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An Assessment of Errors and Near-Misses from Pre-Licensure Student Nurses

Presented to the Faculty of the School of Nursing

The George Washington University

In partial fulfillment of the
requirements for the degree of
Doctor of Nursing Practice

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Abstract

Background: Approximately one-half of new nurses with less than one year of experience who were involved in adverse patient events identified that their formal education preparation was a causal factor in their error (Saintsing, Gibson & Pennington, 2011). An examination of quality and safety measures of a current hospital based associate degree nursing (ADN) educational program provided data regarding errors committed by prelicensure students. Tracking and analysis of frequency and type of student clinical errors provided for identification of similarities and an opportunity for system evaluation and improvements.

Objectives: To identify the number, types and categories of Student Opportunity for Improvement (SOFI) reports generated by a hospital based ADN program over a four-year period from July 30th 2012 through July 30th 2016 and to compare the reports by academic term, the student's previous healthcare experience, and student age.

Methods: A twenty-four month retrospective comparative design was utilized, in a private, non-profit 2-year ADN program in the northeastern region of the United States with an enrollment of approximately 300 students. The target population was all enrolled prelicensure nursing students between the ages of 18 and 60 who have had a SOFI report filed. A convenience sample was utilized. Students who were dismissed from the program due to either academic or clinical failures but who have had at least one SOFI filed were included in the study population. The number and types of SOFI reports generated with the previously discussed demographic variables were measured.

Results: A total of 266 SOFI forms were examined. One-hundred five SOFI reports were associated with the first two semesters of the program while 161 SOFI reports were associated with semesters 3 and 4. Students that had prior healthcare experience completed 25% of the SOFI forms, and 64.3% of the SOFI forms were associated with students 30 years of age or older. Fifty-one SOFI reports were constructed after an Evening/Weekend curricular change as compared to 30 SOFI reports prior to the change. All differences were statistically significant at an alpha level of 0.05.

Conclusions: The challenge associated with nursing education is building an educational foundation and the promotion of an appropriate culture wherein students can learn from their mistakes and near-misses while the errors/near-misses are caught before they reach the patient. A broader and increased knowledge base regarding the clinical errors and near-misses that are conducted by pre-licensure RN students can only assist faculty with regard to the more thorough preparation of these future providers.

Background

There is a growing focus within healthcare organizations regarding the necessity of a promotion of a culture of safety; indeed, the Institute of Medicine decreed that an increase in the safety of healthcare was the first of six domains listed as an aim for the U.S. Healthcare System (Agency for Healthcare Research and Quality, n.d). As today's healthcare professionals, and especially nurses, progress towards a culture of safety, so too must their training. The incorporation of safety and quality competencies in nursing education is critical and has been identified in recent publications (Howard, 2010). In the United States, various state boards of nursing set the academic standards for nursing education programs that are designed to "foster the safe and effective practice of nurse", the standardized measurement of this "safe and effective practice" is the National Council of States Boards of Nursing (NCSBN) NCLEX-RN licensure examination after graduation.

However, the concern arises that there is little to no standardized measurement or assessment practice that measures safe and effective practice at various points in the time frame that precedes graduation (Docherty & Dieckmann, 2015). As there is little consensus and often contention in the determination of what precise behaviors and attitudes constitute a passing nursing student clinical grade, and as there is often further pressure amongst academic administrations and schools of nursing to demonstrate a significant student success percentage, these variables may in fact promote an academic climate of failing to fail. Students being rated as successful in a clinical setting that actually employ behaviors that do not promote a culture of safety have serious, immediate and long-lasting consequences that will affect public health, safety, and welfare (NCSBN, 2011).

Nursing educators are challenged to provide theory content and clinical experiences that ensure nursing students gain the knowledge and experience necessary to practice in a safe manner. There is evidence that some clinical instructors have difficulty with the identification and/or management of students who display incompetent and/or unsatisfactory clinical performance (Larocque & Luhanga, 2013).

To assist with the identification of students and clinical errors and near misses, a Student Opportunity for Improvement (SOFI) form is completed by our clinical faculty for each error or near miss at our hospital based Associate Degree Nursing (ADN) Program research site. SOFI reporting forms are considered part of the institution's clinical paperwork and all of the faculty at this hospital-based ADN program have been trained regarding the criterion standards for the completion of the SOFI.

The purpose of the SOFI is to assist the student in the identification of the event, potential patient consequences, and actions that might have prevented the event(s) in question. Secondary purposes of the SOFI are to assist in the identification of student(s) requiring remediation as well as to assist in the identification and tracking of trends. This identification and measurement intervention process is essential to the provision of optimal, safe care.

Problem Statement

Approximately one-half of new nurses with less than one year of experience who were involved in adverse patient events identified that their formal education preparation was a causal factor in their error (Saintsing, Gibson & Pennington, 2011). An examination of quality and safety measures of a current hospital-based ADN educational program provided data regarding the errors committed by prelicensure students and potential areas for curriculum changes. Examination of our completed SOFIs allowed categorization of errors into groupings such as

medication rights aberration and incomplete clinical preparation. Tracking and analysis of frequency and type of student medication errors provided for the identification of similarities and provide an opportunity for system evaluation and improvements. Quality improvement philosophy in nursing educational programs is based upon the mindset that nursing faculty are essential in the promotion of a patient safety culture, and are invested in the development of safe practitioners (Tregunno, Ginsburg, Clarke, and Norton, 2014).

Purpose

The purpose of my project was to identify the number, types and categories of SOFI reports from a hospital based ADN program over a four-year period from July 30th 2012 through July 30th 2016 and compare the numbers of SOFIs by academic term, the student's previous healthcare experience, and student age. My project also examined the number of errors in the ADN hospital based program after a curricular change was implemented to condense the previously existing 24-month program to 18 months.

Specific Aims

The specific aims of the study were to:

1. Assess the number and types of the clinical errors and near misses (SOFIs) of pre-licensure ADN students from July 30th 2012 through July 30th 2016.
2. Compare SOFIs generated from July 30th 2012 through July 30th 2016 from ADN students by academic semester, student previous healthcare experience, and pre-licensure nursing student age.
3. Compare the number and types of SOFI reports generated from when the academic program was a 24-month program to when the academic program was changed to an 18-month program.

Research Question

What are the number and types of SOFI reports that have been generated from July 30th 2012 through July 30th 2016?

Hypotheses

1. There was a difference in the SOFI reports of ADN students in their first 2 semesters as compared to their last 2 semesters.
2. There was a difference in the number of SOFI reports of ADN students who have previous healthcare experience as Licensed Practical Nurses (LPNs) compared to those who do not.
3. There was a difference in the number of SOFI reports of ADN students who are under the age of 30 compared to students who are 30 years of age or older.
4. There was a difference in the number of SOFI reports of ADN students in the nursing program in the current 18-month Evening/Weekend nursing program option compared to the previous 24-month Evening/Weekend program option.

