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Numeracy Skills for Undergraduate Nursing Students' Clinical Skill Assessment: An Expository Analysis

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Abstract

Introduction: Nursing and mathematics are synonymous, particularly in clinical settings. Numeracy skills have been identified as one of the competency elements for outcome-based education in nursing. Studies have shown that undergraduate nursing students continue to perform poorly on clinically-related numeracy tasks, making errors that betray fundamental misconceptions about the underlying mathematics. These conditions can be eliminated when an effort is made and the effects can be rewarding for nursing students, nursing academics and as well as improving patient care.

Aim: This study aimed to address the importance of numeracy skills for undergraduate nursing students' clinical skill assessment.

Method: This study used an expository analysis approach to address the issues of the importance of numeracy skills competency in the clinical skill assessment of undergraduate nursing students. We have analysed the current undergraduate nursing curriculum and clinical skill assessment components. Moreover, we also review the available literature related to numeracy skills competency for nursing students and newly registered nurses.

Finding: Numeracy skills are one of the important elements of competencies skills that have been introduced to the current Malaysian undergraduate nursing programme. However, the achievement part of it is still questionable. Evidence has shown that new graduate nurses often lack the numeracy skills needed to enable them to do their jobs safely and effectively in the clinical setting. Among the errors done by the new graduate nurses and nursing students are drug calculation errors and which accounted for 30-40% in the clinical.

Conclusion: Numeracy skills competency assessment is vital for undergraduate nursing students who have to make complex calculations and analyse the patient's situation in their clinical setting. Improving numeracy skills for undergraduate nursing students can reduce medical errors and ultimately improve efficiency in the nursing care towards their patients.

Keywords: Numeracy Skills; Undergraduate Nursing; Clinical Skill Assessment; Nursing Competency

Introduction

In the current sophisticated clinical setting, nursing and mathematics are synonymous. Nurses are often intimated by the skills such as arithmetic, mathematics and analysing of the situation of patients that occur in daily clinical practice. Those skills are known as numeracy skills "*the ability to understand the numerical and graphical or visual data in daily clinical life*" [1,2]. Moreover, patient safety depends on the clinical practitioner's ability to calculate the correct medication dosage, proper interpretation of the haemodynamic parameters and diagnostic investigation results, correct usage of equipment required for patient care and so on [1,3].

Healthcare personnel including doctors and nurses often lack the numeracy skills needed to enable them to do their jobs safely and effectively. They cannot accurately perform drug calculations, drug percentages and infusion rates in the clinical setting [4,5]. Whilst further research is needed to establish how improving numeracy could improve patient safety. Moreover, studies suggested that improving numeracy skills is integral to increasing patient safety and reducing the costs of preventable patient stays in the hospital [1,3].

Among the numeracy skills that apply in the clinical setting, the ability to perform drug calculations accurately is an essential skill for practitioners including nurses worldwide. It is assumed that when administering medications to patients, it is required to be 100% accurate by the performance of nurses on drug calculation. Incorrect calculation of drugs can lead to medication errors including adverse complications in patients. Medication error is a global issue concerning patient safety and is an important cause of morbidity and mortality of patients [6-8].

Globally, the economic impact of medication error is estimated at USD 42 billion every year [9]. There has been a rise in global attention on safe medication practices. The World Health Organization (WHO) launched the "*Medication without Harm*", which is a global patient safety initiative aiming to reduce severe, avoidable harm related to medications in all countries by 50% in the next 5 years [9]. In Malaysia, several studies have been conducted and it was found that the rates of medication error reported varied between 11.7 to 97.7% [10-13].

Studies have categorised the medication errors as three distinct groups that have occurred by the nurses. Those groups are referred to as conceptual errors, arithmetical errors and computational errors. Conceptual errors are the most common type of errors found in the literature and involve the inability to formulate the mathematical question correctly from the information given. Arithmetical errors occur when a person is unable to operate an equation correctly. Computational errors involve the miscalculation of simple functions such as multiplication, division, subtraction or addition [14-18]. If we look at those three distinct groups, all of them are related to having poor numeracy skills applied by nurses.

