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Medication competency of nurses according to theoretical and drug calculation online exams: A descriptive correlational study

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SUMMARY

Background: Medication administration is an important task of registered nurses. According to previous studies, nurses lack theoretical knowledge and drug calculation skills and knowledge-based mistakes do occur in clinical practice. Finnish health care organizations started to develop a systematic verification processes for medication competence at the end of the last decade. No studies have yet been made of nurses' theoretical knowledge and drug calculation skills according to these online exams.
Objectives: The aim of this study was to describe the medication competence of Finnish nurses according to theoretical and drug calculation exams.
Design: A descriptive correlation design was adopted.
Participants and settings
All nurses who participated in the online exam in three Finnish hospitals between 1.1.2009 and 31.05.2014 were selected to the study (n = 2479).
Methods: Quantitative methods like Pearson's chi-squared tests, analysis of variance (ANOVA) with post hoc Tukey tests and Pearson's correlation coefficient were used to test the existence of relationships between dependent and independent variables.
Results: The majority of nurses mastered the theoretical knowledge needed in medication administration, but 5% of the nurses struggled with passing the drug calculation exam. Theoretical knowledge and drug calculation skills were better in acute care units than in the other units and younger nurses achieved better results in both exams than their older colleagues.
Conclusion: The differences found in this study were statistically significant, but not high. Nevertheless, even the tiniest deficiency in theoretical knowledge and drug calculation skills should be focused on. It is important to identify the nurses who struggle in the exams and to plan targeted educational interventions for supporting them. The next step is to study if verification of medication competence has an effect on patient safety.

Introduction

Medication administration is one of the most important tasks and responsibilities of registered nurses (Sung et al., 2008). At the same time, medication errors are an internationally significant cause of morbidity and mortality in hospitalized patients (Kohn et al., 2000) and especially in IV therapy (Dennison, 2007; McDowell et al., 2010). All registered nurses and midwives (henceforth nurses) in Finland are trained to be responsible for performing medication. Their expertise in medication, compared to other nurses (practical nurses, enrolled nurses, etc.), is intravenous (IV) therapy.

According to previous studies, nurses lack theoretical knowledge (Morrison-Griffiths et al., 2002; Brady et al., 2009; Keers et al., 2013) and drug calculation skills (Grandell-Niemi et al., 2006; Wright, 2007). Knowledge-based mistakes do occur (Taxis and Barber, 2003), and drug calculation is also a crucial skill as one mistake in calculation can lead to a fatal medication error (Glaister, 2007; McMullan et al., 2011). Hence, adequate medication competence is the basis for safe medication practice (Sulosaari et al., 2014). In this study, the focus is on nurses' theoretical knowledge and drug calculation skills in medication.

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Background

Medication administration involves both the intellectual activity and the physical act of medication preparation or administration (Brady et al., 2009). In the literature, medication competence is defined as a complex combination of knowledge, skills, performance, values, attitudes, and decision-making competence (Cowan et al., 2005; Sulosaari et al., 2011).

The medication competence of nurses appears to vary depending on training and experience (Veräjänkorva, 2003; Khomeiran et al., 2006; Dyjur et al., 2011) but according to a previous study the age, previous occupation or working experience of the participants is not associated with nurses' drug calculation skills (Grandell-Niemi et al., 2006). However, medication competence does not increase linearly but involves a more complex and individual process (Arbon, 2004). For this reason, nurses need to update their skills and knowledge regularly (Meretoja and Koponen, 2012; Keers et al., 2013).

Nurses feel anxious about drug calculations and lack confidence in their abilities (Glaister, 2007). A learning approach to medication education that offers greater support than traditional teaching approaches is warranted (Glaister, 2007). The prevalence of developmental dyscalculia (learning disability in mathematics) in the school population ranges from 3% to 6 % (Shalev et al., 2000). On the other hand, nurses are aware of their mathematical skills (Grandell-Niemi et al., 2006). Nurse students' medication competence in drug calculations is evaluated regularly during studies (Sulosaari et al., 2014) but registered nurses do not voluntarily and regularly practice to maintain their calculation skills (Grandell-Niemi et al., 2006). Nonetheless, a literature review found insufficient evidence to suggest that medication errors are caused by nurses' poor calculation skills (Wright, 2010).

