
Symposium 1.1: Decoding the DNA of healthcare numeracy in nursing through an international program of education translational research.

Tuesday, 10th September - 11:05

Overview

Students must be literate, numerate and digitally/technologically literate to deliver safe nursing care. Regulatory/professional bodies set out healthcare numeracy educational frameworks, e.g. the UK Nursing and Midwifery Council Future Nurse programs (NMC 2018).

- We explore a 30+ year education translational research program which has accelerated the development/distribution of disruptive technology to:
- Transcribe/classify 20 healthcare numeracy skills into individual/combinatory taxonomies.
- Develop a healthcare numeracy competence model.
- Transfer taxonomies into an authentic virtual clinical education environment.
- Design a mathematics/healthcare numeracy learning support environment.
- Identify/classify student mathematics/healthcare numeracy problem-solving methods/errors.

Paper 1: Establishing an international mathematics and healthcare numeracy benchmark and competence framework for nursing: emic, etic, inductive translational research

Abstract ID 269

Authors

Dr. David Pontin (Numeric Generics Ltd), Dr. Keith Weeks (Authentic World Ltd), Dr. Diana Coben (Numeric Generics Ltd), Mr. Alex Weeks (Numeric Generics Ltd), Dr. David Rowe (Numeric Generics Lt), Mr. Matt Brown (Numeric Generics Ltd), Dr. John Clochesy (Numeric Generics Ltd)

Abstract

Background: It is generally agreed that for nurses to give safe care to patients they must be numerate, but there is no consensus on what constitutes healthcare numeracy or what mathematics is needed for nurses to be competent. Healthcare numeracy is buried in nursing practice to the point of invisibility which leads to wide variation in testing, and curriculum content (Weeks et al 2022; Ozimek et al 2021; Wendel 2020).

Aim: To identify the mathematics and healthcare numeracy used in nursing practice to build a benchmark and competence framework for educators and regulators.

Methods: We used primary etic, inductive and emic research to decode the DNA of healthcare numeracy; reviewed seminal work, and established which mathematics and healthcare numeracy skills are needed by RNs to practice safely. The data was collected and analyzed Jan 2017-Dec 2020.

Analysis: We used two main sources to identify core nursing procedures: 1) current point of licensure regulatory competence standards; 2) authoritative clinical nursing texts for common procedures. We also drew on our substantial knowledge/experience of nursing science, mathematics and healthcare numeracy education, and research.

Results: We identified 1] 20 core healthcare numeracy skills across 60 nursing procedures; 2] the incidence of use of individual skills (range 17%-100%); 3] the distribution of mathematics and healthcare numeracy skills between drug dosage calculation and medicines management (40%), and wider nursing practice (60%); 4] the skill combinations needed to perform common nursing procedures, e.g. 13 skills for fluid balance management.

Discussion/Conclusion: Our findings give nurse educators/regulators evidence of the mathematics and healthcare numeracy used in nursing practice. Having bridged the first gap in translational research, educators/regulators can use our education model to build benchmarked education and assessment programs/regulatory systems for delivering safe nursing care to patients.

References

1. Weeks KW, Pontin D, Coben D, Weeks A, Clochesy JM & Rowe D. (2022). Decoding the DNA of healthcare numeracy: Establishing a mathematics and healthcare numeracy benchmark for nursing. <https://safemedicate.com/publications/ng/dna.html>
2. Ozimek D, Kelch B, Zoellner J, Beaudry M & Valdes B. (2021). Math and Statistics Education for Nurses. Austin TX: Dana Center. https://dcmathpathways.org/sites/default/files/resources/2021-01/math_for_nurses_convening_recommendations.pdf
3. Wendel A. (2020). An exploration of numeracy skills required for safe, quality nursing practice. UNLV Theses, Dissertations, Professional Papers, and Capstones. 4090. <http://dx.doi.org/10.34917/23469765>

Lead presenter biography

Dr Keith Weeks

Keith is a UK RN with a PhD in authentic healthcare mathematics education and 40+ years of clinical, education and translational research (TR) leadership experience.

