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Promoting Safe Medication Administration Using Simulation

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Background: Medical errors continue to soar in the United States (U.S.) and are now estimated to be the third leading cause of death (Makary, 2016). Medication administration is a key nursing responsibility directly affecting the quality and safety of patient care. However, there is evidence that students and newly graduated registered nurses have deficiencies in safe medication administration (Sulosaari, Kajander, Hupli, Huupponen, & Leino-Kilpi, 2011; Wolf, Hicks, & Serembus, 2006) related to error identification (Henneman et al., 2010; Whitehair, Provost, & Hurley, 2014), verifying essential steps of safe medication administration (Elliott & Liu, 2010; Schneidereith, 2014), patient identification (Wolf et al., 2006), and medication calculation for correct dose administration (Wolf et al., 2006; Zahara-Such, 2013). Furthermore, nursing students lack adequate clinical judgment, including problem recognition and reporting of essential clinical data (Sherwood & Barnsteiner, 2012), to safely administer medications.

Simulation is an evidence-based pedagogy that facilitates the learning of important aspects of safety and quality patient care (Henneman et al., 2010; Jeffries et al., 2004; Sears, Goldsworthy & Goodman, 2010). In 2016 Zimmerman and House recommended that simulation be used as a strategy to decrease medication errors.

Purpose: The purposes of this two-group pre-test/post-test study were to: 1) pilot test a new medication safety enhanced (MSE) simulation-based learning experience (SBLE); 2) investigate the effect of an MSE program of simulation on nursing students' knowledge of medication safety; 3) investigate the effect of an MSE program of simulation on nursing students' ability to safely administer medications; 4) investigate the effect of an MSE program of simulation on nursing students' perceptions and comfort level about patient safety; and 5) provide further psychometrics for the Medication Safety Knowledge Assessment (MSKA), Medication Safety Critical Element Competency Checklist (MSCEC), and Healthcare Professionals Patient Safety Assessment (HPPSA) tools.

Research Questions: The research questions guiding this study were: 1) What is the effect of an MSE program of simulation on nursing students' knowledge of medication safety; 2) What is the effect of an MSE program of simulation on nursing students' competency in administering medications safely; and 3) What is the effect of an MSE program of simulation on nursing students' perceptions and comfort regarding safe administration of medications?

Methods: Following institutional review board (IRB) approval, a convenience sample of junior level medical-surgical baccalaureate nursing students (n = 86) at a mid-sized, mid-Atlantic, private Catholic university was recruited to participate in the study. Students were randomly assigned to 12 clinical groups at the beginning of the semester and participated in all SBLEs in their clinical group. Clinical groups, each composed of six to eight students, were randomly assigned to the intervention or control group.

There were three SBLEs included in the medical-surgical course. The first SBLE was a medication skills lab for both the intervention and control groups; the second SBLE was a two-patient medication administration SBLE for the intervention group only; and the third SBLE was a gastrointestinal (GI) or a post-operative (post-op) hip replacement SBLE for both groups. The first and third SBLEs were previously validated by experts and have been used for several years at the study school. The second SBLE was newly developed for this study. The control group participated in only the first and third existing SBLEs

with no modifications or enhancements. The intervention group participated in all three SBLEs with medication safety enhanced (MSE) debriefings in the first and third SBLE, and also participated in the newly developed second SBLE administering medications to two standardized patients.

Two new researcher-developed instruments were developed for use in this study: the Medication Safety Knowledge Assessment (MSKA), a 25-item multiple-choice knowledge assessment, and the Medication Safety Critical Element Checklist (MSCEC), an 11-item critical element checklist. The content of the instruments were validated by experts and the instruments underwent pilot testing for psychometrics prior to being used in this study. The MSKA had a content validity index (CVI) of 0.94. A pass/fail cut score ($< 21 = \text{fail}; \geq 21 = \text{pass}$) for the MSKA was determined using the modified Angoff method. The MSCEC had a CVI of 0.92. Inter-rater reliability (IRR) for the MSCEC was > 0.9 . Cronbach's alpha reliabilities for the MSCEC were 0.69 to 0.72, indicating acceptable reliability for a newly developed instrument.