Significance

The Institute of Medicine (IOM) released the landmark publication *To Err is Human: Building a Safer Health System* in 1999, which drew attention to the prevalence and significance of safety and quality concerns that permeated the United States health care industry. Medical errors and sentinel events remain a significant concern in the healthcare arena, despite targeted and focused initiatives and attempts at their reduction. Medication errors, according to some reports, occur at the rate of more than 1 per day per hospitalized patient (Bush, Hueckel, Robinson, Seelinger, & Molloy, 2015). This initial IOM report was quickly followed by subsequent publications that addressed the necessity for changes in education of healthcare

professionals, and in 2003, the integration of new safety competencies that were to be embedded within the curricula of health programs, including nursing education (IOM, 2003). Hospital staff nurses are typically the personnel responsible for the administration of the overwhelming majority of medications within the healthcare system (Bush et al., 2015) and consequently are critical elements in the process. The Quality and Safety Education for Nurses (QSEN) initiative has recommended an educational approach that has foundations firmly entrenched in concepts of safety science, with competencies for prelicensure nursing students that identify specific safety knowledge, skills and attitudes (KSA). Evidence suggests that attitudes regarding patient safety within healthcare systems also affect the reduction of medical errors, as a safety climate that is considered favorable is strongly associated with reduced medical error rates (Bush et al., 2015).

Historically, prelicensure nursing students participate in a curriculum that accommodates safety education through a focus on calculation skills and knowledge of high-alert medications. QSEN recommends instead that prelicensure programs specifically address attitudes within the safety framework to enhance formation of a knowledge base and attitudes that are congruent with a culture of safety designed to reduce risk of error (Smith, Cronenwett, & Sherwood, 2007).

Medication errors compromise patient safety and increase the overall cost of healthcare (Dolansky, Drushcel, Helba & Courtney, 2013). Recent estimates suggest that annually there are more than 400,000 deaths that can be attributed to preventable medical errors, and at least 1.5 million serious, preventable medication errors result in serious injury to patients each year (Bush et al., 2015). Healthcare workers report only the two to three percent of major errors that cannot be concealed (Barnsteiner & Disch, 2012). In order to best minimize such errors, nursing education units integrate medication competency within curricula. Medication errors that occurred during the administration phase of the process involve prelicensure nursing students

more than previously thought (Wolf, Hicks & Serembus, 2006). From a study conducted by Wolf et al. (2006) it was determined that approximately one-third of nursing student medication errors involve omission and administration of a wrong dose, with approximately 17% of medications being administered at the wrong time. Wrong patient errors happen 9% of instances, and wrong route happened approximately 4% of instances. However, the most prevalent cause of medication errors was considered to be performance deficits of students (Wolf et al., 2006).

In the specific subset of prelicensure nursing education, the promotion of a culture of patient safety in clinical settings is inherent to the preparation of future nurses who will align their particular practice with evidence based practice guidelines. There is currently an increased incidence of nursing student clinical errors, as well as near-misses or adverse events witnessed and/or experienced by prelicensure clinical students (Stevanin, Bressan, Bulfone, Zanini, Dante, & Palese, 2015). Prelicensure nursing students struggle to fully comprehend the importance of safe clinical practices, and have not developed the knowledge and competence necessary to appropriately and correctly identify and manage adverse events and/or near-misses. More information is needed about student-made errors. The clinical component to nursing education provides an opportunity for prelicensure students to learn to think and function as professionals in the nursing discipline (Tanicala, Scheffer & Roberts, 2011). However, there are barriers to ensuring adequate prelicensure nursing student education in patient safety, such as varying academic infrastructure amongst schools and colleges of nursing, a fully saturated curriculum, a lack of related educational resources and materials, and a lack of faculty motivation (Lee, Jang & Park, 2015).

Students should be involved with the completion of real or simulated error reports on all clinical experiences in order to cement the point that errors are common and need to be reported. This can be integrated with clinical pre and post-conferences, and should be a component of the clinical experience. The prelicensure student's comprehension of responsibility as the primary key component of medication error prevention is essential. Given this, utilization of the previously described SOFI form for the purpose of assessing errors and near-misses and subsequently assisting prelicensure students with a reflection on their particular patient safety knowledge and competence might assist them in the provision of safe patient care (Cooper, 2013).

Literature Review

A literature review was conducted to determine what, if any, prior research had been published focusing on the safety education and knowledge of pre-licensure nursing students. A search of the literature explored the following databases: CINAHL, PubMed, Cochrane, and Ovid using the search terms "pre-licensure nursing safety", "medication safety", "student nurse safety" and "nursing safety education". Inclusion criteria included availability of full text publications, English language, and articles published in the last ten years (2011-2016). As this initial search yielded few usable research selections, the search was opened to the past ten years (2006 - 2016). Exclusion criteria included those publications that did not directly address nurses' safety education or practices.

Wolf, Hicks, and Serembus (2006) performed a descriptive, retrospective secondary analysis study using data from MEDMARX, a database operated by the United States Pharmacopeia through the Patient Safety Program. This is one of the only research articles that focused on descriptive analysis of student medication errors and contributing causes. The

researchers obtained a convenience sample (n = 1305) of voluntary reports of errors committed by student nurses from January 1 1999 through December 31 2003 submitted to MEDMARX, an anonymous Internet accessible program used by facilities for quality improvement initiatives. This research examined the characteristics of medication errors made by nursing students during the administration phase of the medication use process and determined that the most prevalent causes of errors at approximately 51% of all errors was a deficit inherent in the prelicensure students' clinical performance. Wolf et al. (2006) categorized performance deficit as a student possessing the requisite skills and knowledge to safely perform the medication administration, with failure to discharge duties successfully. The next highest causes of error were failure to follow procedure/protocol (32%), knowledge deficit (26.5%), and communication (17%). Inexperience and distractions were considered to be the next most prevalent contributing factors to the errors and near-misses. The authors concluded that administration errors committed by students were more frequent than previously thought. Interestingly, the authors determined that these four causes of error were higher amongst a student subset of errors than the overall MEDMARX data set.

A major limitation to this research was that data collected within MEDMARX is voluntarily submitted, and not all facilities subscribe and/or submit information to MEDMARX. Data regarding student near-misses is also often considered part of the learning process, and might not necessarily be given the same weight as a near-miss committed by a veteran staff member. Alternately, a strength of this research is that the database draws upon reports submitted by multiple facilities and thus decreases a degree of selection bias.

Disch and Barnsteiner (2014) concluded that little was known about the errors and near-misses conducted by student nurses and developed an occurrence reporting tool, tested by 10

schools of nursing. This pilot study used a web-based format as a test version of a potential national, anonymous web-based data repository for reporting errors and/or near-misses by nursing students. The authors initially asked 20 schools to participate but only 70 reports from 10 schools were submitted. It should be noted that the reported incidents could have been actual or fabricated, and the reported incidents included medication errors, communication issues, and inappropriate practice. The overwhelming majority of the reports were from faculty members. The authors discussed the challenges associated with finding a central site to store the secure data and still allow for peer review. While the data in the repository was not patient-specific, not subject to FERPA oversight, and was HIPAA compliant, there was still significant concern about the potential of outside entities discovering the database and making the results public, particularly in regard to the quality of nursing education provided by particular programs (Disch & Barnsteiner, 2014). To date, discussions are still underway with national organizations to house the potential repository.

Saintsing, Gibson, and Pennington (2011) performed an integrative review to examine data relating the errors of novice nurses when they were faced with clinical decision-making situations. They utilized research available through Ovid and Proquest databases, with search terms of novice nurses, graduate nurses, new nurses and error terms. They further evaluated approximately 75 articles, selecting those that specifically included types of errors, causes of errors and potential interventions, ultimately selecting twenty articles for focused review.