He is Founder, President of TR/Chief Research & Development Officer, Authentic World Ltd, where he leads global research, design and development of safeMedicate™(https://www.safemedicate.com/publications/elsevier/videos/video_5.html; <https://www.safemedicate.net/>).

Keith is also Founder, CEO & Healthcare Mathematics Education Director, Numeric Generics Ltd, where he leads global TR, design and development of the safeHANDS Healthcare Authentic Numeracy Development Suite of nursing mathematics and healthcare numeracy virtual clinical environment education programs.

Paper 2: Nursing numeracy educators: Teaching and assessing numeracy and medication calculations within Australian undergraduate nursing education: A qualitative study

Abstract ID 276

Authors

Mrs. Christine Walker (Western Sydney University), Prof. Nathan Wilson (Western Sydney University), Dr. Leanne Rylands (Western Sydney University), Dr. Jim Pettigrew (University of New South Wales), Dr. Leanne Hunt (Western Sydney University)

Abstract

Background: Proficiency in numeracy skills is critical for patient safety, however, the accuracy rate of calculations by undergraduate and registered nurses is deficient worldwide (Minty-Walker et al, 2021). This issue is alarming for the education of undergraduate nurses and the quality of nursing care. Approaches best suited to improve the numerical calculation abilities of nurses remains unclear (Minty-Walker, in press). Furthermore, in the Australian context, there are no accreditation standards referring to numeracy.

Aim: To explore the approaches to teaching and assessing numeracy and medication calculations from the perspective of Australian nurse education leaders of undergraduate nursing degrees.

Methods: In this qualitative study, purposive sampling was used to recruit nurse education leaders ($n = 17$). Individual interview data were collected between Nov 2022 - Jan 2023, and analysed using thematic analysis.

Results: A bespoke range of teaching approaches and assessment formats were implemented. Academics were considered good clinicians, not maths teachers. There was an assumption that students would have numerical proficiency upon entering university. Support was required for struggling students to pass high stakes assessments, often under conditions incongruent to the clinical setting (Minty-Walker et al, 2023).

Discussion: Flexibility and diversity in developing and implementing numeracy education across institutions is expected, however, nurses' inability to pass a numeracy or medication calculation test prompts consideration into the suggestion of adopting a clear pedagogical rationale for teaching one approach over another, along with a standardised method of assessment.

Conclusions: To improve the quality of nursing numeracy education and ensure safer patient outcomes, this research aims to inform the development of an evidence-based and standardised conceptual teaching framework for tertiary education. Furthermore, to prompt consideration into the recommendation for a national independent numeracy assessment that would ensure that candidates have all achieved the required benchmark to practice safely.

References

Minty-Walker, C., Pettigrew, J., Hunt, L., Rylands, L., & Wilson, N. J. (2023). Nurse education leaders' perspectives on the teaching of numeracy to undergraduate nursing students: A qualitative research study. *Nurse Education in Practice*, 72(103754), pp. 1-8. <https://doi.org/10.1016/j.nepr.2023.103754>

Minty-Walker, C., Wilson, N. J., Rylands, L., Hunt, L., & Pettigrew, J. (2021). Undergraduate nursing curricula: Numeracy and accreditation. *Collegian*, 28(5), pp. 559-564. <https://doi.org/10.1016/j.colegn.2020.10.006>

Minty-Walker, C., Wilson, N.J., Rylands, L., Hunt, L., & Pettigrew, J. (in press). Numeracy teaching for undergraduate nursing students: A scoping review. *Journal of Nursing Education*.

Lead presenter biography

Christine Walker

Christine is an Australian RN with over 28 years' experience in clinical practice and education. Her clinical area of expertise is in operating theatre nursing where she held governance positions of clinical nurse specialist, clinical nurse educator and nurse educator. She is a lecturer and campus program advisor at Western Sydney University teaching on the undergraduate nursing degree in theoretical and clinical units, and also acts as subject coordinator. Christine has been developing her publications profile since 2016 and is currently a PhD Candidate at WSU researching nursing numeracy education.

