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Applied Numeracy Assessments within the Nursing Associate Curriculum

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The Nursing Associate is a new role in nursing in the UK, creating a bridge between unqualified health care assistants and registered nurses. Health Education England (HEE) and the Nursing and Midwifery Council (NMC) were instrumental in designing a national curriculum for HE courses leading towards this new qualification (HEE, 2017). Pilot schemes were quickly set up involving a number of universities. The University of Gloucestershire's 2-year Foundation Degree Nursing Associate course began in April 2017, involving close collaboration with local healthcare Trusts.

Initially, the exact parameters of the NA role had not yet been officially determined by the NMC and Government. The introduction of the new role had proven contentious, as it was thought to undermine the profession's long-fought for accession to all-graduate status by essentially reintroducing the state enrolled nurse role (Brindle, 2018). The various professional, practical and legal implications of this new tier of nurse registration required extended consultation and deliberation. Advisory guidance on the scope of registered practice emerged in March 2018 (HEE, 2018; Bouzanne, 2018), followed by NMC standards in October 2018 (2018). The latter publication moved the academic goalposts for the pilot NA programme significantly. A requirement for TNAs to achieve 100% in an applied numeracy examination was stipulated as a minimum benchmark for registration as nursing associates:

“Ensure that all programmes include a health numeracy assessment related to nursing associate proficiencies and calculation of medicines which must be passed with a score of 100%.” (NMC, 2018; p5)

Much debate has taken place about how to appropriately deliver vocational mathematics within a curriculum with safety-critical work in mind (Coben & Weeks, 2014). In the case of

nursing, drug errors can result in poor patient outcomes, including death (Armitage, 2009). It is beholden upon all stakeholders to work to minimise the incidence of medication errors across the NHS. This is a complex area, where errors can occur “*during the prescription... dispensing, and administration phases of drug preparation and distribution*” (Wolf, 1989; p8). Medication errors make up about a quarter of litigation cases in the NHS (Harvey *et al*, 2010).

Yet, there are serious questions about the actual effectiveness of mathematics tests to screen out poorly prepared nurses (Ludwig-Beymer *et al*, 1990). Although it seems self-evident that there should be a correlation between medication errors and poor numeracy skills among nurses, investigative research studies have produced, at best, mixed results (Conti & Beare, 1988; Calliari, 1995), with serious questions raised about whether written tests reflect clinical efficacy with drug calculations (Wright 2007). Following up her research with a literature review, Wright “*found insufficient evidence to suggest that medication errors are caused by nurses poor calculation skills*” (2010). Calculation errors can be a contributing factor, but numeracy skills appears to be one issue among many (O’Shea, 1999): Coroners Court reports involving deaths from medicines reveal a broad sweep of extant issues across the multidisciplinary *piste* (Ferner, Easton & Cox, 2018).

For decades, there has been a consistent problem with poor performance of nurses taking numeracy tests; to some extent irrespective of accumulated clinical experience (McMullan, Jones & Lea, 2010; Dilles *et al*. 2011; Arkell & Rutter, 2012). For student nurses, anxiety is an important factor influencing efficacy with drug calculations (McMullan, Jones, & Lea, 2012). Where previously attained qualifications in mathematics provide the strongest non-affective indicator for success, ‘maths anxiety’ is the strongest affective predictor for numeracy performance among student nurses (Thompson *et al.*, 2015). Van der Mortel *et al* advocate a consistent pass mark throughout a nursing course to build resilience (2014).

In response to this challenge, formalised testing of numeracy skills to agreed standards has systematically grown in the UK over the last two decades, within both nurse education and practice (Merrifield, 2016). In 2008, this culminated in a required 100% pass-mark in applied numeracy skills as a pre-requisite for nurse registration (NMC, 2007). Higher Education Institutions (H.E.I.s) can each interpret how to assess these skills (Coben *et al*, 2008), subject to NMC quality assurance. This devolution allows institutional differences in complexity and rigour when setting examination questions: There is no standardised national benchmark.

Overly simplistic and formalised word-based questions have been criticised for being unrealistic by not properly establishing a proper experiential understanding of applied numerical calculations in practice (Coben & Weeks, 2014). Insofar as it is possible to immerse a written examination question into an authentic setting, questions need to reflect the ‘real-world’ experience of a practising nursing associate. There is an uneasy juxtaposition between theory and practice here, where classroom teaching of mathematics can reach a high conceptual level whilst set within a simplistic framework, compared with a fairly rudimentary set of mathematical skills which must then be applied to problems of significant complexity within the workplace (Steen, 2004).

