology course during sophomore year. Effects of the teaching methods were then measured. Students with pharmacology integrated into the curriculum scored higher than students who took a separate pharmacology course.

OBJECTIVES

The purpose of this study was to describe student perceptions of the relationship between pharmacology education and safe clinical practice. This qualitative analysis was conducted as part of a larger study at a college in the Northeast. The larger study included an examination of curricular changes and learning outcomes in pharmacology education for traditional and non-traditional RN-BSN students. As part of this survey work students were queried on their perceptions and the impact of pharmacology in education and on safe medication administration. Both groups of students had received pharmacology education prior to receiving the survey. The traditional BSN students received pharmacology education in the form of pathopharmacology. Pathopharmacology is required for traditional nursing students offered second semester sophomore and first semester junior year and focuses on the pathophysiology of disease and its

relationship to pharmacological interventions. RN-BSN students received a traditional pharmacology course in a 8 week hybrid online-inperson format. The RN-BSN students are required to be on campus for the first and last class with the remaining course work online.

DESIGN

As stated previously, this study was an analysis of qualitative data collected as part of a larger survey pertaining to pharmacology education. Human subjects approval was received from the Institutional Review Board at a college in the Northeast prior to beginning this study. Data were collected from students currently enrolled in the traditional baccalaureate and nontraditional RN-BSN hybrid program. Recruitment and data collection were conducted by the first two authors. The authors were at the time both course faculty in the BCN nursing program and the first author also taught in the RN-BSN program. At the beginning of the traditional BSN pharmacology course, students were informed of the study, asked for voluntary participation, and signed consent. As the authors were serving as course faculty for the traditional BSN pharmacology course, extra efforts were made to ensure students that participation was voluntary, anonomyous, and unrelated to their performance in the course. The researchers explained the study to RN-BSN students while on campus for the inperson portion of 4 seperate non-pharmacology classes, asked for voluntary participation, and signed consent. All students completed an anonymous brief paper survey instrument consisting of 10 items, which included both quantitative and open-ended questions. As part of this survey, participants were asked the following question: “Do you feel the information learned in pharmacology has prepared you to safely administer medications? Why or why not?”

PARTICIPANTS

The convenience sample consisted of 28 RN-BSN students and 71 traditional BSN students. The research was conducted at a college in the New England region of the United States. All surveys were completed on paper documents, on campus, and in classroom settings The RN-BSN students' age ranged from 23 to 60 (μ=37.55). Traditional BNS students' age ranged from 20 to 21 (μ= 20.33). The majority of both groups were female, 87.9% of RN-BSN and 97.3% of traditional BSN students. Practice data was collected for the RN-BSN students, with participants reporting years in clinical practice ranging from 1 to 29 (μ= 7.36).

METHODS

The data were analyzed using conventional content analysis (Hsieh & Shannon, 2005). This method of analysis is an appropriate choice for qualitative research when a research area, such as nursing pharmacology education, lacks extensive literature or substantive theories (Hsieh & Shannon). The three authors analyzed data compiled from survey responses. The analysis was conducted in several inductive phases. Initially, data were analyzed in two groupings RN-BSN and traditional BSN students. Each author independently reviewed participant responses word-by-word and line-by-line. Codes were identified to capture key ideas related to our primary research question: "How do traditional baccalaureate and RN-BSN students perceive the relationship between pharmacology education and safe medication administration?" Group meetings were conducted to reach consensus on coding decisions. The next phase of analysis involved analysis across groups for similarity in responses. Initial codes were reduced and collapsed within emerging organizing thematic categories. The final product of analysis resulted in 4 themes and 9 subthemes.

