

Towards a benchmark in numeracy for nursing: assessing student nurses' performance in medication dosage calculation

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This paper reports on work in progress on an interdisciplinary project funded by NHS Education for Scotland (NES) which aims to propose a benchmark for numeracy in nursing. It updates our presentation at the ALM-14 conference (Coben, et al., 2008) where we argued the case for such a benchmark and presented our initial research. Following a pilot study in England, the main study was undertaken in Scotland in a sample of Higher Education Institutions with pre-registration nurse education programmes. It explored key issues around determining and assessing the achievement of competence in nursing numeracy with specific reference to medication calculation. We tested the efficacy of a computer-based assessment of pre-registration nurses' medication calculation skills by comparing outcomes from this with calculations undertaken in a practical setting. Participants' performance in the assessments, together with their evaluation of content, will inform our judgements on the suitability of items of assessment for inclusion within a proposed benchmark standard for medication dosage calculations.

The need for a benchmark

Nursing numeracy manifestly matters: to patients, to nurses, to their employers, to the public and to nurse educators (Coben, et al., 2008). However, there is no consensus with regard to the scope, level or means of assessment of this critical area of nursing: no benchmark. From September 2008 the Nursing and Midwifery Council (NMC), the body that regulates the nursing profession in the UK, requires students to pass a test of "numeracy in practice" at 100% before they are allowed to register as nurses (NMC, 2007) but the absence of a benchmark begs the question: 100% of what?

While competence in the numeracy skills required for clinical nursing practice is regarded as a pre-requisite to nurse registration, anecdotally one third of nursing students currently fail calculation tests (Sabin, 2001; Starkings, 2003). The calculating ability of nursing students has been found to be significantly poorer than that of other similar students (Pozehl, 1996). Problems with mathematics are not confined to nursing students but are also present amongst qualified (registered) nursing staff

(Bliss-Holtz, 1994; Cooper, 1995; Kapborg, 1995) (Lerwill, 1999). Indeed, the calculating ability of registered nurses has been found to be poorer than that of pre-registration students in some studies (Kapborg, 1994; Laverty, 1989).

A benchmark would set out the scope and level of the numeracy nurses need in order to practise safely and effectively. If students, teachers and employers all knew what numeracy to expect of registrants at the end of pre-registration nursing programmes, lecturers could help students to become competent in the numeracy they need for nursing; employers could be confident that newly-qualified nurses were competent in numeracy for nursing; registered nurses' numeracy competence could be periodically checked against the benchmark; and nurses, patients and the general public could be assured of nurses' competence with respect to numeracy.

Responsibility for developing this area of nursing practice lies in a partnership between the profession and education in prioritising numeracy learning and support within the curriculum and in practice experience. At present there is considerable variation in patterns of calculation used within the branches of nursing practice (i.e., in the UK: adult, children/paediatric, learning disability and mental health), between different professional groups, and in learning, teaching and assessment strategies adopted by different educational institutions. In the study outlined in this paper, NHS Education for Scotland (NES, <http://www.nes.scot.nhs.uk/>) is doing something about this in Scotland.

The NES Numeracy Reference Group

In the first instance, a NES reference group was established comprising nurses, midwives, pharmacists and allied health professionals, service managers, representatives from higher education institutes (HEIs) and Scotland's colleges, professional organisations and professional regulators. Associated agencies such as NHS Quality Improvement Scotland (<http://www.nhshealthquality.org>), those involved with adult and community education literacies (<http://www.scotland.gov.uk/Topics/Education/Life-Long-Learning/17551>) and wider UK stakeholders such as the Higher Education Academy (HEA) (<http://www.heacademy.ac.uk/>) and the Nursing and Midwifery Council (NMC) (<http://www.nmc-uk.org>) were engaged in the consultation. The NES Numeracy Reference Group undertook a consultation focussing upon issues associated with the identification, development and measurement of numerical competence in the context of healthcare education and practice. The resulting consultation document (NES Numeracy Working Group, 2006) was circulated widely and received considerable interest across the sector in Scotland. On the basis of the consultation and a review of research in numeracy for nursing (Sabin, 2001), NES recognised the need for a standardised numeracy assessment tool for nursing staff at the point of registration to their profession and brought together an interdisciplinary team (see the list of authors above), encompassing expertise in nursing numeracy, numeracy education, computer assessment and psychometrics, to undertake research and development in this area.

Work in progress on the study

This paper reports on work in progress on a study stemming from this work and funded by NES. The study aims to address issues of parity, scope and level in assessing numeracy skills for successful calculation of medication dosages by nurses

when they qualify, as part of a wider aim to propose a benchmark for numeracy for nursing.

The first phase of the study made the case for a benchmark in numeracy for nursing and identified appropriate principles and criteria (Coben et al., 2008). We developed an evidence-based benchmark assessment tool utilising interactive computer simulations that approximate to real world practice, focussing initially on drug dosage calculation based upon the Authentic World® (<http://www.authenticworld.co.uk>) computer model developed at the University of Glamorgan (Weeks, Lyne, Mosely, & Torrance, 2001; Weeks, Lyne, & Torrance, 2000).

We are currently (in 2009) exploring key issues around determining and assessing the achievement of competence in medication dosage calculation through a comparison of this computer-based assessment tool with the assessment of the same skills in a practical setting using task-based activities with a sample of Final Year students in pre-registration nurse education programmes in Scotland. This follows a pilot study with student nurses from one university in England, undertaken in 2008 at the beginning of their final year of study.

In the pilot we found a reasonable to very high level of congruence between the two assessment methods. We also identified aspects of nursing numeracy which were not assessed in our online assessment tool, for example, when students drew up air into a syringe along with (simulated) liquid medicine and then ‘read off’ the amount of medicine as including the (potentially lethal) air bubble, thereby presenting a wrong volume of ‘drug’ in spite of a ‘correct’ reading of the plunger level. This has led us to plan further work on the assessment of competence in numeracy for nursing. We concluded that:

The pilot study was invaluable in resolving practical issues. It provided early indications that the two methods of assessing medicine dosage calculations produced similar results (mean congruence between student performance within the two environments = 80%). This suggests that this particular computer assessment of drug calculations should give a good indication of a student’s performance in practice. What it also showed was that while the computer model was able to assess conceptual and calculation skills and to an extent technical measurement skills, it could not assess all of the wider numeracy issues involved with safety in medicines measurement (for example dispelling air from a syringe). (Hutton, et al., in press)¹

Since September 2008 we have been using the research design piloted in England with final year nursing students at six HEIs in Scotland. We assessed the students towards the start of their final year of study. Students were also asked to evaluate the usefulness and authenticity of the packages. At the time of the presentation of this paper, data collection is complete and data analysis is under way, so it is not possible to include findings at this stage.

¹ A corrected proof of this article is online at <http://www.nurseeducationtoday.com/inpress>

Postscript

A new website for the project has been launched since the ALM-16 conference (<http://www.nursingnumeracy.info>) and before this paper went to print. The site includes the final report on the study outlined here (Coben, et al., 2010), thereby updating this paper, and allows others to use the exemplar benchmark assessment to assess their own programmes and assessment and to comment and add to current knowledge.

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