Questions should test competence on both conceptual and interpretative levels, as well as determining the candidate’s firm numerical grounding (Wright, 2007). These need to be aligned with the Essential Skills Cluster for nursing associates, reflecting their areas of clinical responsibility within medicines management (NMC, 2018a; p6), appropriate for relevant learning standards expectations set out by the Quality Assurance Agency for Higher Education (QAA, 2014; p23). Word-based questions suggestive of an appropriate practical context can build ‘error wisdom’ (Reason, 2004), but can be misinterpreted if they lack sufficient clarity. This can be a significant issue if the pass mark is 100%. Sitting a 30

question paper, TNAs may achieve 28 or 29 correct answers; sometimes repetitively. This is to be expected in terms of error theory, but can be extremely stressful for trainees who consistently ‘just’ fail. Furthermore, the disparity between lowering entry requirements and heightened learning outcomes has created a great deal of stress and anxiety among students faced with summative applied numeracy examinations, in keeping with similar issues already faced by student nurses (Van der Mortel, Whitehair & Irwin, 2014). Dropping a mark or two is a source of frustration for all concerned, but does not necessarily indicate that the candidate would be unsafe in practice.

Arguably, raising the bar regarding numeracy skills of nurses, and particularly nursing associates, has a *significant* potential downside. Those attracted to nursing often have a poor numerical aptitude compared to their professional peers (Arkell & Rutter, 2012), and such candidates, who would otherwise make excellent person-centred caring professionals (Lloyd & Chippendale, 2018), may be screened out by an assessment process which demands numerical perfection. Foundation degree and Higher Apprenticeship nursing associate programmes are funded, and sometimes *selected for*, by healthcare trust partners based upon internal mathematics and literacy tests. This fragmentation is moving even further away from the central standardisation of pre-course testing sensibly advocated by Roberts and Campbell (2017), and creates an influx of trainees who lack functional skills in mathematics and literacy.

The introduction of the NA role aims to tackle the recruitment and retention issues within the nation’s nursing workforce (House of Commons Health Committee, 2018). The introduction of the nursing associate role had lowered the bar into nursing in numeracy, yet the 2 year learning outcome for TNAs is 100% mastery. Quixotically, our undergraduate student nurses reaching the equivalent progression point at the end of the second year need to achieve a 90% pass mark in applied numeracy (although the complexity of the questions is higher, as they

are tested on IV drug calculations which are more challenging, even for experienced registered nurses (McMullan, Jones and Lea 2010)).

Within the NHS itself, there has been a growing acceptance of the inevitability of medication errors, despite all efforts to mitigate them through clinical governance and risk management strategies. Armitage (2009) argues that this shift away from an organisational blame culture was influenced by the psychologist James Reason (2000), whose application of error theory to healthcare made a distinction between the person approach (mistakes resulting from forgetfulness, inattention, etc.) and the system approach, where errors are considered inevitable consequences of error traps and processes and must be learned from to build systemic resilience. Reason called upon nurses to make use of their 'error wisdom' to mitigate the risk of clinical errors (2004).

Within this context, contemporary requirements to achieve numerical perfection seem draconian, and misplaced. As previously argued by Kerri Wright (2012), regulatory emphasis upon written drug calculation tests is not well supported by research (which is ironic in a profession which strongly advocates evidence-based practice), and does not offer any real comfort regarding future performance of qualifying graduates. Mandating a 100% pass mark does not represent regulatory balance, but rather the desire of a profession to appear whiter than white. This 100% policy may already be proving counterproductive. Its unintended consequence is that we deny professional career pathways to some much-needed nurses and nursing associates, leaving the NHS struggling to cope with demand in the wake of unfilled vacancies, and thereby, in the end, putting patient care at risk. There are clearly risks in both directions, and a more appropriate balance needs to be struck.

Many of the research studies examining numeracy among nurses and student nurses took place between 2007 and 2011. This was understandable given the educational changes taking

place at that time within nursing and allied professions. Surprisingly, there seems to have been little work published since 2014 (based upon relevant searches using keywords ‘numeracy’, ‘nursing’ and/or ‘nurses’ using multiple databases including CINAHL, Science Direct, HEA search). While there should be a continued focus upon attaining high levels of applied numeracy skills among nurses and nursing associates as part of a broader medicines management curriculum, research is urgently needed to review the efficacy, or otherwise, of the NMC’s 100% policy over the last decade or so.

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