Novice, new graduate nurses are expected to practice at a safe level as determined by the state nursing boards and nurse practice acts. An emphasis on safe nursing practice is a required component of nursing curricula, and a nurse that graduates from an accredited program is expected to have met the standard of safe practice as determined by their respective nursing

programs (Saintsing et al., 2011). A survey performed by the National Council of State Boards of Nursing (NCSBN) found that the employers of new graduates perceived newly licensed nurses to be inadequately prepared to enter practice. It is further estimated that 75% of novice nurses are involved in medication errors, and that approximately 30% of the medication errors are related to critical thinking. These results align with current research (Saintsing et al., 2011).

If the types of errors committed by prelicensure nursing students are understood more completely it is possible to make changes on several levels in order to improve the quality of patient care and reduce the number of errors. Much of the literature reviewed in this research was focused on addressing didactic gaps between theory and application of curriculum to practice. Saintsing et al. (2011) further concluded that most of the reviewed literature only provide information on errors from an outside perspective, meaning that the student nurse was not directly involved in a discussion the reasons and causes of the errors. A significant gap in the reviewed literature is discussion regarding the provision of student nurses with specific information on errors and their reduction.

Bush, Huekel, Robinson, Seelinger, and Molloy (2015) utilized the Quality and Safety Education for Nurses (QSEN) quality and safety competency as a framework to create an education project designed to increase the knowledge, skills and attitudes (KSA) of prelicensure nursing students about medication safety. Traditional safety education for prelicensure nursing students has focused on safety at a level of nurse-patient interactions, yet a broader integration of safety science encompasses a systems approach to patient safety, with development of processes to reduce errors or the effect of errors. Bush et al (2015) developed a focused medication safety course that aligned with the QSEN safety competencies designed to increase and foster students' KSA. Four online modules were developed that addressed a recognition of the context of

medical errors, common causes and types of medication errors, prevention strategies, and the impact of medication errors on patients, families, and the health care system. Learning activities included exploration of photographs with hot spots identifying different contributions to medication errors, video simulation of a medical error with corresponding reflection opportunities, online journaling, and interactive quiz questions. Strengths of this approach include the utilization of a student focus group during the development process. The summative evaluation included an appreciation for more in-depth learning about medication safety. Furthermore, online, anonymous journaling might increase participation from students that might be more reticent to contribute in a classroom environment. Weaknesses include a small sample size of application to one cohort program of nursing students.

Tregunno, Gisburg, Clarke and Norton (2014) reported on the perspectives of teaching faculty in the medical, nursing and pharmacy fields about factors influencing curricular integration and preparation of safe practitioners. The authors utilized qualitative methods to assist in data collection from faculty members (n=20; n=6 medical faculty, n=8 nursing faculty, n=6 pharmacy faculty) and performed a thematic analysis to compile a comprehensive account of faculty perspectives. Semi-structured interviews were conducted in person by the lead author, and were audio recorded and transcribed verbatim. The three major themes associated with the complexities associated with the integration of patient safety that emerged were (1) challenges to safe practice, (2) challenges in preparation of safe practitioners, and (3) faculty concerns. Interestingly, pharmacy faculty focus primarily on safe medication practices, physician safety education focused on communication within and among other members of the medical team, yet nursing faculty identified the broadest set of threats to patients safety, integrating environmental concerns such as fast pace of care. The authors ultimately concluded that each discipline

functions within highly specific and specialized roles with unique professional competencies, and, given this, there are relatively few faculty with the knowledge and skills to appropriately and competently teach the breadth of patient safety-related content. Limitations to the research include the concern that the study was performed within the confines of one Canadian jurisdiction. As such, application to other universities or geographic areas may be limited. The interview participants represent a small convenience sample, and self-selection bias is an inherent risk to the validity of the conclusions. However, this research is unique in an exploration of faculty perspective on student safety education and prevention of medical and medication errors, and assists in informing an understanding of the formal and quasi-formal variables that influence the prelicensure education of nursing students.

Theoretical Foundation

The theoretical foundation of this research study is the Situated Clinical Decision-Making Framework model. Novice nurses and nursing students make linear decisions, frequently with a focus on singular tasks and/or problems, and often do not recognize the relevance of differences from a textbook representation of a clinical scenario and the patient in front of them. They further focus on doing as opposed to thinking and reflecting. Consequently, when confronted with a complex or perhaps unfamiliar clinical situation, an inexperienced nurse or nursing student will react through utilizing their theoretical knowledge and psychomotor skills as opposed to implementing decision making that reflects the complex needs of the patient in the scenario (Gillespie and Peterson, 2009).

The Situated Clinical Decision-Making Framework can be utilized as a mechanism to assist a prelicensure nursing student reflect on the decisions they make in their clinical experiences in order to develop decision making skills that are based on more than a basic

understanding of nursing, and can also be implemented to guide retrospective reflection on the efficacy of decision making processes and outcomes. The Situated Clinical Decision-Making Framework incorporates context, foundational knowledge, decision-making processes, and thinking processes (Gillespie and Peterson, 2009).

Context influences clinical decision-making in the sense that context includes the social, cultural, political, ideological, economic, historical, temporal, and physical factors, illuminating the complicated web within which nurses must make decisions. Context facilitates an understanding of the essential factor of effective communication and possibility of collaboration within clinical decision-making. Foundational knowledge informs nurses' clinical decision-making processes, as knowledge is generated from dimensions such as the nursing profession, self, and both general and specific aspects of the patient situation. Effective decision-making means that the nurse must do more than simply have knowledge in its inherent form; instead, the nurse must participate in active assimilation of new knowledge along with critical selection and use of existing knowledge. The phases of the clinical decision-making process are not linear, rather they inform and may be informed by one another. Cues, judgments, decisions and evaluations of outcomes guide nurses in various phases of clinical decision-making. Thinking within the clinical decision-making process supports nurses in identification of and challenge of their assumptions, values, and beliefs in a given situation, considering context, imaging possibility and maintaining reflective skepticism (Gillespie and Paterson, 2009).

The Situated Clinical Decision-Making Framework was used to guide my research, as opposed to utilization for hypothesis testing. Utilization of this theory is based upon the premise that one method to assist prelicensure nursing students in the reduction of nursing errors is to enhance the students' making of effective clinical decisions. The framework was used as a

foundation for the SOFI to assist prelicensure nursing students' comprehension of the complexity of everyday clinical decision-making and to assist them in the focus of a critical reflection of their clinical decision-making and learning needs.

Variables

The independent variables for my study were student semester level of the program, previous healthcare experience, age, and program. The dependent variables were the number, types and categories of SOFI reports generated by student errors and near-misses. Please see Appendix A for Table 1, which depicts the variables, theoretical definitions, and operational definitions of my research.

Research Design

A twenty-four month retrospective comparative design of Student Opportunity for Improvement (SOFI) reports was utilized in this research project. This design was chosen as the data provided shed evidence on the types of prelicensure nursing student clinical errors and near-misses. Knowledge of the characteristics of students' clinical errors and near-misses as reflected in the SOFI will assist faculty in transforming curricula, as the type of training provided in nursing programs can be important in reduction of errors made by novice nurses. This design was also feasible, as the SOFI data has been collected since 2010.

Study Population

The target population was all first and second year prelicensure nursing students enrolled in a 24-month or 18-month hospital based school of nursing that provides an associate degree in nursing. Students were included in the study if they were between 18 and 60 and have had a SOFI report filed. A convenience sample was utilized. Students who have been dismissed from the program due to either academic or clinical failures but who have had at least one SOFI filed

were included in the study population. Students who were dismissed could theoretically have committed clinical errors leading to their dismissal, therefore examination of those errors was important for validity.