Both theoretical and practical assessments have to be passed in order to register as a nurse (Watson et al., 2002) and previous studies have recommended nurses' theoretical competence to be verified regularly (Walsh et al., 2009; Sulosaari et al., 2011). Since the Finnish Ministry of Social Affairs and Health published a handbook for safe pharmacotherapy in 2006, Finnish health care organizations have started to develop systematic verification processes for medication competence. All the nurses of this study, regardless of department, are required to perform the verification process for medication competence to receive a local medication license which is valid for 5 years. An e-learning course was organized for this purpose as it is a cost-effective and time and place independent learning method (Atack, 2003; Sneck et al., 2015). In e-learning, students take responsibility for their own learning, i.e. self-regulated learning. This learning method is recommended also for nurses' undergraduate programs. (Latter et al., 2001; Sulosaari et al., 2014).

Within the past few years, the majority of Finnish nurses has completed some kind of a medication competence test, but there does not seem to be any studies on the testing as of yet. This study will provide new and pertinent knowledge. European institutions seek methods and tools that would best contribute to ensuring safe and high-quality care (Cowan et al., 2005; Stievano et al., 2009; European Commission, 2010). Even though this study was conducted in a limited area, theoretical knowledge and drug calculation skills can be considered universal in nursing. Hence, the results of this study can be utilized internationally.

Research Design and Methods

Aim

The aim of the study was to describe the medication competence of nurses according to the theoretical and drug calculation online exams.

More specifically, the research questions of the study were as follows:

1. What is the nurses' theoretical medication knowledge according to the online exam?
2. What is the nurses' drug calculation skill level according to the online exam?
3. What characteristics of the nurses or the exam are related to their medication competence according to the online exam

Design

A descriptive correlation design was adopted.

Sample/Participants

The target population consisted of registered nurses, midwives, and ward sisters (they all are qualified to work as registered nurses in Finland) from a university hospital and two district hospitals (N = 2723 in June 2014). All the hospitals selected used the same e-learning course and were therefore chosen to participate in this study. All nurses who participated in the online exam between 1.1.2009 and 31.05.2014 were selected to the study.

There were altogether 2479 participants in this study. They had taken 6663 exams in all (2960 theoretical exams and 3703 drug calculation exams). These exam results provided altogether 137,978 separate answers to be analyzed (118,400 theoretical questions and 19,578 drug calculation questions).

Data Collection

The data were collected using electronic material, i.e. results of the exams. The e-learning course consists of online study material and two online exams. The content of the study material is based on the Finnish graduating nurses' medication competence requirements. In the online study material, there is a conscious focus on IV therapy. The theoretical exam contains 40 multiple-choice questions based on the study material and to pass the exam nurses need to answer 75% of the questions correctly. The drug calculation exam contains three questions. To pass the exam nurses need to complete 100% of the drug calculations correctly. The use of the e-learning study material while taking the exam is permitted, as of 2011, and a calculator is allowed for drug calculations. (Ministry of Social Affairs and Health, 2009). Table 1 presents the grouping of the questions i.e. question bank.

There is a time limit of 60 minutes in the theoretical exam and 30 minutes in the drug calculation exam. In case of dyslexia, extra time and exam in printed form can be allowed. All nurses are automatically given three attempts to pass the exams, but they can apply for permission for three more attempts from their head nurse.

Table 1
Number of questions in the question bank.

Exam	Group of questions	Number of questions
Theoretical	Anatomy and physiology	11
	Blood transfusion	6
	Clinical pharmacology	7
	Emergency medication	3
	Medication management, administration, and asepsis	29
Drug calculation	Basic arithmetic and conversions	4
	Basic dosage calculations	14
	Complex dosage calculation	11
	Diluting and solutions	14
	Flow rates	6