RESULTS

Students described the impact of pharmacology education as either having a positive or negative effect on safe medication administration. The majority of students in both groups (87%) described a positive effect. Positive responses were characterized into the following themes: *Knowing how medications work*, *Improving the nursing process*, and *Building a foundation of clinical knowledge*. Negative responses were more heavily endorsed by RN-BSN students representing nearly 40% of the RN-BSN responses. The negative responses were substantiated by one theme: *Inability to transfer from didactic to clinical practice.* All of the themes were further supported by subthemes and several participants' responses included examples that crossed themes. The 4 themes and 9 subthemes are described below with illustrative quotes from participants.

Knowing How Medications Work. Students described how knowledge gained from pharmacology helped them to understand both why they were administering medications and when it was safe to do so in the clinical setting. Students described specific knowledge such as "drug action" (participant 12, BSN student), "expected outcomes" (participant 44, BSN student), "side effects" (participant 123, RN-BSN student), drug "interactions" (participant 102, RN-BSN student), and "contraindications" (participant 8, BSN student) for administration. This understanding of how the medications work was described as applicable in clinical practice was perceived as improving safety in medication administration.

Knowing the therapeutic effect. "I am more confident in how the med works as well as expected outcomes" (participant 44, BSN student). Students described an increased understanding of the therapeutic effect or action of the drug gained through pharmacology education leading to increased safety in medication administration in clinical practice. As stated by one student the knowledge gained in pharmacology, "helped me to know why it was being

given and what to look for. Helped to understand [the] action of [the] drug" (participant 9, BSN student). Students described applying knowledge of drug action or "how the med works" readily to clinical settings to administer medications safely. "It has helped me to understand drug actions, interactions, patient teaching, and what to monitor" (participant 12, BSN student).

Knowing when to safely administer. In addition to understanding the therapeutic use of medications, students described information pertaining to "contraindications" (participant 8, BSN student) for administration as important to safe medication administration. Traditional baccalaureate students exclusively endorsed this subtheme. Participant 19 (BSN student) , "The information learned in pharmacology allowed us to catch contraindications... we also have knowledge about when it is a safe time to administer the meds." Students thus describe that both knowing when to administer medications and when not to administer due to clinical contraindications is important for guiding safe clinical practice. RN-BSN students identified pharmacology as providing an introducation to safe medication administration that is enhanced with clinical experience. "It was an introduction of the info…experience with my career has made it more safe" (participant 122, RN-BSN student).

Improving the Nursing Process. Students explained an improvement in integrating pharmacology education into the nursing process, especially assessment and patient education. The nursing process is a widely utilized organizing framework for describing and organizing nursing care. Steps in the nursing process include assessment, diagnosis, planning, implementation and evaluation. As undergraduate students learning to provide patient care and practicing nurses applying pharmacology education to clinical practice, the nursing process served for participants as a framework for clinical application.

Assessment with pharmacology. "The information I have learned in this class taught me how to administer meds, major concerns and how I should change my care based on their treatment" (participant 4, BSN student). Participants described application of knowledge from pharmacology to the first step of the nursing process: assessment. Students described pharmacology knowledge as guiding assessment of the effects of medication administration, including for example: "side effects" (participant 8, BSN student) and "allergies" (participant 123, RN-BSN student). As participant 10 (BSN student) stated, "I have a better general understanding of the drugs and what to look for after, while, or before administering them."

Patient teaching. Patient teaching represents a smaller subtheme expressed only by traditional baccalaureate students. These students specifically describe information obtained in pharmacology as applicable to patient teaching, an important contributor to safe medication administration. Students such as participant 13 (BSN student) described specific class content pertaining to teaching as applicable to patient care, "the patient teaching sections were extremely helpful." Additionally, participant 61 (BSN student) states, "I had a background of what I was giving so I could give adequate patient education."

Building a Foundation of Clinical Knowledge. The most widely endorsed theme for both traditional baccalaureate and RN-BSN students was *Building a Foundation of Clinical Knowledge*. Students expressed that pharmacological knowledge contributed to enhanced clinical knowledge through improved confidence, knowledge of how to use resources, and a basic understanding of content. Students related this knowledge to safe medication administration in that it created a foundation for building additional clinical skills. This starting point was fundamental both for students entering clinical for the first time and also for practicing nurses looking to continue to build clinically relevant knowledge.