To allow for an anticipated effect size (Cohen's d) of 0.5, a statistical power level of 0.8, and a probability level of 0.05 to test a two-tailed hypothesis 128 total samples was needed, with 64 samples in each group. Due to our desire to comprehensively assess the numbers and types of SOFI forms, and because of the ability to analyze all SOFIs since July of 2012, we requested access to up to 600 SOFI forms from students in the analysis. Each of the SOFI forms included in the data pool were examined. No recruitment of student subjects was necessary.

Setting

The setting was a private, non-profit 2-year program leading to the Associate in Applied Science (AAS) with a major in nursing in the northeastern region of the United States. Total enrollment is approximately 300 students, divided into 2 separate programs. Faculty are all currently masters prepared, licensed as nurses in the State of New York and maintain expertise appropriate to their professional responsibilities in manners such as maintaining clinical practice(s), attendance at conferences and workshops, and other continuing education opportunities. Classes are held at the College of Nursing, while the majority of clinical experiences are held at the partnering hospital located on the main campus. Some clinical experiences are held off-site at specialty settings.

Associate degree curriculum

There are 2 program options within the College of Nursing. One is a typical four academic semester (fall, spring, fall, spring) schedule, called the Weekday Option. This option follows a typical academic calendar, with semesters beginning in late August and concluding in

mid-December for the first semester, and beginning in mid-January and concluding in early May for the second semester. The approximately 80 Weekday students complete 4 semesters or two years in order to earn an associate degree in nursing.

The second program option is termed the Evening/Weekend Option (EWE), which has approximately 50-60 students in both the Level I and Level II years. The EWE option was previously 24-months but now is currently 18-months and there are approximately 60-65 students enrolled in each EWE cohort. It is important to note that the program outcomes and training are identical between the two options; the only difference in the curriculum or required clinical hours is a difference in total program option time frame.

In response to a nation wide demand for well-prepared nurses and requests from the community for an alternate method for the completion of the AD curriculum, our faculty and staff developed an innovative and unique educational model. The EWE option received approval by the NYS Education Department in 1999 with the first class of eleven students entering in January of 2000. Enrollment in the EWE option has steadily increased since its inception in 1999 with enrollment now at maximum capacity of 60 students with a waiting list.

The original EWE curriculum was 24-months. It began in July each year and graduated 2 years later in June, with classes running on Friday nights, Saturday and Sunday afternoons and clinical experiences Saturday and Sunday morning and early afternoons. Classes were every other weekend for 2 years. In July of 2014 the 24-month EWE program became an accelerated, 18-month program and the previous 24-month curriculum ceased to exist. In the accelerated 18-month EWE program there are still four semesters in order to ensure that the two program options have the same curriculum for accreditation purposes. The current accelerated EWE

semester 1 runs July - November, Semester 2 November - March, Semester 3 March - July, Semester 4 August - December.

The EWE program has always been specifically designed to accommodate students who need to be able to be free to pursue Monday through Friday daytime commitments. The current 18-month EWE program option has classes every Wednesday evening from approximately 5pm-8pm and every other weekend. The “weekend” encompasses Friday afternoons from approximately 4pm – 8pm, and the Saturday and Sunday from approximately 7am – 6:30 pm. The program is completed in 18 months. Cohorts begin in late July and complete their coursework in mid-December. Clinical rotations are included within the weekend hours.

At the time of this research project, 1.5 cohorts will have completed the accelerated 18-month EWE program option and data will be available on previous cohorts of the 24-month EWE program for comparison purposes.

Instrumentation

A SOFI form is completed whenever an event happens during a clinical experience that has the potential for harming a patient. The SOFI form was developed by faculty at the institution to (1) assist the student to identify and describe the event, potential patient consequences and steps that would have prevented the event, (2) identify the learner requiring remediation and the type of remediation necessary, and (3) identify and track trends that may impact on the course of teaching and learning in the curriculum. This form has been in use since 2009, with the most recent version having been approved by the faculty at a Faculty Organization meeting in 2011. The forms contain comparable information. A SOFI form and additional information about examples of categories are included in Appendixes B and C respectively.

When there was an event or potential for an event, the clinical faculty identified it in conference with the student and initiated the SOFI form. The faculty member completed the top section of the SOFI form, reporting the student's name, the date, the hospital unit, the course, and the faculty member. The course level corresponds to the student semester level. The faculty member then wrote a brief description of the event and determined the category of the event. Categories include (1) 6 Rights, which included such events as the right dose, right time, right route, right medication, right documentation, right patient, (2) Medication, which included such events as given without instructor, no labs/parameters checked, incorrect computer scanning procedure, or other, (3) IV Management which included such events as no date/time/initials, air in tubing, IV regulation/calculation, expired tubing, incorrect procedure, (4) Patient Safety, which included such events as not checking name band, siderails not being up, bed in the high position, break in sterile/aseptic technique, and (5) Miscellaneous which included such events as incorrect procedure, order not followed, documentation errors, and incomplete clinical preparation. Each SOFI report had only one event, however, students have earned multiple SOFIs during a single incident (i.e., calculating a IV rate incorrectly and forgetting to prime IV tubing).

The student then filled out the remainder of the form, writing their own description of the event, the potential patient consequences, and steps that would have prevented the event. The student then returned the form to the initiating faculty member, who placed one copy in the student file and gave one copy to the student, one to the Assistant Dean, and one to the Course Chairperson. Student advisement occurred to counsel the student on how best to improve their clinical performance and modify any pertinent behaviors.

Appendix F is an Excel data collection spreadsheet with each of the categories and events described above. The student's semester of study was identifiable from the course identifier on the SOFI form. Information regarding whether the student was an LPN, the student's age, and student's program option was obtained from student demographic information that is available to the institution's faculty before the spreadsheet is de-identified.

Data Collection Procedure

The SOFI forms were physically stored in a locked cabinet in the Assistant Dean's or her designee's office. All data from the SOFI reporting forms since 2012 was available to all faculty in an Excel spreadsheet in a secure faculty share hard drive. This Excel spreadsheet was downloaded to the secure research computer, and data entered for the student SOFI category, student semester, student age, program option, and previous healthcare experience. The program option, student age, and previous healthcare experience demographic information was available to all faculty on a shared drive. The student course and therefore semester of enrollment is recorded on the SOFI form. Names were permanently removed prior to analysis.

Approximately every 5th SOFI form entry was verified with the secure access Excel spreadsheet data as compared to the original SOFI forms for accuracy, and the Assistant Dean or her designee performed the check of each data entry from the SOFI to the Excel spreadsheet to verify accuracy. Data entries that were determined to be inaccurate were modified in the secure spreadsheet after consultation with the Assistant Dean or her designee. A running total of inaccurate entries were tabulated for further analysis if inaccurate entries are found. Once the data was cleaned and verified for accuracy it was downloaded from Excel to SPSS for data analysis.

Data from the SOFI reporting form have never been used in a pilot study, nor has the instrument been used in a related population or research study.