Paper 3: Nurse academics confidence and anxiety levels when teaching nursing numeracy to Australian undergraduate nursing students: A cross-sectional study

Abstract ID 278

Authors

Mrs. Christine Walker (Western Sydney University), Prof. Nathan Wilson (Western Sydney University), Dr. Leanne Rylands (Western Sydney University), Dr. Jim Pettigrew (University of New South Wales), Dr. Leanne Hunt (Western Sydney University)

Abstract

Background: Nurse academics are required to teach undergraduate nursing students' numeracy and medication calculations ensuring a safe practitioner. The literature reveals that nurse academics do not consider themselves maths teachers, and experts in that area are better suited to teaching this skill (Minty-Walker et al, 2023). The literature reports widely on the anxiety felt by school teachers when teaching maths (Ganley et al, 2019), however, there is no research on the anxiety or confidence levels of nurse academics when teaching numeracy concepts to undergraduate nursing students.

Aims: To describe and analyse Australian nurse academics' confidence and anxiety levels when teaching numeracy; to describe who is best placed to teach numeracy and identify the resources to support academics to teach this skill.

Methods: Purposive sampling was used to recruit Australian nurse academics (n = 170) who currently teach numeracy and medication calculations to undergraduate nurses. Data were collected between Nov 2023 - Feb 2024, using an online survey platform, and analysed using R analytics.

Results: The anxiety and confidence levels of nurse academics varied according to demographic profile; academics would like resources and support to build their teaching capabilities, a combination of a registered nurse and mathematics support staff were considered best placed to teach numeracy, and academics were willing to learn and teach methods of calculation besides their preferred style.

Discussion: Students enter university with limited numeracy knowledge; hence it is vital that nurse academics are supported with teaching this skill. By investing in nurse academics own professional development, they are better equipped to meet the diverse needs and learning styles of the students.

Conclusions: This research suggests a call for the formulation of an evidenced-based framework to guide the teaching of nursing numeracy. Building the teaching capacity of nurse academics will enhance student competence and contribute to patient safety.

References

Ganley, C.M., Schoen, R.C, LaVenita, M. and Tazaz, A.M. (2019). The construct validation of the math anxiety scale for teachers. *American Educational Research Association (AERA) Open*, 5(1), pp. 1-16. <https://doi.org/10.1177/233285841983970>

Minty-Walker, C., Pettigrew, J., Hunt, L., Rylands, L., & Wilson, N. J. (2023). Nurse education leaders' perspectives on the teaching of numeracy to undergraduate nursing students: A qualitative research study. *Nurse Education in Practice*, 72(103754), pp. 1-8. <https://doi.org/10.1016/j.nepr.2023.103754>

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Paper 4: Assessing healthcare numeracy among US baccalaureate nursing students: cross-section study

Abstract ID 279

Authors

Dr. John Clochesy (Numeric Generics Ltd), Dr. Jessica Varghese (New York Institute of Technology), Dr. Beatriz Valdes (University of Miami), Dr. Keith Weeks (Authentic World Ltd), Mr. Alex Weeks (Numeric Generics Ltd), Dr. David Pontin (Numeric Generics Ltd)

Abstract

Background: Aspects of numeracy in healthcare have been a persistent concern and regularly appear in the nursing literature. Contrary to popular belief, healthcare numeracy is a complex competency. Healthcare numeracy is more than being able to manipulate numbers or being able to succeed in academic courses in mathematics often constructed by non-nurses. Leaders of undergraduate nursing programs often assume, albeit erroneously, that recruits entering nursing student programs have the required proficiency in numeracy skills to succeed. Evidence suggests that this is not always the case (Weeks et al 2022; Ozimek et al 2021; Wendel 2020).

Aim: The aim of the current study was to assess the healthcare numeracy in a cohort of US baccalaureate nursing students and identify areas of concern.

