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Numeracy for nursing - the scope for international collaboration

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What do these things have in common?

Air traffic control

Brain surgery

Nursing

They all have a
“manifest disaster criterion”

(Nokes, 1967)

Numeracy is implicated in potential – and some actual –
disasters,
and in safe and effective practice in these fields

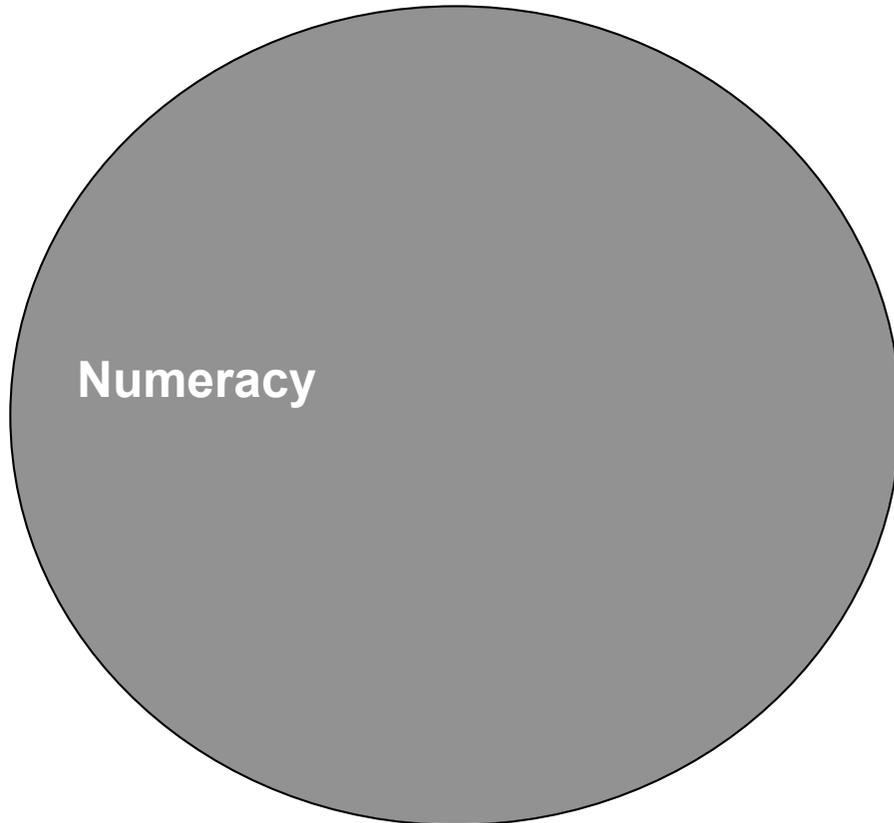
Nurses’ numeracy manifestly matters

Numeracy is a key skill for professional practice
in nursing...

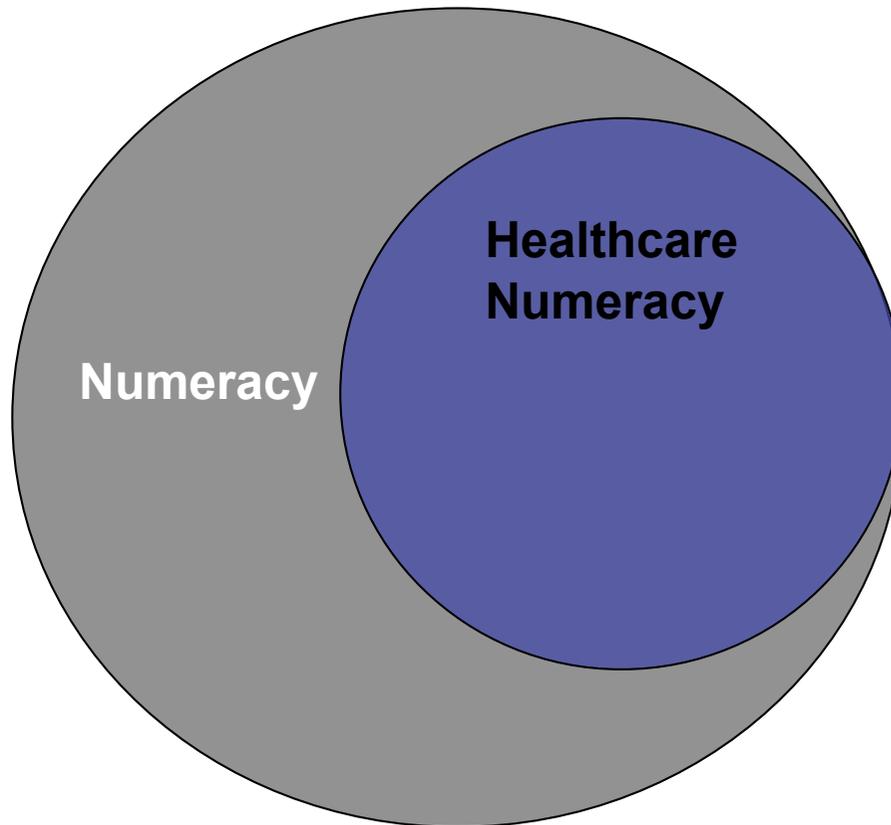
...yet successive studies reveal a lack of
proficiency amongst