Data Analysis

Data was downloaded from Excel to SPSS 23. The research question regarding the number and types of SOFIs during the study interval was analyzed with descriptive statistics. These descriptive statistics, used to examine the sample characteristics and the study variables of the research question, were outlined in the data collection spreadsheet (Appendix F), and the data was reported in a tabular format. For research hypothesis one, a t-test was performed to determine if a difference existed between the number of SOFI reports by first two semesters vs. the last two semesters. For research hypothesis two, a t-test was performed to identify if a difference existed between the number of SOFI reports by the two levels of previous healthcare experience. For research hypothesis three, a t-test was performed to identify if a difference existed between the number of SOFI reports by two levels of student age. For research hypothesis four, a t-test was performed to identify if a difference existed between the number of SOFI reports by the two program types. The Hypothesis Testing Table was developed using the statistical output variables in Appendix E. All hypotheses were tested at a statistical significance alpha level of 0.05.

Ethical Considerations

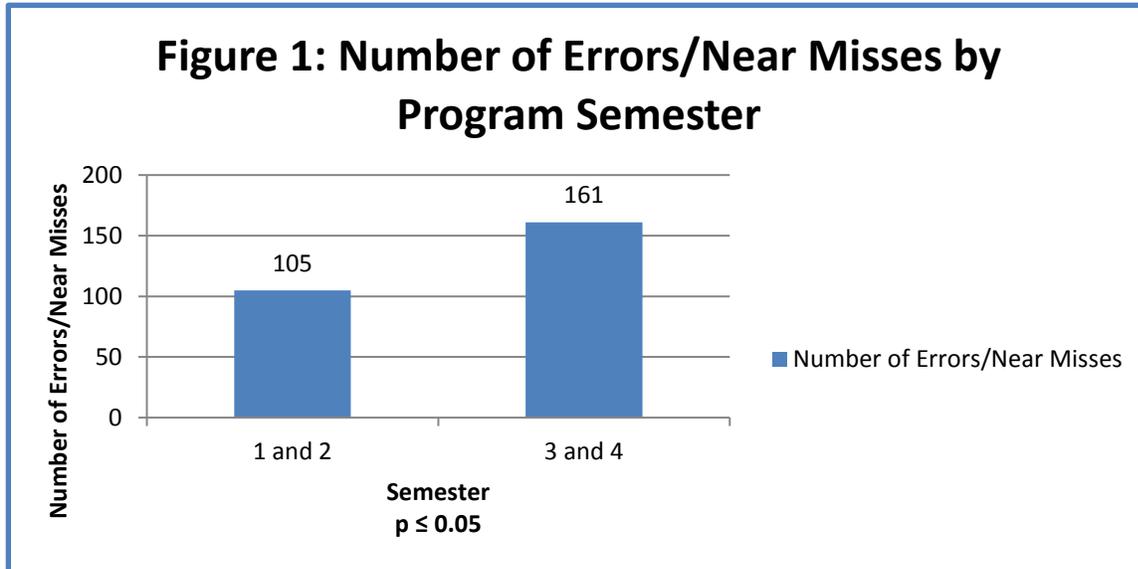
Institutional Review Board (IRB) approval was needed from the hospital's IRB and The George Washington University's IRB prior to initiation of the research. The actual SOFI forms were returned to the Assistant Dean as per protocol in the College of Nursing once the data is verified. The anonymity of the student was protected through identification numbers assigned to each record. All data on the Excel spreadsheet was de-identified by removing the student name

column on the excel spreadsheet prior data analysis. An Excel spreadsheet of all SOFI forms from 2012 to the current time is presently available to all faculty on a password protected faculty share drive. To ensure further confidentiality of data, the Excel spreadsheet was downloaded to a password protected research computer and backed up on a password protected flash drive, which was stored in a secure, separate location from the research computer.

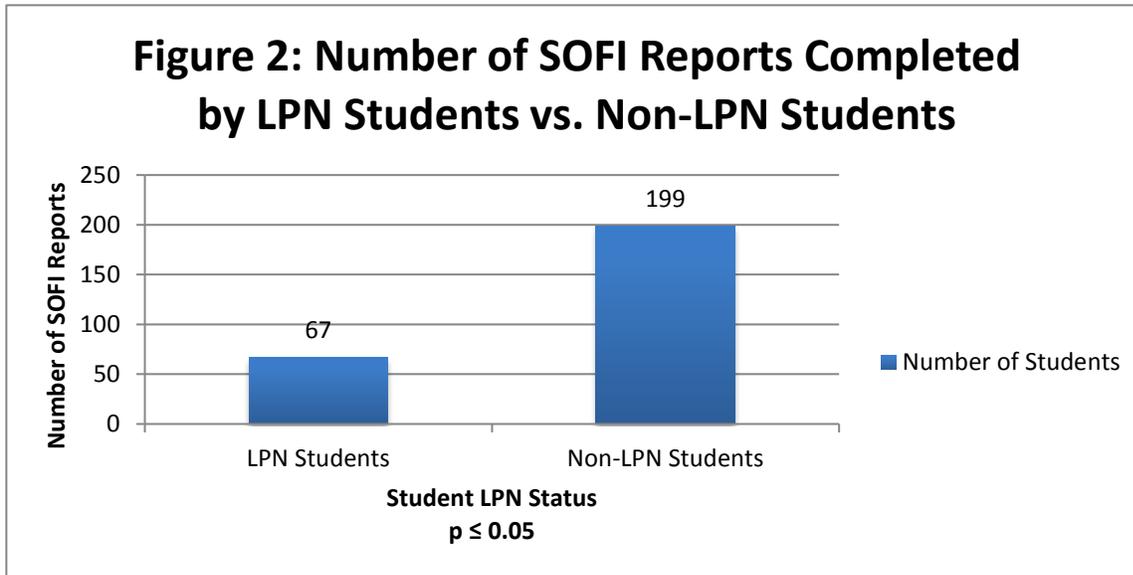
Results

A total of 266 SOFI forms were completed from July of 2012 through July of 2016. 80 SOFI forms were associated with Evening/Weekend cohort members while 186 were associated with Weekday students. One hundred seventeen (117) SOFI forms were associated with students who were enrolled in the previous, former 24-month curriculum and 149 SOFI forms were associated with students who were enrolled in the new 18-month curriculum (see Table 5).

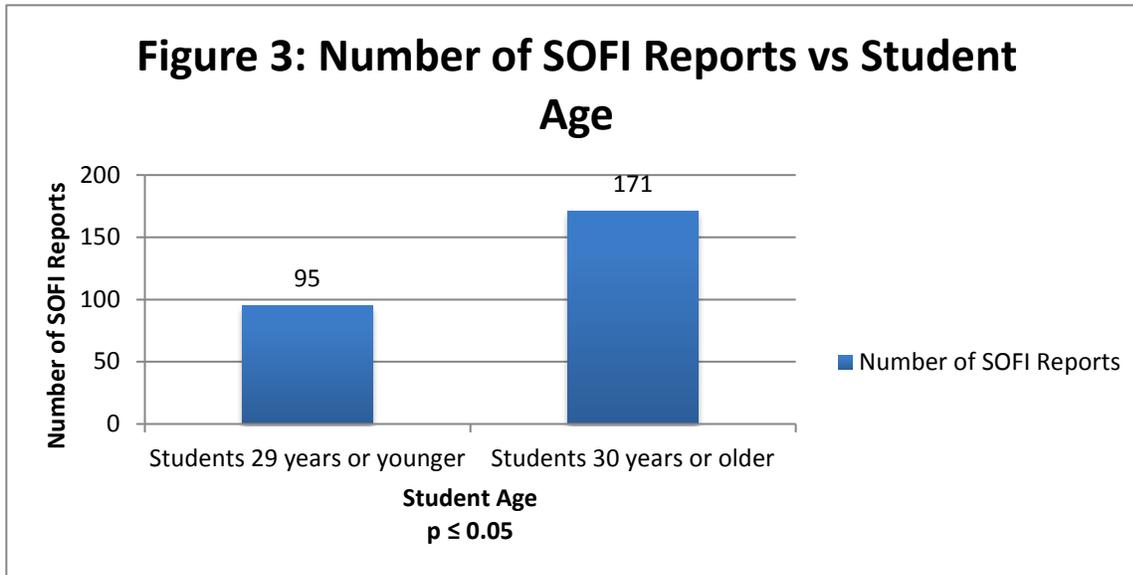
Hypothesis 1: There was a difference in the SOFI reports of ADN students in their first 2 semesters as compared to their last 2 semesters. The data collected to address this hypothesis is presented in Table 1. From July of 2012 through July of 2014, there were 105 SOFI reports completed for students in their first two semesters of their academic program and 161 SOFI reports completed by students in their final two semesters of nursing school. The difference in the number of errors/near misses and therefore SOFI reports between Semesters 1 and 2 ($M=0.4$, $SD = .49$) as compared with Semesters 3 and 4 ($M=0.6$, $SD = .49$) of the program was statistically significant at an alpha level of 0.05.