Subjects were pre-tested for medication administration safety knowledge using the MSKA, and comfort and perceptions about patient safety using the HPPSA prior to participating in the SBLEs, and post-tested for medication administration safety knowledge, and comfort and perceptions about patient safety after completion of the last SBLE. Participants were also tested on competence in the skill of safe medication administration using the MSCEC after completion of the last SBLE.

Results: The Medication Safety Knowledge Assessment (MSKA) was analyzed based on a Knowledge Pass/Fail cut score ($< 21 = \text{fail}; \geq 21 = \text{pass}$). Crosstabs and Chi-Square analyses were computed. For the pre-test, there was no statistically significant difference between intervention and control groups demonstrating that the groups were homogenous prior to the intervention. For the post-test, a statistically significant difference was found between the intervention and control groups ($X^2 = 5.13, df = 1, p = .02$) with the intervention group having higher post-test pass rate (57%) than the control group (28%).

The pre-posttest scores on the Health Professional Patient Safety Assessment (HPPSA) were analyzed using independent and paired *t*-tests. For both the intervention and control group there were no statistically significant differences in pre-posttest scores on Part 1 and Part 3. However, both groups had significantly higher Part 2 post-test scores (intervention group $t = 3.96, p = .001$ and control group $t = 3.11, p = .004$).

For the Medication Safety Critical Element (MSCEC) assessment, between group scores were compared using an independent *t*-test. The intervention group scored significantly higher than the control group ($t = 2.28; p = .028$).

Discussion: The nursing literature is limited in discussion of both the psychomotor skill acquisition of administering medications (Ross, 2012) and the knowledge and competency regarding safe medication practices. The findings of this study support that SBLE interventions can contribute to student learning and performance related to medication administration and patient safety. These findings are consistent with existing literature identifying that simulation can enhance safe medication practices of student nurses (Pauly-O'Neill, 2009; Radhakrishnan et al., 2007; Sears et al., 2010; Zahara-Such, 2013).

While the results of this research are promising, replication of this study with different samples would improve the generalizability and provide additional psychometrics for the newly developed instruments. Moreover, a longitudinal study design would help to identify if students retain the knowledge and competence. Future research that studies the transfer of safe medication administration knowledge and skill from SBLEs to the patient care setting is recommended to address a gap in the literature and an identified priority in nursing education research (Mariani & Doolen, 2016; NLN, 2016).

Title:

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References:

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Abstract Summary:

This presentation will describe a two-group, pre-test/post-test study, and the associated instrument development and psychometric testing, to assess the use of medication safety enhanced simulation based learning experiences on baccalaureate nursing students' knowledge and competence related to safe medication administration.

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3. Methods

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 - i. National League for Nursing (NLN) Jeffries Simulation Theory
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- c. Research Questions
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 - 1. Medication Safety Knowledge Assessment (MSKA)
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 - 2. Medication Safety Critical Element Checklist (MSCEC)
 - a. Development and Pilot Testing
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- f. Data Analysis
 - i. Medication Safety Knowledge Assessment (MSKA)
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 - 1. Independent and Paired t-tests
- 4. Results
- 5. Discussion
 - a. Limitations
 - b. Implications for Nursing Education
 - c. Recommendations for Future Research

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Professional Experience: Dr. Ross has been an Assistant Professor of Nursing at Villanova University since 2014. Prior to that, she was an Adjunct Clinical Instructor for 8 years at Villanova University College of Nursing. Dr. Ross teaches in the classroom, lab, and clinical settings with freshman, sophomore, and junior undergraduate nursing students.

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Author Summary: Dr. Mariani is an associate professor of nursing at Villanova University. Her research and scholarship focuses on simulation development and outcomes, research instrument development/psychometrics, and debriefing. She has published and presented nationally and internationally on debriefing, simulation for patient safety, leadership development, instrument development/psychometrics, simulation with SPs with disability, and the outcomes of simulation on student learning.

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Author Summary: Susan Paparella, MSN, RN is Vice President at the Institute for Safe Medication Practices, (ISMP) in Horsham, Pennsylvania. After 20 years as a nurse leader in acute care settings, Susan joined ISMP, and for the last 16 years has overseen their consulting and collaborative services, bringing extensive knowledge and practical experience to patient safety issues. Susan is adjunct faculty for the Temple University School of Pharmacy and is a member of Sigma Theta Tau International.