

CASE STUDY

Making the Move from “Med Math” to Medication Administration and Safety

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Abstract

The World Health Organization (WHO) recognized medication errors as a global health problem in 2017 highlighting them as a top patient safety challenge (World Health Organization, 2023). The American Association of Colleges of Nursing (AACN) highlights quality and safety as one of the essentials of nursing (2021). In response to declining medication math scores and the emphasis on patient safety, one Midwest United States nursing program updated their curriculum to address medication administration and safety on exams instead of just “med math” as dosage calculation. Addressing the varying skills and knowledge of foundational mathematical concepts for nursing students entering and progressing throughout the program remains an area of further study.

Keywords: Medication Administration, Medication Safety, Nursing, Medication Errors, United States.

1. Introduction

It is widely accepted that safe medication administration is an essential nursing school competency and is supported by a variety of assessment strategies utilized throughout the nursing curriculum. There is variability among requirements of exams, definitions, teachings and even what is considered competency among nursing programs, but most undergraduate programs require some sort of “med math” exam that is successfully completed by their students prior to graduation. There is also great variability in the definition of “Med Math”. Some definitions consider only dosage calculation, others consider safe dosage calculation and quality in administration of medications. Preparation of graduates for competent medication administration is the goal of nursing programs, related to the overwhelming evidence of the safety and quality issues regarding medication errors. Medication errors are a global health issue. The World Health Organization (WHO) has recognized and identified medication errors occurring in all stages of the medication use process, including prescribing, transcribing, dispensing, administering, and monitoring (2023). Medication safety is a concern for both patients seen in acute settings and in outpatient settings, and the WHO has named medication errors as one of the top patient safety challenges since 2017 (WHO, 2023).

In the United States healthcare system medication errors, among others, were brought to light with the Institute of Medicine’s (IOM) report, *To Error is Human: Building a Safer Health System* (Kohn, Corrigan and Donaldson, 2000). As a result, regulatory agencies like The Joint Commission, <https://www.jointcommission.org>, have continued to make medication safety a priority, focusing on areas such as National Patient Safety Goals. As a result, nurses and nurse educators have a responsibility to work for the achievement of these goals, and to share this information with students and other colleagues (Joint Commission, 2023). The American Association of Colleges of Nursing (AACN) has also prioritized patient safety through their updated document “*The Essentials*” (American Association of Colleges of Nurses, 2021).

That document updated the framework outlining expectations for competency in nursing practice and describes 10 Domains which are the “essence” of nursing practice and from which the expected competencies follow. Domain 5 is centred on Quality and Safety. This domain focuses on enhancing quality and minimizing “risk of harm to patients and providers through both system effectiveness and individual performance. In alignment with *The Essentials*, the decision was made at the University of Detroit Mercy, to move from “Med Math” to “Medication Administration and Safety” and highlight the importance of integrating the competency into the nursing curriculum, prioritizing patient safety and quality care.

2. Intervention to improve competence

The undergraduate nursing program at the University of Detroit Mercy was analysing program assessment data to consider curriculum redesign. Anecdotal data presented to faculty by students regarding medication assessment competencies in the classroom, advising sessions and in clinical setting was concerning. In alignment with the new AACN essentials, this nursing program’s current “med math” (dosage calculation) assessment strategy underwent a philosophical change to a more integrated approach that became known as medication administration and safety.

The shift from “med math” to “Medication Administration and Safety” was a policy redesign for this, Midwest United States nursing program within a Catholic University. A year was spent on the redesign to map competencies of three different Bachelor of Science in Nursing (BSN) educational tracks. In the United States the BSN leads the graduate to a licensing exam in the state where the graduate resides. The nurse, upon passing the exam (which includes math incorporated into multistep scenario questions), becomes a Registered Nurse (RN). The graduate may not work in the hospital as a graduate nurse until the licensing exam is successfully completed. The three educational tracks were as follows: The student who comes to the university directly from high school, the student who comes to the university who has a degree in another discipline and can move more quickly through the nursing program, and lastly, the student who comes with a degree from a community college with a degree known as an associate degree that can transfer 90 credits towards the required 126 credits of the BSN degree. This challenge to change began for two reasons. First, was the obvious need to connect and better align with *The Essentials*. The second and more concerning challenge was the increase in the number of students failing the previous Med Math exam. These failures had significant impact on progression through the program for students, as they could not meet clinical/curriculum objectives. Students who were unable to pass Med Math exams were not able to pass medications at clinical/practicum sites. Students who failed were held back a semester to repeat the clinical course. The faculty of the department had concerns about this from a financial, psychosocial, and spiritual perspective of the student. As a Catholic institution with a commitment to academic excellence and social justice, this policy was not mission driven.