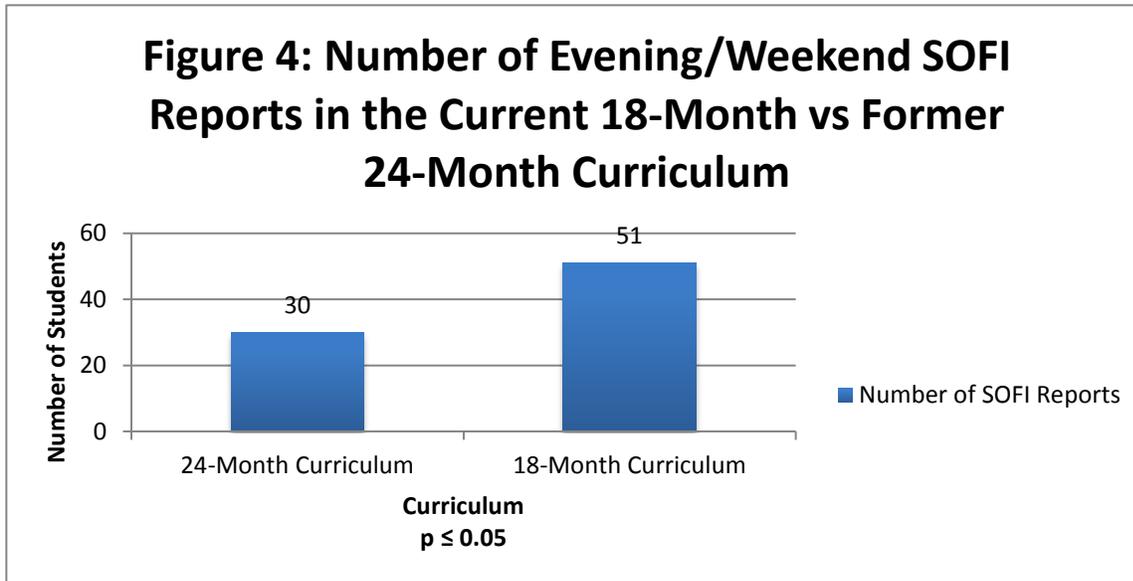
Hypothesis 2: There was a difference in the number of SOFI reports of ADN students who have previous healthcare experience as Licensed Practical Nurses (LPNs) compared to those who do not. Sixty-seven (67) SOFI forms, or 25% of the SOFI forms, were completed by students who had earned their Licensed Practical Nurse (LPN) credential while 199 students, or 75% of the students who completed SOFI forms, had no hospital or health care experience. This data is presented in Table 2, and the number of LPN students completing SOFI forms ($M=.25$, $SD = .43$) compared to those that had no healthcare experience ($M=.75$, $SD = .43$) is also statistically significant at an alpha level of 0.05.



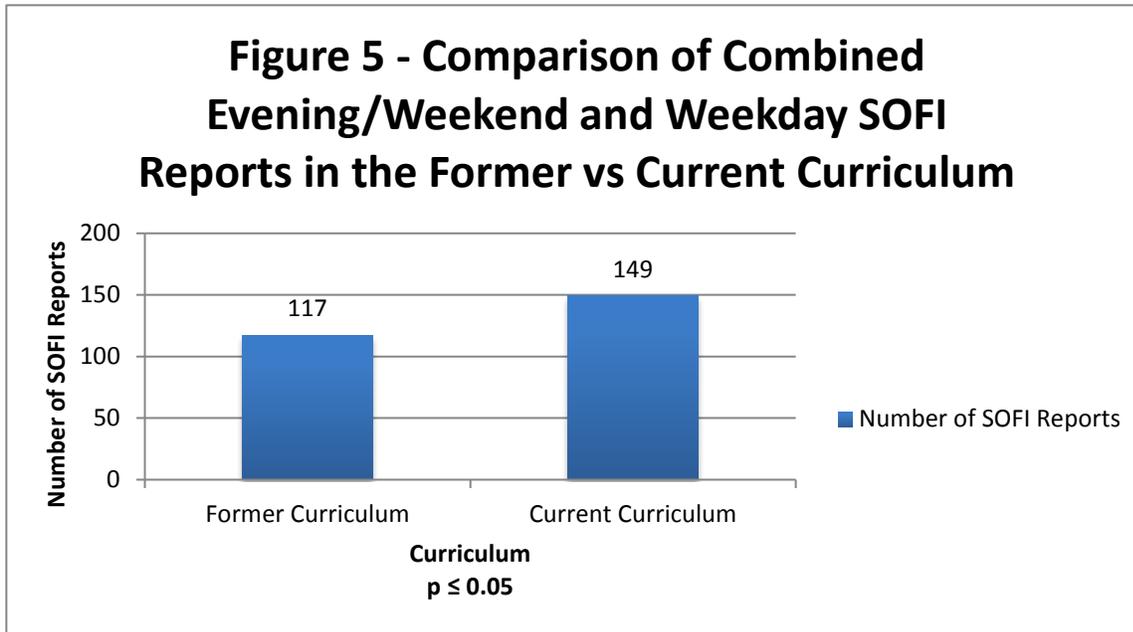
Hypothesis 3: There was a difference in the number of SOFI reports of ADN students who are under the age of 30 compared to students who are 30 years of age or older. This data is represented in Table 3. Ninety-five out of the 266, or 35.7%, of SOFI reports were linked with students 29 years of age or under ($M=.36$, $SD = .48$), while 171 or 64.3% of the SOFI reports were associated with students 30 years of age or greater ($M=.64$, $SD = .48$). It should be noted that if students aged into the second category during their association with the program that the SOFI was categorized based upon their age at the time of the event. T-test analysis of the data demonstrates a statistical significance at an alpha level of 0.05 of the difference in SOFI reports due to the age of the student in question.