- students
- registered nurses
- in the UK and elsewhere
- ...and efforts to remediate the situation

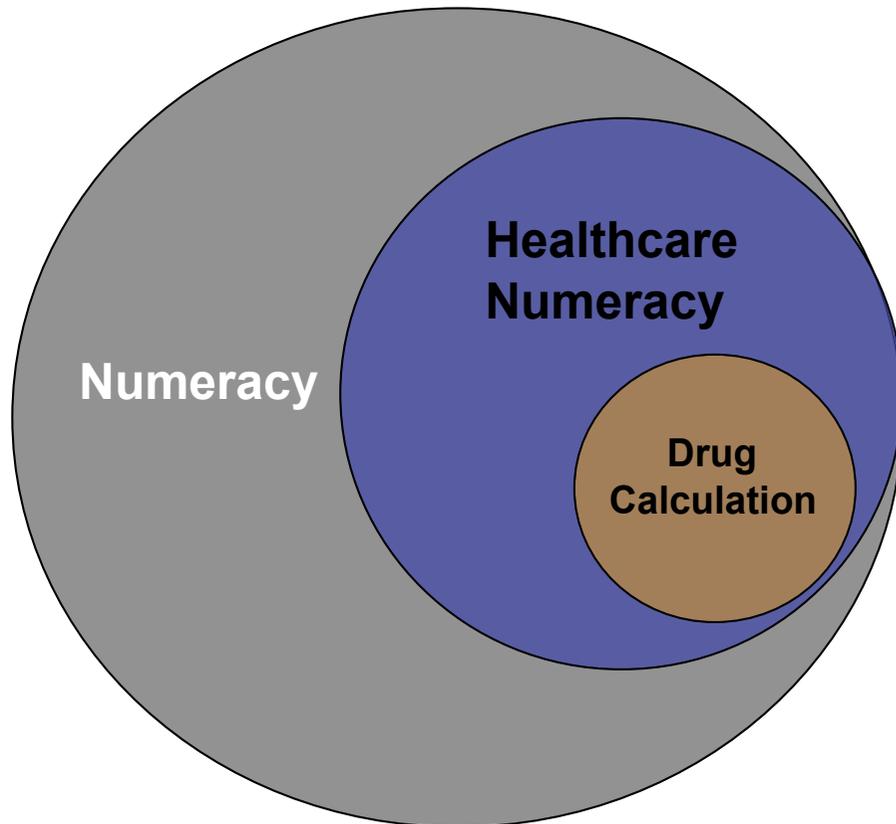
What is competence in numeracy for nursing?