On the other hand, although numeracy skills have been identified as one of the competency elements for outcome-based education in the undergraduate nursing programme. However, the competency assessment of those skills posed by the nursing students is still in the infancy stage [19]. Studies have shown that undergraduate nursing students continue to perform poorly on clinically-related numeracy tasks, making errors that betray fundamental misconceptions about the underlying mathematics. These conditions can be eliminated when an effort is made and the effects can be rewarding for nursing students, nursing academics and as well as improving patient care and safety. Thus, this study aimed to address the importance of numeracy skills for undergraduate nursing students' clinical skill assessment.

Method

This study used an expository analysis approach to address the issues of the importance of numeracy skills competency in the clinical skill assessment of undergraduate nursing students. This approach is used since there is research on expository writing that is still limited. Furthermore, the addressed issues are extremely recommended to be discovered [20]. To achieve the purpose of this study, we have analysed the current undergraduate nursing curriculum and clinical skill assessment components. Moreover, we also review the available literature related to numeracy skills competency for nursing students and newly registered nurses. The detailed findings of the expository analysis are described in the following session.

Findings

Current Undergraduate Nursing Curriculum

The undergraduate nursing programme is designed to provide the knowledge, skills and attitude necessary to be competent, safe and efficient nurses. The current undergraduate nursing curriculum in Malaysia is aligned with the organization`s mission to widen excess to quality education as well as to provide lifelong learning opportunities for nursing students. The current nursing curriculum is divided into two distinctive types of courses, including theoretical and practical. Both are important and provide different contributions to learning. Additionally, practical experience is a very important constituent of the socialization of nurses.

Moreover, the nursing education landscape has shifted to become an Outcome-Based Education (OBE) in Malaysia. This outcome-based learning curriculum requires nursing students to be prepared to meet the demands of the nursing profession with a high level of competency as they enter the real clinical environment in the future. The introduction of the OBE in nursing education has proven to improve competency in knowledge, cognitive skills, clinical skills and nursing core competencies with high behavioural skills while performing procedures [21]. This dynamic interaction in the advancement of technology in the OBE nursing education may have a direct influence on the students' academic and clinical performances therefore they need to understand what a digital life looks like nowadays and compare it to how it looked before [22].

Furthermore, the current undergraduate nursing curriculum emphasizes what learners should know, understand, and demonstrate and how to adapt to life beyond formal education. The numeracy skills have been identified as functional work skills competency elements for outcome-based education in the current undergraduate nursing curriculum of Malaysia. All the nursing clinical subjects' learning outcomes have numeracy skill elements for the learner to achieve at the end of their study.

Current Clinical Skill Assessment

In the current nursing curriculum, formative and summative assessments are used to assess the clinical competency of nursing students. Formative assessment is usually carried out as a running assessment in the clinical setting and summative assessment is carried out in a structured setting like the clinical skill assessment centre of the institution. For the summative assessment, objective structured clinical examinations are often used. However, those methods view nursing competency from a behaviourist point of view, and the major focus is on clinical skill performance in clinical settings.

Needless to say, nursing practice is situation-dependent. To reflect on a particular clinical situation, it is important to understand the background of that situation. Once a nurse determines and shares the direction of the nursing care with the person receiving the care and explains the reasons and anticipated outcomes, reflection becomes a factor for competency improvement. Clinical judgment training through reflection is important for improving nursing competency; however, reflection by itself does not improve all competencies. Nursing competency includes a variety of components, such as knowledge, skills, attitudes, thinking ability and values; therefore, nursing competency training should incorporate various educational programs. To train all areas of nursing competency, it is necessary to

understand the attributes and components of these nursing competencies as parts of the clinical ladder and develop training methods that address the order of competency acquisition. Moreover, in addition to evaluating nursing competency, further discussions and research are needed to examine the outcomes of competency improvement.

Evaluation is a systematic process to collect, analyse and interpret the data which is implemented in order to control the progression of the programs accurately toward predetermined goals and to understand the cost-effectiveness or determination of the value of ongoing programs. George Miller proposed a framework for the evaluation of clinical competence. At the lowest level of his proposed pyramid, knowledge (knows) is placed and at the next level, there are respectively competence (knows how), performance (shows how) and action (does). Accordingly, skill-based assessment methods are placed at the top level of the pyramid. One of these methods is objective structured clinical examination (OSCE).