Improved clinical confidence. "It's a great feeling to actually be in clinical and start to know what you are talking about when describing a med to a pt." (participant 35, BSN student). Several students described pharmacology education directly contributing to increased confidence with medication administration in clinical settings. As stated by participant 21 (BSN student), "I feel more confident with meds and med administration than I would have if I hadn't taken such an in-depth course like this." Other students described this confidence as being more comfortable with the knowledge needed and role of clinical nurses in medication administration. "I still like to look up a med before I give it but this class makes me feel more comfortable with it" (participant 20, BSN student).

Building a basic understanding. The most frequently described subtheme was building a basic understanding. "Becoming familiar with medications/classifications of medications and the way they operate was beneficial certainly at the beginning" (participant 122, RN-BSN student). While many students describe the information presented in pharmacology courses as vast, they related in their responses the ability to apply this knowledge in everyday clinical practice. Students translated this basic understanding as providing "a background of what I was giving so I could give adequate patient education" (participant 61, BSN student). "Information about the meds and their mechanism of actions helps spark an idea of any possible interactions to check" (participant 104, RN-BSN student).

Knowing how to use resources. In addition to confidence and basic understanding, students described their pharmacology courses as creating a blueprint for utilizing pharmacology resources. As stated by one student, "The course gave me the tools for when I encounter a med I am unfamiliar with" (participant 112, RN-BSN student). Students following completing of a pharmacology course were more readily able to identify gaps in their clinical knowledge. This

assisted them in knowing when to utilize additional resources to assist in safe medication administration. "…..I know I will never remember it all, which we do not need for real life b/c we have resources" (participant 2, BSN student).

Inability to Transfer Didactic to Clinical Practice. The first three themes describe student perceptions of how pharmacology courses can positively impact safe medication administration. The fourth and final theme includes student perceptions of pharmacology education as lacking utility in clinical practice. Students described difficulty applying content learned in pharmacology to their experience in the clinical setting because of too much information covered resulting in a lack of confidence in knowledge, irrelevant knowledge, and still needing to look up drugs prior to administration. "I didn't relate to about 85% of the meds discussed" (participant 116, RN-BSN student).

Too much information for one course. Student responses included criticism of the volume of information included within pharmacology courses. "…so much information presented in a short period of time" (participant 115, RN-BSN student), "…a lot of hard content that I wish was slowed down" (participant 18 BSN student), and " ..far too much information in a short period of time. I wouldn't feel comfortable with administering the meds without first looking them up again" (participant 116, RN-BSN student). The depth of material was often overwhelming for students who perceived much of pharmacology content as not directly applicable to safe medication administration.

Information needed obtained elsewhere. Students who found a pharmacology course not relevant to safe medication administration described other important sources of information. As described by participant 46 (BSN student),"I don't use the content of the class specifically when administering meds." Other students described the knowledge they learned in clinical settings as

more relevant to safe medication administration; "our professors in clinical teach us important things about the drugs" (participant 67, BSN student). For these students there was a perception that practical knowledge needed for safe medication practice was better gained in other nursing courses or in the clinical setting. "…you learn a lot more on the job" (participant 117, RN-BSN student).

IMPLICATIONS

This study has explored students' perceptions and the impact of pharmacology in education and on safe medication administration. What these findings offer to educators is a student perspective on the relationship of didactic teaching of pharmacology content and medication administration in clinical practice. The findings present a mixed perspective, with students emphasizing both the usefulness and limitations of pharmacology knowledge gained within a classroom setting and its application in the clinical world.