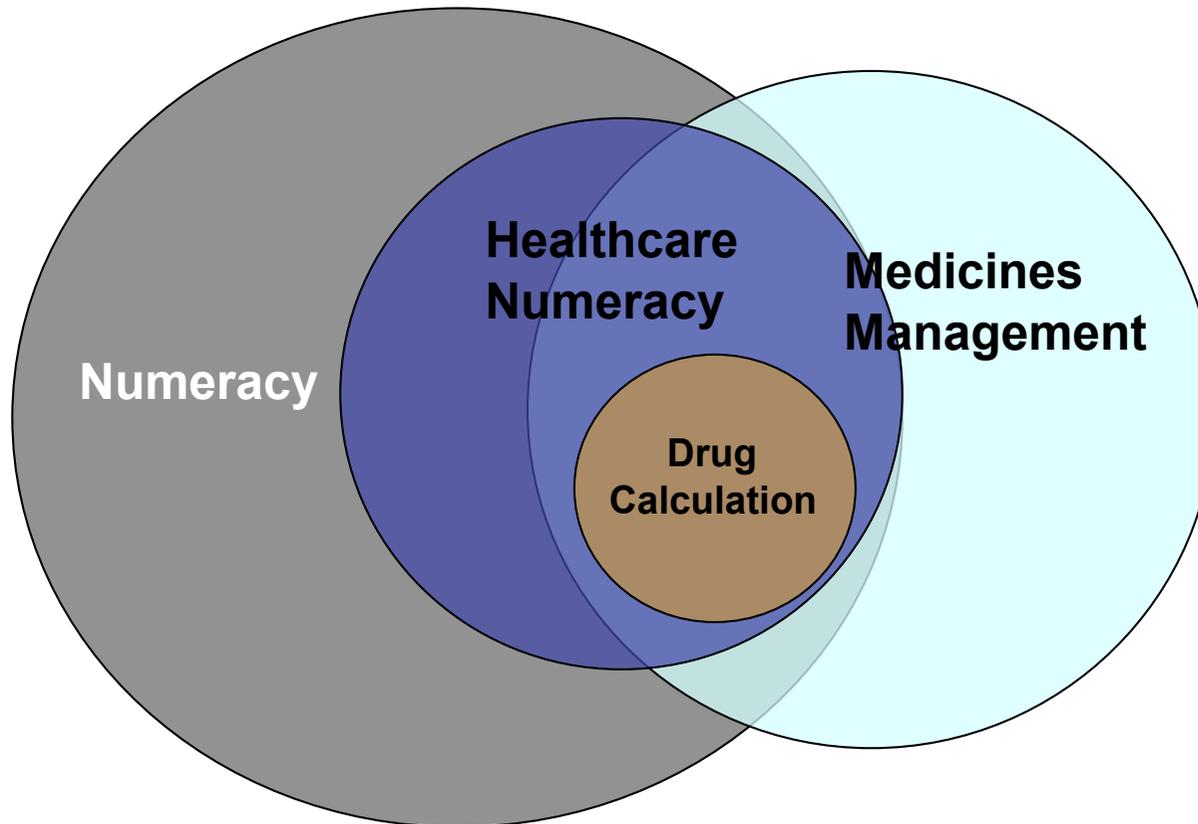
What is competence in numeracy for nursing?



What is competence in numeracy for nursing?



What is competence in numeracy for nursing?



Well no, it's not OK.
I haven't got a clue how she worked it out...
but I don't want to look stupid
by asking how she did it.

We need Aminophylline 200
milligrams...
It comes as 250 milligrams in 10ml.
Therefore we need to give 8ml...
OK?



What is competence in numeracy for nursing?

- It entails effective use, not just knowledge and skills, and purpose, in making sense of use (Coben, 2007)
- The situatedness of numeracy, shaping its use and purpose, is important, as is critical engagement on the part of the numeracy 'agent' (Coben et al., 2003; Condelli et al., 2006)
- 'Nursing numeracy' can be seen as a form of 'sociomathematics' (Wedegge, 2003)
- Numerical components are embedded within contextually specific procedures, and competence requires 'techno-mathematical literacy'. (Hoyles *et al.* 2002)
- Workplace cultures, with instruments, rules and divisions of labour tend to disguise or hide mathematics (Williams & Wake, 2007).

Research on numeracy for nursing

- Still a new area for research despite pioneering work by Susan Pirie in the 1980s (Pirie 1987)
- Growing interest and research activity, much of it small-scale, e.g., evaluations of local interventions
- Danger of re-inventing the wheel

The bigger picture...

