DRAFT Recommendations

From the High-Quality Mathematics Education for Nursing Task Force

Recommendations for Mathematics and Statistics Education for Quality and Safe Nursing Practice

Background

Mathematical competency and effective quantitative reasoning skills are essential for safe nursing practice, both in medication administration and in quality improvement. However, research on the mathematics and statistics education of nurses continues to identify a number of challenges, including a lack of consensus on the necessary quantitative learning outcomes for undergraduate nursing programs and the significant disconnects between typical educational practices and the essential quantitative skills for quality and safe nursing practice.

For example, nursing programs often place a significant focus on developing students' medication calculation skills, even though the ability to interpret and analyze both mathematical and statistical information in the contexts of patient data and healthcare administration are equally important for safe nursing practice. Additionally, curricula, instructional practices, and assessment measures for nurses' mathematical competency often focus on story-based word problems, which tend to omit the realistic elements and social complexities of nursing practice.

Over the past two years, the High-Quality Mathematics Education for Nurses Task Force, jointly supported by the Charles A. Dana Center at The University of Texas at Austin, the Mathematical Association of America (MAA), and Quality and Safety Education for Nurses (QSEN), has connected with educators to address these challenges and to work towards realizing the vision that "*all students in nursing programs will gain the mathematical and statistical knowledge, skills, and attitudes to promote and provide safe, high-quality health care*."

QSEN INSTITUTE

MAA MATHEMATICAL ASSOCIATION OF AMERICA

The University of Texas at Austin Charles A. Dana Center

The "Math for Nurses" Convening

In an effort to build consensus and develop a strategy to achieve this vision, interprofessional leaders convened at the University of Miami on October 5 and 6, 2019. Representatives from the mathematics, statistics, education, and nursing communities met (1) to build connections between our communities, and (2) to develop a forward-thinking consensus about the quantitative education of nurses.

The "Math for Nurses" convening was sponsored by Transforming Post-Secondary Education in Mathematics (TPSE Math) and hosted by Dr. John Clochesy, Professor and Vice Dean of the School of Nursing and Health Sciences at the University of Miami.

The following organizations and institutions were in attendance:

- American Mathematical Association of Two-Year Colleges (AMATYC)
- Bayer – Crop Science
- The American Statistical Association (ASA)
- Bill and Melinda Gates Foundation
- CGFNS International
- The Charles A. Dana Center at The University of Texas at Austin
- Delta College
- Ferris State University
- Mathematical Association of America (MAA)
- National Association for Healthcare Quality (NAHQ)
- National Council of State Boards of Nursing (NCSBN)
- The National League for Nursing (NLN)
- The NROC Project
- Organization for Associate Degree Nursing (OADN)
- Pennsylvania College of Health Sciences
- Quality and Safety Education for Nurses (QSEN)
- The University of Miami

Recommendations and Consensus from the Convening

The remaining content in this document serves two functions:

1. It serves as an artifact to document the consistent themes and areas of consensus resulting from structured discussions at the convening.
2. It provides a set of recommendations for faculty, institutions, organizations, and other invested partners to influence the development of improved and more comprehensive quantitative education in nursing.

The recommendations are intended to serve as the initial groundwork for ongoing dialogue and collaboration among our communities. They should be developed and revised over time as education and best practices continue to change and develop.

It is important to note that much of the content in the recommendations depends on first specifying the fundamental quantitative skills and competencies required for quality and safe nursing practice. While multiple taxonomies published in the last 40 years have described the essential quantitative skills for nursing, it is imperative that an updated collection of quantitative skills and competencies, grounded in current nursing practices, is developed and distributed broadly. That is, an accurate collection of quantitative skills and

competencies is the foundation for developing appropriate learning outcomes, educational curricula, and professional development needs.

Recommendations for Developing Improved Quantitative Education for Nursing Practice

Each recommendation below provides direction for improving quantitative education for nursing practice. Descriptions and resources are included to provide additional context.

Mathematics, statistics, education, and nursing faculty and communities of interest should engage in structured conversations to . . .

***1. Identify** the combination of mathematics, statistics, and nursing educational offerings necessary to meet the desired learning outcomes around the quantitative skills for quality and safe nursing practice.*

There is a need to develop rationale behind course offerings (Quantitative Reasoning, College Algebra, "Math for Nurses" Course, Statistics, etc.) and the selection of faculty responsible for teaching the content (faculty from a mathematics, statistics, or nursing department).

Emerging Solutions in Mathematics Education for Nursing

***2. Incorporate** recommendations and best practices in nursing, mathematics, and statistics education into learning outcomes, instructional practices, materials, and assessments.*

Learning mathematics and statistics involves more than simply "getting an answer." Curriculum and instruction should support learners in developing flexible problem-solving skills, confidence, and perseverance to overcome obstacles.

Common Core State Standards Initiative: Standards for Mathematical Practice

Guidelines for Assessment and Instruction in Statistics Education (GAISE) College Report 2016

MAA Instructional Practices Guide

***3. Integrate** quantitative and data reasoning throughout the nursing curriculum (i.e., reject a "once-and-done" mentality).*

Passing a mathematics or statistics course does not mean one's quantitative education is complete. Additional opportunities for learners to develop the quantitative competencies and skills needed for safe practice should be dispersed throughout the curriculum.

4. Integrate *the complexities of nursing practice throughout instruction (e.g., in-class scenarios, simulations), materials, and measurement of learning outcomes.*

Quantitative reasoning in clinical settings is often applied in distracting environments and requires interpreting and operating with numerical information that is uniquely tied with nursing-specific tools and processes.

Teaching Dosage Calculations: Strategies for Narrowing the Theory-Practice Gap *(recording and materials)*

5. Include *an ongoing analysis and discussion of ethical and effective communication of mathematical and statistical data, results, and recommendations.*

Communicating quantitative information and results to patients, their families, and the community (e.g., interpreting false positives of diagnostic tests, relative vs. absolute risks, at-home medication and care instructions) involves careful consideration of factors extending beyond purely abstract calculations.

Gigerenzer, G. (2009). Making sense of health statistics. *Bulletin of the World Health Organization*, *87*(8), 567. doi:10.2471/blt.09.069872. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2733256/

Piercey, V. (2019). Quantitative ethics. In G. Karaali & L. S. Khadjavi (Eds.), *Mathematics for social justice: Resources for the college classroom* (pp. 53-60). Washington DC: Mathematical Association of America.

6. Incorporate *assessment measures that reflect changing licensure requirements and provide learners the opportunity for continuous improvement, rather than only serving as a high-stakes benchmark for academic progression.*

NLN Fair Testing Guidelines for Nursing Education

Position Statement of the AMATYC on Fostering Learning

7. Inform *the community through collaborative professional development opportunities for nursing, statistics, and mathematics faculty that integrate best practices from all fields.*

Teaching quantitative concepts and skills for safe practice implicitly involves teaching nursing concepts and practices that are uniquely connected. Through collaboration, faculty from these fields can develop a deeper understanding of these unique connections and thus construct more meaningful learning opportunities for learners.

Conclusion

The content in this document represents the consensus reached by the organizational and institutional representatives at the "Math for Nurses" convening at the University of Miami on October 5 and 6, 2019.

The recommendations resulting from this effort reflect the desire to promote quality and safe practice through collaborative and evidence-based improvements to quantitative educational practices in nursing.

The High-Quality Mathematics Education for Nurses Task Force is excited to steward this important work forward and continue to support the ongoing collaboration between the mathematics, statistics, education, and nursing communities.