Most of the students in this study describe pharmacology education as having positively impacted their ability to safely administer medication. Improved safety was attributed to what have been identified in the analysis as positive responses. Students discussed knowing medications mechanism of action, assessment of adverse effects, and possible drug interactions as contributing to increased clinical proficiency and safety with medication adminstration. Interestingly, this positive response was more heavily endorsed by traditional baccalaureate students while the RN-BSN students more heavily endorsed the negative findings, , or those findings that do not confirm the connection between pharmacology and medication administration safety. These findings may suggest the perception of usefulness of pharmacology education and the application of knowledge from pharmacology courses are influenced by

student background and/or clinical experience. In this study, only students from a traditional baccalaureate program and a hybrid RN-BSN program were included in the sample. Primary differences between these groups, seen in the demographic descriptions are age with the traditional students being younger and the clinical experience of the RN-BSN students. RN-BSN students are all practicing registered nurses, providing a perspective on pharmacology education that includes current clinical practice. The significance and factors responsible for this difference cannot be concluded from this current study, study findings warrant further exploration.

The positive themes, present a picture of how students are applying pharmacology content to medication administration. Student perception of how pharmacology content is most readily applied to medication administration can be useful for educators in course design. Framing pharmacology content from a clinical lens with discussion of why medications are given, when it is safe or unsafe to give the medication, and how to utilize pharmacology content in the nursing process, could help students to receive classroom knowledge in a way that is readily applied to clinical areas and supported through clinical instruction. Assessment is an essential component of the nursing process particularly when monitoring the effectiveness of pharmacological treatment, medication adverse effects, and making decisions about administration of prn (as needed) medications. Pharmacological knowledge is integral as managing multiple medications is a large portion of the daily tasks in the role of the RN in the current health climate. The theme, *Building a foundation of clinical knowledge*, supports the beginning nature of the application of pharmacology education to the clinical role. Clinical educators have the opportunity to build upon the knowledge gained in the classroom setting through clinical experiences administering medications and assessing outcomes. Clinical educators that place emphasis on what knowledge students have gained from the classroom may

further increase the development of clinical reasoning and confidence in medication administration and management.

The negative theme, *Inability to transfer didactic to clinical practice*, further describes the importance of building a relationship between classroom and clinical instruction. One critique of pharmacology in the findings is that the depth of content is too much for one course. Student perception of the difficulty of a specific course or the depth of content of that course cannot be generalized. Despite this, nursing educators are universally presented with the challenge of adequately covering vast content areas such as pharmacology without overloading individual courses. Nurse educators, in both traditional and nontraditional programs, should consider threading pharmacology throughout the curriculum to make the material more manageable and applicable to course content. Clinical educators can help bridge this gap by requiring students to critically think and apply classroom content while preparing and administering medications. Case studies and simulation exercises can also assist in the transfer of didactic to clinical practice. The other negative subtheme, *Information needed obtained elsewhere*, presents educators with a much different challenge. This subtheme presents the student perception that the information needed to safely administer medications is not obtained in a pharmacology course. Students point to other important resources such as clinical educators and work experience, as more important and relevant to safe medication administration. Other resources identified include the use of medication reference sources prior to medication administration in clinical settings. Some students discuss the perception, that the use of medication reference sources in clinical negates the need for a formal pharmacology course. Future studies are needed to understand the specifics of clinical instruction for medication administration and the relationship with classroom content.

Findings for this study are both consistent with and contradictory to current published literature. Negative findings support studies that have found pharmacology education, particularly when delivered in traditional didactic form, lead to inadequate preparation for clinical practice (Bullock & Manias, 2002; Candela & Boules, 2008; Smith & Crawford, 2003). This study contributes to the literature by providing a beginning understanding of why this disconnect between pharmacology education and clinical performance occurs. Students suggest dense pharmacology material presented in a single course, makes it difficult to translate material into practice. To address this criticism, studies support alternative teaching methods to address including dispersion of pharmacology content into clinical education (Devi et al., 2013) and spreading pharmacologic content across the curriculum (Zellner et al., 2003). While negative findings are supportive of the current limited literature in this area, respondents to this study predominantly endorsed a positive relationship between pharmacology education and safe clinical practice.