A small ad hoc group was formed to work on the policy in the Spring 2022 semester, with plans for implementation in the Fall 2022 semester. Transition from the old policy to the new occurred during the summer 2022 semester. Emphasis was focused on preparing faculty for the transition as there was a shift to “more teaching” and “less testing.” Teaching of medication administration and safety concepts was specifically stated as an expectation in specific courses, as it related to course content. This was a large shift in how content throughout the curriculum was taught. Content related to medication administration and safety was previously primarily taught by one or two faculty members, in only two didactic courses (one in the beginning and one in the middle) of the nursing program, with the expectation that competencies were reinforced in the clinical setting. Medication

administration and patient safety competencies were outlined in eight additional didactic courses within the new program design. Each of these courses also had a clinical component.

Additional learning experiences were also written into the policy Medication Administration and Safety. For example, students now had medication administration and safety simulations and skills sessions as well as medication administration and safety-focused instructional sessions. Students were assigned self-study modules to assist in their preparation as well. Exam testing was decreased to a total of two exams throughout the course of the curriculum, from the previous five exams. In the Fall 2022 semester a new faculty member was assigned to help facilitate the policy rollout. This faculty member was also responsible for assisting faculty with testing and working with faculty and the simulation centre coordinator to ensure medication administration and safety competencies were achieved.

3. Results

A summary of differences in exams before and after the policy change is shown in the Appendix. At the time of article submission, data had been collected for one full year since the new policy was implemented. Exam scores were assessed per nursing education track for exam 2 taken at about midpoint in the curriculum for all educational tracks. Test taker exam scores, of those who would be graduating under the new policy and had received education under the new policy, were compared against those of students in education tracks graduating under the old policy. The combined mean score on exam 2 of educational tracks for those who will be graduating under the new policy was 85.5%. This score was higher than the mean score of 83.2% for those in educational tracks graduating under the old policy. The mean percent of students who passed on the first attempt increased from an aggregate of 55% among educational tracks post policy implementation compared to 51.1% pre-implementation (Table 1)

Nursing Ed. Track test takers for Exam 2 by Graduation Date	Number of Students in Ed. Track (n)	Passed on first attempt [n (% of Ed. track)]	Combined first attempt pass rate (%)	Mean exam score for Ed. Track (%)	Combined Mean Score based on competency Policy (%)
May 2022	34	17 (44.7)	51.10	82.2	83.2
Dec 2022	33	19 (57.5)		84.2	
Transition to new policy					
May 2023	24	12 (50)	55.5	84.3	85.5
Dec 2023	30	13 (43.3)		83.1	
May 2024	15	11 (73.3)		89	

Table 1: Nursing student exam 2 aggregate scores and pass rates per graduation date by education track

4. Discussion

This change in philosophical approach to viewing “med math” as more than just dosage calculation but an encompassing policy of the administration of medication and improving patient quality and safety was considered a bold change for this nursing program. The program will continue to need to

evaluate progress and outcomes as data is collected. Test scores improved with less testing and more interactive learning. As expected, anecdotal responses from student reported decreased stress from fewer exams. Faculty reported enhanced engagement with students in the classroom. Students continued to struggle with story problems. Clinical nursing practice requires critical thinking, estimation, logic and reading. Students must be able to read provider orders, look at pictures of medication labels and understand abbreviations used on these labels. For example, the “Do Not Use” list has many abbreviations often found on medication labels. Students properly educated and trained and able to understand what is being asked in a story problem will be less likely to make medication errors. These competencies were assessed in simulation and could not have been assessed as accurately though a written exam.

Dosage calculation as “med math” will continue to be a part of nursing curriculum. Nursing programs can and should expand “med math” to include the principles of critical thinking and decision making that are foundational to medication administration and safety. Teaching improved quality and safety in classrooms can help to reduce medication errors and ultimately decrease patient harm. Students should be able to self-assess medication administration competencies throughout the continuum of the program. The program is working to offer a variety of learning opportunities for assisting students who score low. Moving forward we will also continue to work on effective ways to objectively meet competencies with testing. The program continues to search for ways to engage students with the competencies of patient quality and safety related to medication administration.