- What numeracy do nurses need to be safe and effective?
- And what can mathematics educators do to help?
- A first step...?
 - What's going on around the world in institutions training nurses?
 - What standards are expected at key points in nurse education and continuing professional development?
 - What approaches to teaching, learning and assessing numeracy for nursing are being used?
 - How successful are they and what are the criteria for success?
- We could find out using existing networks such as:
 - o Adults Learning Mathematics - A Research Forum (ALM)
 - o European Federation of Nurse Educators (FINE)
 - o National nursing organisations...

The scope for international collaboration - some examples of recent work in...

- USA
- Australia
- New Zealand
- Finland
- Sweden
- UK
- Elsewhere...

USA

- National shortage of registered nurses (RNs) predicted to continue to grow over next 20 years
- More severe shortage in some States than others
- Health Resources and Services Administration (HRSA) states that
 - “to meet the projected growth in demand for RN services, the U.S. must graduate approx 90% more nurses from U.S. nursing programs.” www.aacn.nche.edu/IDS <http://bhpr.hrsa.gov/healthworkforce/reports/behindrnprojections/index.htm>
- Concern over nurse student drop-out:
 - "National research shows a 30% drop-out rate for Hispanics in nursing programs. This has been directly tied to economic hardship issues that involve the need to support the family and an educational preparation that may not have emphasized the knowledge and skills needed to succeed in the selected program," [Hispanic Times Magazine, June 22, 2001](#)
 - UK: “More than a quarter of the UK's student nurses dropped out of their courses in 2006” (BBC News 9th April, 2008)

Examples of US studies

What's the situation?

- Exploration of the mathematical competencies of baccalaureate degree nursing students (Brown, 2006; Allen & Pappas, 1999)

What can we do about it?

- Evaluation of the efficacy of a teaching strategy in improving beginning nursing student learning outcomes (Rainboth & DeMasi, 2006)

Australia

Concern over nurses' competence in drug calculation:

- Evaluation of an innovation by a teaching team who developed a Safe Administration of Medicines (SAM) website. The site includes a 'Maths for Nurses' learning resources which identify the key numerical concepts and provides an explanation of these concepts, examples and clinical quizzes to ensure skills are contextualised in workplace practice (Behrend, et al., 2006).
- Assisting Nursing students solve drug calculation problems using metacognition and error analysis (Galligan & Pigozzo, 2002).
- Two methods for teaching drug calculation compared:
 - traditional formula-based teaching methods
 - building on students' existing mathematical problem-solving skillsOn the basis of quantitative measures, the formula-based approach appeared more effective.
The findings are supported by other evidence that alternative teaching methods may be more effective in increasing students' confidence, and achieving better long-term recall and transfer of skills (Gillies, 2004).

New Zealand

- Numeracy built into Nurse Education programmes, e.g.,:
 - Christchurch Polytechnic Institute of Technology (CPIT) (Dodds, 2006; http://www.cpit.ac.nz/subjects/mathematics_and_statistics/programmes_and_courses)
- Research
 - ‘Addressing obstacles to success: improving student completion, retention, and achievement in science modules in applied health programmes, with particular attention to Maori’, Kelly Gibson-van Marrewijk, Waikato Institute of Technology
 - Project investigating factors that impact on student completion, retention, and achievement rates for science modules in applied health programmes, with particular attention to Maori.
<http://www.tlri.org.nz/projects/2005/>

Finland

Concern over nursing students' competence in drug calculation:

- basic mathematical proficiency and the medication calculation skills of graduating nursing students in Finland
- how students experienced the teaching of medication calculation.

Aimed to find out whether these experiences were associated with various background factors and the students' medication calculation skills.

The students found it hard to learn mathematics and medication calculation skills.

Overall their mathematical skills were inadequate.

One-fifth failed the medication calculation test.

Positive correlation between students' grades in mathematics (Sixth Form College) and their skills in medication calculation.

(Grandell Niemi, et al., 2001)

Sweden

Concern over competence in drug dosage calculation of students and qualified staff.

- Diagnostic test assessed the mathematical knowledge and skills of experienced nurses, student nurses and physicians.
- Aim: to investigate whether student nurses and registered nurses have adequate knowledge and skills in drug dosage calculation.
- 9 out of 14 test items solved accurately.
- No differences found in the average performance between the two groups.
- To evaluate physicians' knowledge about statutory regulations on drug prescription and legal responsibility, 36 physicians from different health care areas answered a questionnaire. The answers revealed that the majority was not familiar with these regulations.
- The results are discussed in relation to nurse education and the physicians' legal responsibility in connection with drug administration and prescription.