While the focus of this article has been on pharmacology education, a broader perspective of the difficulty of bioscience education in undergraduate nursing can offer both additional insight and solutions for the negative findings. The teaching of biosciences, including pharmacology, physiology, anatomy, and pathology, while integral to nursing education present similar challenges with limited studies attempted to test innovative curricular solutions. One approach addressing the issue of a lack of application of biosciences to clinical practice involved integrating bioscience and nursing content, both in lecture (Christensen, Craft, Wirihana, & Gordon, 2015) and active learning workshop formats (Craft, Christensen, Bakon, & Wirihana, 2017). These studies explore an integrated approach to teaching bioscience content concurrent to nursing content following completion of separate bioscience courses (Christenson et al., 2015;

Craft et al., 2017). This integrated approach presented students with bioscience content concurrent with nursing content directly relating and reemphasizng the bioscience information with nursing clinical issues and applications (Christensen et al., 2015; Craft et al., 2017). Students when presented with related bioscience and nursing content concurrently in lecture format report greater ability to relate the infromation to clinical practice (Christensen et al, 2015). Further, integration with a small, interactive, workshop environment contributed to students feeling more engaged with the content, able to understand rather than memorize the bioscience content, in addition to applying it to clinical practice (Craft et al., 2017). This integrated approach presents one alterative solution to this curricular issue. It also presents one possible response to the negative findings presented in this study, which question the relevance of pharmacology to clinical nursing practice. By teaching pharmacology as integrated with nursing content the connection for students may become more readily applicable and thus translatable to clinical practice.

Interpretations of the findings of this study are limited both to the method of data collection and also the study design. The findings of this study were derived from qualitative analysis of one open-response item in an anonymous survey which limited the authors in their ability to further expand upon participant responses. Future studies to both address these limitations and expand upon this beginning knowledge include longitudinal analysis of alternate formats of pharmacology preparation in education and the impact on student perceptions and resulting clinical performance at all levels. Comparative analysis of pharmacology education in varied educational programs including licensed practical nursing programs, associate degree program, traditional baccalaureate, and RN-BSN, is needed to further understand the best ways to provide pharmacology education to different student groups. Lastly, additional studies

exploring the relationship of pharmacology education in clinical and classroom instruction are needed.

CONCLUSION

Expanded analysis of pharmacology education in nursing curricula is essential to enhance knowledge of the preparation needed to increase student success in clinical practice. Consensus is necessary to determine the most effective method to prepare nurses to correctly administer medications decreasing the risk of errors. Student perceptions of the relevance of pharmacology instruction in classroom settings to clinical experiences offer educators some insight that is needed to inform curriculum design.

References

Bullock, S. & Manias, E. (2002). The educational preparation of undergraduate nursing students in pharmacology: a survey of lecturers' perceptions and experiences. *Journal of Advanced Nursing, 40*, 7–16. doi:10.1046/j.1365-2648.2002.02335.x

Candela, L & Bowles, C. (2008). Recent RN graduate perceptions of educational preparation. *Nursing Education Perspectives, 29*(5), 266-271.

Christensen, M., Craft, J. A., Wirihana, L., & Gordon, C. J. (2015). Pathophysiology team teaching: Bioscientist contribution to knowledge integration in a nursing subject. *Journal of Clinical Nursing, 24*(23-24), 3739-3741. doi:10.1111/jocn.12959

Craft, J., Christensen, Bakon, S., & Wirihana, L. (2017). Advancing student nurse knowledge of the biomedical sciences: A mixed methods study. Nurse Education Today, 48, 114-119.

Devi, E. S., Mayya, S. S., Bairy, K. L., George, A., & Mohan, M. K. (2013). Comparative analysis of the outcome of two teaching-learning approaches adopted for teaching pharmacology. *International Journal of Nursing Education, 5*(2), 66-69.