Methods: A prospective, cross-sectional design was used. The settings were 2 US university baccalaureate nursing programs: a traditional program and an accelerated program for second degree students. In total, 204 baccalaureate nursing students participated in the study. The data was collected and analysed between January 2023-January 2024.

Results: Correct student responses ranged from 11 out of 60 (18.3 %) to 58 out of 60 (96.7 %). No participant managed to answer all of the items correctly. The most common errors presented were related to equivalences between fractions decimals and percentages, indices and logarithms, statistics, estimation, interpretation of tables charts and graphs, formulas and equations, percentage, and ratio.

Conclusions: Healthcare numeracy continues to be a challenge among nursing students with implications for attrition and nursing staffing in the future.

References

1. Weeks KW, Pontin D, Coben D, Weeks A, Clochesy JM & Rowe D. (2022). Decoding the DNA of healthcare numeracy: Establishing a mathematics and healthcare numeracy benchmark for nursing. <https://safemedicate.com/publications/ng/dna.html>
2. Ozimek D, Kelch B, Zoellner J, Beaudry M & Valdes B. (2021). Math and Statistics Education for Nurses. Austin TX: Dana Center. https://dcmathpathways.org/sites/default/files/resources/2021-01/math_for_nurses_convening_recommendations.pdf
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Lead presenter biography

John Clochesy

John, a prolific and award winning author, is a critical care nurse in the US with a PhD in nursing science and a MA in psychology. He has 48 years of clinical, education, and research experience leading research projects funded by the US National Institutes of Health ranging from weaning from mechanical ventilatory support to serious games for health. He has collaborated with colleagues in the UK on translational research related to healthcare numeracy for more than 20 years and currently serves as Pan American Research Director for Numeric Generics Ltd.

Paper 5: Developing and integrating nursing competence through authentic technology-enhanced clinical simulation education: translational research

Abstract ID 282

Authors

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Abstract

Background: This paper acts as the bridge to crossing the second gap in translation research as part of knowledge reception and adaptation (Weeks et al 2022). The bridging of this second gap is an integral component of our patient-safety critical translational research work on healthcare numeracy, conceptual-calculation-technical competence modelling, and the design and development of virtual learning and diagnostic assessment environments (safeMedicate®, safeHANDS®) (Weeks et al 2019).

Aim: To advance the current debate on healthcare numeracy competence in nursing; to explore the role, place and value of simulation education in supporting student competence development; to explore the place of accelerator mechanisms in applying knowledge to practice.

Methodological discussion/presentation: We focus on three concepts. First, we present a re-conceptualisation of the cognitive and physical modalities of a theory-practice gap that is created by the dominant organization mode of health professional education practice. Second, we suggest that simulated clinical environments occupy the liminal spaces that exist between the ordered, symbolic and abstract world of the Faculty classroom, and the situated, messy world of clinical healthcare practice. Third, we maintain that technology-enhanced boundary objects (TEBOs) function as simulation pedagogy modalities. These have two functions. First, they support the transition of students across the liminal space and boundaries between Faculty classroom and clinical practice setting. Second, they support competence development and integration in nursing, in this case the healthcare numeracy skills needed to provide safe patient care.

Conclusion: In this paper we use a constructivist-based clinical simulation education model as a guiding pedagogical framework for applying TEBOs and an integrated nursing competence model to the translational research used to decode the DNA of healthcare numeracy.

References

1. Weeks KW, Pontin D, Coben D, Weeks A, Clochesy JM & Rowe D. (2022). Decoding the DNA of healthcare numeracy: Establishing a mathematics and healthcare numeracy benchmark for nursing. <https://safemedicate.com/publications/ng/dna.html>
2. Weeks KW, Coben D, O'Neill D, Jones A, Weeks A, Brown M & Pontin D (2019) Developing and integrating nursing competence through authentic technology-enhanced clinical simulation education: Pedagogies for reconceptualising the theory-practice gap. *Nurse Education in Practice*, 37, 29-38 <https://doi.org/10.1016/j.nepr.2019.04.010>

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