(Kapborg, 1994)

UK: Recent work on numeracy for nursing

- Literature review of broad issues (Sabin 2003)
- Conceptual and theoretical analysis (Weeks et al. 2000)
- Analysis of concept of competence in numeracy for nursing (Hutton 2005)
- Study of techno-mathematical aspects of pediatric nursing practices (Noss et al., 2002; Hoyles et al., 2002)
- Development of local support initiatives and materials (Starkings 2005; Weeks 2005)
- Evaluation of interventions (Hall et al. 2005; Wright 2004)
- Testing of pre- and post-registered nurses (NMC 2004)
- Network conferences in Scotland, England and Wales (NES/University of Nottingham/University of Glamorgan) - and reports to ALM (e.g., Coben, 2008) and elsewhere

Two inter-disciplinary research projects on numeracy for nursing - UK

- 'Medication Dosage Calculation: a benchmark assessment for nursing' funded by NHS Education Scotland
 - establish a national benchmark for numeracy for nursing in Scotland
- 'Numeracy for Nursing at King's College London' (2008), funded by the Department of Education & Professional Studies at King's College London
 - evaluate the assessment of numeracy for nursing in the King's College London undergraduate/Diploma Nursing programme

Medication Dosage Calculation: a benchmark assessment for nursing

Mike Sabin, NHS Education for Scotland

Dr Keith Weeks, University of Glamorgan

Norman Woolley, University of Glamorgan

Dr Carol Hall, University of Nottingham

Professor Diana Coben, King's College London

Dr Meriel Hutton, Consultant & King's College
London

Dr David Rowe, University of Strathclyde



Why a 'benchmark'?

UK NMC requires students to pass a test of “numeracy in practice” at 100% in order to register as nurses (NMC, 2004)

Uncontrolled testing will lead to each Institution, practice area or employer developing their own test, with no measures of reliability or validity and variable standards

Testing in practice is unlikely to provide consistent assessment in terms of complexity, comprehensiveness or context

Background

- Ongoing research funded by NHS Education for Scotland
- Aim to address issues of parity, scope and level in assessing numeracy skills for successful calculation of medication dosages by nurses when they qualify
- First phase of the work developed an evidence-based benchmark assessment tool utilising interactive computer simulations that approximate to real world practice (Coben et al., 2008)
- Next phase seeks to evaluate this tool and compare this with assessing the same skills in a practical setting using task-based activities

A robust competence benchmark will:

- ensure consistency across education providers in meeting the needs of:
 - providers of Nurse education
 - regulator (UK: Nursing & Midwifery Council - NMC)
 - employers
 - students
 - patients
 - public
- encompass levels of numeracy competence
- include process and outcome
- be based on available research evidence
- allow:
 - practitioners to demonstrate achievement
 - universities to demonstrate effective learning and teaching strategies
 - employers to support governance and patient safety

Numeracy for Nursing

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- Interdisciplinary research project in Education and Nursing
- Exploratory investigation of aspects of teaching, learning and assessment of numeracy for nursing:
 - analysing existing data from online numeracy assessment of Nursing undergraduate/Diploma students;
 - critically evaluating assessment instruments and procedures used by King's School of Nursing and recommending improvement as appropriate;
 - characterising the approach to teaching, learning and assessment of numeracy for nursing in King's School of Nursing... with a view to developing future studies, including international comparative studies.

A first step

What's going on
around the world?

A draft framework for international comparison of numeracy in Nurse Education

- Regulatory framework
- Labour market issues re nursing
- Standards of numeracy expected at key points in nurse education and continuing professional development
- Place of numeracy in Nurse Education programme:
 - Integrated/discrete
- Status of numeracy content (if any) in programme
 - Mandatory/advisory, at institution/State/National level
- Approximate proportion of time spent on numeracy
- Assessment of numeracy
 - Formal/summative: contributing to Nurse registration
 - Proportion of final grade
 - Formative
- Specific interventions, e.g.,
 - National (and international?) benchmarks
 - Teaching, learning & assessment

What next?

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