Hypothesis 4: There was a difference in the number of SOFI reports of ADN students in the nursing program in the current 18-month Evening/Weekend nursing program option compared to the previous 24-month Evening/Weekend program option. This data is represented in Table 4. It should be noted that a weekday program comparison was not done due to the fact that the length of the weekday program did not change. 81 reports out of the total of 266 SOFI reports were associated with Evening/Weekend Option students; students in the previous, 24-month curriculum completed 30 SOFI reports and students in the current, 18-month curriculum completed 51 SOFI reports. T-test analysis demonstrates that the difference in SOFI reports constructed during the 24-month curriculum ($M=.63$, $SD = .49$) and the 18-month curriculum ($M =.63$, $SD = .49$) is statistically significant at an alpha level of 0.05.



When the Weekend Option was changed to be an 18-month program in 2014, both the Evening/Weekend and Weekday options also implemented significant curricular changes to incorporate a concept-based curriculum. The numbers of SOFI reports collected prior to the curricular change and after the curricular change are presented in Table 5, and t-test analysis of the difference between the sum of the SOFI reports from both the Evening/Weekend and Weekday options prior to ($M=.44$, $SD = .5$) and after ($M=.56$, $SD = .5$) the curricular change are significant at an alpha level of 0.05.



Discussion

It is important to note that use of the SOFI form was initially approved in and has been in use since 2009, well before the implementation of this research project, and faculty receive routine professional development on the appropriate use of the SOFI. There were no newly hired faculty during the time frame of the study, and the most recently hired faculty member was hired in 2010, well before the time frame of the research study, so it is assumed that faculty use of the SOFI form is not reflective of comfort with the form or inexperience with the faculty role. The nursing curriculum at this particular institution is scaffolded to provide students with the opportunity to assume more responsibility for their patients as they progress through the program. Medication administration is introduced near the middle of the first semester of the program, with students beginning to administer oral, topical, optic, otic, and subcutaneous medications during the middle of their first semester. Intramuscular injections are introduced immediately upon the commencement of the second semester. By the completion of their third semester and beginning of their fourth and final semester, students are assuming total care for

two increasingly complex patients and often the medication administration for two patients, dependent upon patient census and faculty discretion.

That fact that the number of student errors and near-misses is increasing closer to program completion is concerning. Ideally, errors would decrease as experience and exposure to content is increased, particularly errors that were designated as safety errors. An increase in the number of errors later in the program might reflect student knowledge deficits that have gone unaddressed or unnoticed until students are given more autonomy. Another possibility for increasing errors throughout a program might be reflective of students' exposure to increasing complexity in patient care, or changes to policy and procedure. Still another possibility is that faculty might have provided more guidance and support to students while they were enrolled in earlier courses, rationalizing that they might have needed more direction and instruction due to a lack of experience. Faculty consequently might have treated the first several student errors and/or near-misses as more constructive learning opportunities, rather than the formal remediation reflected with a SOFI.

An increase in errors and/or near-misses could also potentially reflect students collectively assuming more responsibility for their patients, performing more medication administrations, and caring for multiple patients. It is also possible that as students care for more patients and assume more responsibility for more complex patients the students give a greater number of medications than they did earlier in their curriculum, thus increasing the number of opportunities for error as a result of a potential greater total of administrations.

LPN students who were transitioning to RN filed sixty-seven SOFI reports, or approximately 25% of all completed SOFIs. LPN students make up approximately 5-10% of all the enrolled associate degree nursing students, yet they are responsible for 25% of the SOFI

reports. It is possible, given that many of the LPNs enrolled in the program are employed within the healthcare setting, that these particular students have either a sense of confidence that might not be appropriate in the educational clinical setting, reflective a false sense of security. It is also possible that the unconscious or conscious expectations of faculty might be different for LPN students, and faculty might be quicker to catch errors/near-misses committed by LPN students.

It was interesting to note that of the total number of SOFIs, a greater percentage of them had been completed by students 30 years of age or older. The average age of enrolled students is 25. It is possible that students returning to school after a lapse in schooling might be more nervous and uncertain of their skills than students who have been continuously enrolled in school programs, and who might have more confidence in their hands-on skill techniques. This lack of confidence might lead to a greater incidence of errors and near-misses.

Curricular changes can be challenging for faculty, and time is sometimes required for faculty and students to adjust. Of particular concern with regard to the hypotheses related to the number of SOFIs in the new 18-month versus the former 24-month curriculum in the Evening/Weekend cohort is the truncated curriculum. The fourth hypothesis examines the difference in SOFIs under the former and current curriculum for both program options, Evening/Weekend and Weekday. The current curriculum, implemented in both the Evening/Weekend and Weekday program options, represents a change to a concepts based curriculum, which has resulted in more overall total errors and consequently SOFI reports. When separating out errors/near-misses conducted by Evening/Weekend cohort students the number of errors is increased in a shorter period of time. It is possible that students do not assimilate knowledge as completely in a condensed curriculum. However, the data collection pool demonstrates that errors have occurred with increased frequency in the later semesters of

the nursing program. What is particularly alarming, however, is that this current data collection pool only contains two days collection of SOFIs from the Evening/Weekend cohort's last and final semester. Past precedent would indicate that there would be substantially increased numbers of SOFIs in the final semester, yet those SOFIs are not included in this data set, and the number of SOFIs is already higher than previous years under the previous curriculum.

Limitations

Examination of the SOFI forms demonstrated some inconsistencies amongst faculty. Some forms were only partially completed, and those forms were eliminated from the data pool. The Associate Dean alluded to the possibility of some missing SOFIs as a result of administrative error, and many faculty anecdotally expressed that they had a tendency to utilize the SOFI form only after having provided education and remediation on the clinical unit at the moment of students' previous mistakes and/or near-misses. All of these circumstances have the potential to affect the veracity of the data. Students who might have switched program options from Weekday to Evening/Weekend had their SOFI form recorded under their program classification at the time of the error. Furthermore, this is a single data set from a hospital based school of nursing that graduates approximately 120 students a year, and the results and analysis of students enrolled in this program who participated in clinical errors and/or near-misses can not be generalized to the rest of nursing schools and colleges across the country.

The data reports are de-identified; consequently one cannot ascertain whether the errors and/or near-misses are being made by a select group of students or if the mistakes are more widespread throughout the cohort. This could potentially skew the data findings and the validity of the t-test results; however, discussion of this possibility with the Dean provides evidence that this circumstance is unlikely. The clinical rotations are relatively short on occasion; students

sometimes spend just 4 days with a faculty member. Students that make multiple errors are supposed to be identified early when copies of SOFI reports are given to the Progression Committee, and the student is supposed to be provided with focused remediation. Given the de-identified format of the SOFI reports it is difficult to ascertain if this practice ideal is reflective of current circumstances.

The name of the faculty member responsible for the clinical experience linked to the SOFI occurrence was not included in the data collection from the IRB. This particular information might have been helpful to further validate the SOFI data given that some faculty might be more likely to mandate reports than other faculty despite institutional professional development and training on the appropriate utilization of the SOFI form.

Implications/Recommendations

As discussed above, one of the possible rationales for the increase in errors/near-misses as students' semester progressed is a potential increase in medication administrations due to a corresponding increase in patient volume, acuity, and complexity as the students assumed more responsibility and care for their patients. Examining the number of student errors/near-misses per each medication administration might provide for a different interpretation of the data. This particular analysis is not feasible with the current available data; however, requesting faculty to account for the total number and types of student medication administrations throughout their various clinical rotations would allow for a more accurate depiction of the true percentage of errors and in turn be an interesting topic for further examination.