Dilles, T., Stichele, R. R., Bortel, L. V., & Elseviers, M. M. (2011). Nursing students' pharmacological knowledge and calculation skills: Ready for practice? *Nurse Education Today, 31*(5), 499-505. doi: 10.1016/j.nedt.2010.08.009

Hsieh, H., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*, 1277-1288. doi: 10.1177/1049732305276687

Institute of Medicine. (2006). Preventing Medication Errors: Quality Chasm Series.

The Joint Commission. (2014). Hospital: 2014 National Patient Safety Goals.

Kaylor, S. K. (2014). Preventing information overload: Cognitive load theory as an instructional framework for teaching pharmacology. *Journal Of Nursing Education, 53*(2), 108-111. doi:10.3928/01484834-20140122-03

Manias, E., & Bullock, S. (2002a). The educational preparation of undergraduate nursing students in pharmacology: perceptions and experiences of lecturers and students. *International Journal of Nursing Studies, 39*(7), 757-769. doi:10.1016/s0020-7489(02)00018-4

Manias, E., & Bullock, S. (2002b). The educational preparation of undergraduate nursing students in pharmacology: clinical nurses' perceptions and experiences of graduate nurses' medication knowledge. *International Journal of Nursing Studies, 39*(8), 773-84. doi:10.1016/S0020-7489(02)00008-1

Sears, K., Goldsworthy, S., & Goodman, W. M. (2010). The relationship between simulation in nursing education and medication safety. *Journal of Nursing Education, 49*(1), 52-55. doi: 10.3928/01484834-20090918-12

Smith, J., & Crawford, L. (2003). The link between perceived adequacy of preparation to practice, nursing error, and perceived difficulty of entry-level practice. *JONA'S healthcare law, ethics and regulation, 5*(4), 100-103.

Smith, J., & Crawford, L. (2003). Medication errors and difficulty in first patient assignments of newly licensed nurses. *JONA'S healthcare law, ethics and regulation, 5*(3), 65-67.

Sulosaari, V., Suhonen, R. and Leino-Kilpi, H. (2011). An integrative review of the literature on registered nurses' medication competence. *Journal of Clinical Nursing, 20*, 464–478. doi:10.1111/j.1365-2702.2010.03228.x

Vaismoradi, M., Jordan, S., Turunen, H., & Bondas, T. (2014). Nursing students' perspectives of the cause of medication errors. *Nurse Education Today*, *34*(3), 434-440. doi: 10.1016/j.nedt.2013.04.015

Zellner, K., Boerst, C., & Semling, K. (2003). Teaching separate versus integrated pharmacology content. *Western Journal of Nursing Research, 25*(3), 338-348. doi: 10.1177/0193945902250422

Table 1. Major Findings Classified by Impact of Pharmacology Education on Safe Practice (N= 99; Traditional baccalaureate (TB) = 71, RN-BSN (RB) = 28)

Themes/Subthemes	Number of Responses
A. Knowing How Medications Work	23 (TB = 20; RB = 3)
1. Knowing the Therapeutic Effect	13 (TB = 10; RB = 3)
2. Knowing when to Safely Administer	10 (TB = 10; RB = 0)
B. Improving the Nursing Process	21 (TB = 20; RB = 1)
1. Assessment with Pharmacology	15 (TB = 14; RB = 1)
2. Patient Teaching	6 (TB = 6; RB = 0)
C. Building a Foundation of Clinical Knowledge	43 (TB = 27; RB = 16)
1. Improved Clinical Confidence	8 (TB = 7; RB = 1)
2. Building a Basic Understanding	31 (TB = 19; RB = 12)
3. Knowing How to Use Resources	4 (TB = 1; RB = 3)
D. Inability to Transfer Didactic to Clinical Practice	20 (TB = 9; RB = 11)
1. Too Much Information for One Class	9 (TB = 4; RB = 5)
2. Information Needed Obtained Elsewhere	11 (TB = 5; RB = 6)

Note: The counts provided do not sum to the total sample size because many participants' responses were classified into multiple themes/subthemes.