5. Appendix

Summary of differences in exams before and after the policy change

	Exam Before Policy Change	Exam After Policy Change
Number of Tests During Curriculum	Five exams – exams taken in theory courses associated with accompanying clinical courses: First: skills/fundamentals Second: med surg Third: Pediatrics Fourth: OB Fifth: Leadership/Immersion	Two exams First: prior to start of didactic learning Second: midway through nursing curriculum
Student Exam Preparation	Primarily student responsibility to study suggested material	Content and student learning objective added to specific courses in curriculum Medication Safety and Administration specific content added to simulation scenarios Medication Safety and Administration faculty and peer review sessions available for student sign up
Exam Format	10 questions 25 minutes If the class is online, the exam was recorded video on lockdown web browser; otherwise, the exam was in person All questions multiple choice	20 questions 45 minutes All exams taken in person regardless of class format Questions may be multiple choice or fill in
Example Questions from Exam 1	1. If a patient weights 220 lbs, how many kilograms does the patient weight? a. 2.2 kg	1. A nurse caring for a child who weights 22lbs has a fever of 102.7. There is a prn order for ibuprofen 10mg/kg prn fever >102.5. Available

Example Questions from Exam 1 continued...	b. 52 kg c. 100 kg d. 220 kg 2. A child is ordered: Amoxicillin 200mg po x 1 now. Pharmacy has sent: 80mg/3ml suspension in a multiuse container. How many ml should be administered to the child? A. 1.2 ml B. 3 ml C. 7.5 ml D. 80 ml 3. The order is to administer Pepcid 15mg IVP x 1 now. Pharmacy sends Pepcid 10mg/ml. How much will you give? A. 0.5ml B. 1ml C. 1.5 ml D. 2ml	from pharmacy is ibuprofen 40mg/ml. How many ml should the nurse administer to the child? (round answer to the nearest tenth) a. 1.5ml b. 5.5ml c. 2.5ml d. 3.25ml 2. Mr Shaham is ordered furosemide 60mg PO x 1 now. The supply from pharmacy is pictured below. How many tablets will you instruct the patient to take?  Picture from https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=79d9aef8-cfb9-4f6e-ac15-f830d7ea2324&type=display 3. The IV order reads 300ml of NS to infuse over 6 hours, what is the hourly rate?
Example questions from Exam 2	1. The order for your patients continuous IV fluids reads "0.9NS IV @ 30ml/hr". Pharmacy has sent you a 0.5L bag of IV fluid. How long before you expect your IV fluid to run out and you will have to change the bag again? A. 16 hours and 5 minutes B. 16 hours and 25 minutes C. 16 hours and 40 minutes D. 16 hours and 67 minutes 2. You are the nurse caring for a patient who is ordered sucralfate 500mg PO q 6 hours for a duodenal ulcer. Available from pharmacy is 1g/10ml. What will you prepare for administration to your patient? a. Administer 2 tablets orally b. Administer ½ tablet sublingually c. Administer 20ml sublingually d. Administer 5ml orally	1. A nurse is reviewing the prescriptions for four clients. The nurse should contact the provider to clarify which of the following prescriptions? a. Haldol 0.5 mg at bedtime b. Clonidine 0.1 mg PO once daily in the morning c. Chlorpromazine 25 mg IM q 12 hrs prn psychosis d. Fluoxetine 20mg PO daily q am 2. You have an order to administer ondansetron 8mg IV piggyback 200ml in 0.9NS to infuse over 30 minutes. What rate should you set the infusion pump (in ml/hr)? 3. You are caring for a patient with constipation, docusate 2 tabs PO BID prn constipation is ordered. What is the max number of tablets the patient can have in a 24 hour period? a. 1 tablet b. 2 tablets c. 3 tablets d. 4 tablets

6. References

American Association of Colleges of Nurses, 2021. *The essentials: Core competencies for professional nursing education*. Available at <https://www.aacnnursing.org/Portals/42/AcademicNursing/pdf/Essentials-2021.pdf>

Kohn L.T, Corrigan J.M, and Donaldson M.S, eds, 2000. *To Error is Human: Building a Safer Health System*. Washington DC: National Academies Press.

The Joint Commission. 2023. *2024 National Patient Safety Goals*. Available at: <https://www.jointcommission.org/standards/national-patient-safety-goals/> [Accessed 9 March 2024]

World Health Organization. 2023. *Patient safety*. Available at: <https://www.who.int/news-room/fact-sheets/detail/patient-safety> [Accessed 14 August 2023]