OSCE method can easily evaluate learners' basic and fundamental skills in cognitive, emotional and psychomotor domains and it can eliminate the effect of confounding variables by representing students' skills in different stations. At the same time, this method is completely reliable, stable and practical. In OSCE, one or more assessment tools are used during a few separate stations, during which the test subjects encounter the patient or simulated patient and each station usually takes 5 minutes to be completed. The entire test subjects move from one station to another in a specific order based on a predetermined program. However, the pre-prepared checklist used in the current nursing clinical skill assessment is step driven and mainly focused on dexterity performance rather than the attitude and thinking ability of the students. Moreover, the numeracy skill component in the current OSCE checklist can be still questionable and not clearly seen in most of the procedure checklists.

Literature Review Findings

Numeracy skills are one of the important elements of competencies skills that have been introduced to the current Malaysian undergraduate nursing programme. However, the achievement part of it is still questionable. Medication calculation errors may decrease the clinical effectiveness of a drug, and increase the incidence of adverse drug events, morbidity, mortality and health care costs. Additionally, errors in calculation and medication administration can threaten a nursing career. However, nurses often perform poorly on numeracy tests.

Experience does not necessarily improve applied numeracy skills, as qualified nurses as well as nursing

students often struggle with such skills. To address this issue some nursing accrediting authorities have determined that 100% mastery of medication-related calculations and administration is required of nursing students upon registration in order to ensure patient safety. Evidence has shown that new graduate nurses often lack the numeracy skills needed to enable them to do their jobs safely and effectively in the clinical setting. Among the errors done by the new graduate nurses and nursing students are drug calculation errors and which accounted for 30-40% in the clinical.

Discussion

The curriculum is the heart of every educational institute and every nursing program. The curriculum sets the goals, outcomes, standards, philosophy, and content that each nursing student will learn and perform. A high-quality nursing curriculum plays an important role in preparing effective nurses or holistic nurses for the current and future health care delivery system. Student assessment is a critical aspect of the design of the undergraduate curriculum. A previous study suggested that when learning outcomes are externally mandated (or strongly encouraged), it is important that institutions have effective road maps for their implementation [23].

Assessment of clinical skills is an essential component of undergraduate nursing education because it provides information about potential knowledge deficits and attitudes that interfere with the successful performance of patient care skills. Many studies on nursing competency training methods have focused on basic nursing education and little has been studied on clinical skill competency assessment [24-26].

The OSCE is a new form of evaluation that first was designed and implemented by Dundee in the mid-1970s in Scotland. A core competency of nursing is "the ability to practice nursing that meets the needs of clients cared for using logical thinking and accurate nursing skills." The nursing competency structure consists of four abilities: the ability to understand needs, the ability to provide care, the ability to collaborate and the ability to support decision-making. These four abilities are closely related and utilized in all types of nursing practice settings.

Nowadays, nurses' responsibilities are not only serving the medication to patients, but also need to analyse the situation of patients' clinical condition, analyse the investigation results of the patients, interpret the haemodynamic status of the patients, and many more numerical activities in daily life. Therefore, they should be competent with numeracy skills to deal with all the situations in the clinical setting. A recent study also showed that it is important to have a well-structured clinical skill assessment tool to assess the nursing student's competency level in order to produce holistic graduate nurses who equip with clinical skills and soft skills for the current healthcare delivery system [27]. Thus, it is important to have holistic nursing competency assessment methods which not only focus on psychomotor skills assessment but should assess their thinking skill like assessing the numeracy skills which contributes to improving nursing quality.

Conclusion

Numeracy skills competency assessment is vital for undergraduate nursing students who have to make complex calculations and analyse the patient's situation in their clinical setting. Improving numeracy skills for undergraduate nursing students can reduce medical errors, prevent further complications and ultimately improve efficiency in the quality nursing care towards their patients.

Conflict of Interests

There is no conflict of interest. The development of this manuscript is part of a PhD study.

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