It is unknown how many of these errors/near misses actually reach the patient. Revising the SOFI form to include a question that reflects the Safety Event Classification (SEC) Patient Safety Measurement System for Healthcare, developed by the Healthcare Performance

Improvement group (2009), would be advisable. The classifications are Serious Safety Event, wherein a deviation from generally accepted performance standards reaches the patient and results in moderate to severe harm or death, a Precursor Safety Event, wherein a deviation reaches the patients and results in minimal harm or no detectable harm, or a Near Miss Safety Event, wherein a deviation does not reach the patient and is instead caught by a detection barrier or by chance (HPI, 2009). Adding an additional category to the SOFI form will help structure the SOFI data into the above breakdown and might yield additional information, providing information that might yield targeted areas for intervention through curricular emphasis or restructuring.

Very few schools of nursing have their own internal reporting systems, which can skew depiction and analysis of data when trying to analyze nationwide patterns. There have been previous efforts to structure nationwide reporting systems for pre-licensure student near-misses and errors, but to date the databases do not reflect the diversity of associate degree programs in the country. Wide-spread utilization of a national database would provide for the opportunity for trends in student errors/near-misses to be studied on a more extensive scale than at the individual program level, and would allow for a broader, systems-focused examination of appropriate faculty and curricular interventions to decrease the number of student clinical errors and/or near-misses (Disch & Barnsteiner, 2014).

Quality improvement or staff education departments might be interested in investigating error/near miss occurrences in first year graduate nurses, but this potential research is complicated by the fact that these reporting systems are usually reliant on self-reporting. Other suggestions for further research would include an investigation of the first-time licensure examination success rate for students who earned SOFIs. Finally, an analysis of the current

curriculum is indicated. As a pre-licensure program, the institution is tasked with the adequate and appropriate preparation of students to ensure their ability to enter the nursing workforce and provide safe, high quality nursing care. The current analysis of SOFI reports indicates a potential deficit in students' assimilation and application of those nursing principles. While it is understood that nursing school is a learning process in and of itself and students will make mistakes, there are still areas of concern and potential curricular gaps that are leading to the conduction of nursing students' clinical errors and near-misses.

Conclusions

The findings of this particular research study highlight the necessity of classroom and clinical instruction regarding safe, appropriate care and techniques for error management. The impact of national safety patient programs on nursing curricula need to be assessed, and potentially need stronger implementation efforts. Since the publication of *To Err is Human* (IOM, 1999), there has been considerable time, attention and effort invested in the training and preparation of those who might be associated with medical errors. While errors are often considered to be part of the learning process of pre-licensure students, the challenge associated with nursing education is building an educational foundation and the promotion of an appropriate culture wherein students can learn from their mistakes and near-misses while the errors/near-misses are caught before they reach the patient. A broader and increased knowledge base regarding the clinical errors and near-misses that are conducted by pre-licensure RN students can only assist faculty with regard to the more thorough preparation of these future providers.

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Appendix A

Table 1: Variables, Theoretical Definitions, and Operational Definitions

Independent Variables	Theoretical Definitions	Operational Definitions
Semester Level of Program	Student semester of enrollment when SOFI was generated.	1 = Semesters 1 or 2 2 = Semesters 3 or 4
Previous Healthcare Experience	Student status of previous healthcare experience	1 = LPN 2 = Non-LPN background
Student Age	Student chronological age in years as grouped into categories	1 = < 30 years or age 2 = >= 30 years of age
Student Educational Program	Student educational program enrollment status	1 = 18 month program 2 = 24 month program
Dependent Variables	Theoretical Definitions	Operational Definitions
Number of SOFI reports	Student/faculty generation of a SOFI report	N = actual number of SOFI reports

Appendix B

St. Joseph's College of Nursing
at St. Joseph's Hospital Health Center, Syracuse, NY
Student Opportunity for Improvement (SOFI)

Student _____ Date _____
Unit _____ Course _____ Faculty _____
Description of event _____

To be Completed by the Student by _____ (DATE)

Description of event:

Potential patient consequences (or harm)

Identify steps that would have prevented the event.

Student Signature _____

To be completed by Faculty prior to giving the form to the Student

Circle category of event

- 6 Rights: right dose right time right route right medication right documentation
right patient (not checking identification bracelet/scan)
Medication: given without instructor no labs/parameters checked incorrect Adm. Rx procedure
other (specify)
IV management: no date/time/initials air in tubing IV regulation/calculation expired tubing
incorrect procedure IV manage/computer incorrect procedure (general) other (specify)
Patient safety: not checking name band siderails bed in high position
break in sterile/aseptic technique other (specify)
Miscellaneous: incorrect procedure order not followed documentation
incomplete clinical prep other (specify)

**Original copy to be kept in learner clinical folder and copy given to Student, Academic Dean, Team Leader, and CLL Manager. Copies to be sent as soon as completed.

Faculty Signature _____

Date Received _____

Faculty Approved: March 31, 2014
Revised: March 10, 2014
Revised: February 2011

CURRICULUM

Appendix C**Student Opportunity for Improvement (SOFI) EXAMPLES**

The following are guidelines for events that merit the student receiving a SOFI report, although it is not all-inclusive.

A. The basic "six rights" must be followed at all times and include:

1. Right medication
2. Right dose
3. Right time- student will follow hospital policy (1/2 hour before or after scheduled time on MAR) unless extenuating circumstances arise.
4. Right route
5. Right patient-student will correctly identify patient per hospital protocol each time meds are given.
6. Right documentation, including injection site, amount of medication delivered and MedRx procedure.

B. Medication administration

1. Not knowing correct procedure for medication administration
2. Incorrect ADMIN-Rx procedure
3. Administering medications without checking with the instructor
4. Recapping contaminated needles
5. Incorrect isolation procedure with medications
6. Not checking parameters/labs prior to coming to instructor with meds

C. IV management

1. Failure to check site/IV bag every hour
2. Allowing bag to run dry
3. Failure to date, time, initial IV bag or tubing
4. Not noticing IV bag or tubing have expired
5. Air in tubing
6. Failure to record information accurately in the computer
7. Incorrect IV calculation or calculation not done
8. Accessing/flushing and so on CVAD without faculty

D. Patient / Learner Safety

1. Side rails not up as needed
2. Patient not restrained as needed or ordered
3. Leaving a syringe and or needle in the patient's room
4. Bed left in high position with patient in bed
5. Call bell not within reach of the patient
6. Break in sterile/aseptic technique
7. Using improper technique or devices when moving or lifting patient

E. Miscellaneous

1. Failure to perform initial, ongoing and thorough assessments specific to the individual patient and the course level of the student
2. Failure to report significant patient events or statements.
3. Failure to follow standard precautions.
4. Not following through on Kardex orders.
5. Not prepared for clinical
6. Incomplete or inaccurate documentation

Revised: February, 2011

Revised: June 2010

Faculty Approved: November 23, 2009

Appendix E

Comparison of Number of SOFI Reports by Semester, Previous Healthcare Experience, Age and

Curriculum

	Number of SOFI	Statistics	P value
Semester		t-test	P=
• First two semesters	Mean (SD)		
• Last two semesters	Mean (SD)		
Previous healthcare experience		t-test	P=
• Yes	Mean (SD)		
• No	Mean (SD)		
Age		t-test	P=
• <30 years	Mean (SD)		
• ≥30 years	Mean (SD)		
Curriculum		t-test	P=
• 24-month program	Mean (SD)		
• 18-month program	Mean (SD)		