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Web course on medication administration strengthens nursing students' competence prior to graduation

Sari Mettiäinen [a,*], Katja Luojus [b], Satu Salminen [c], Meeri Koivula [d]

[a] Tampere University of Applied Sciences, School of Health Care, Kuntokatu 3, 33520 Tampere, Finland
[b] Pirkanmaa Hospital District, PL 2000, 33521 Tampere, Finland
[c] Tavastia Education Consortium, Hattelmalantie 8, 13100 Hämeenlinna, Finland
[d] University of Tampere, School of Health Sciences, Nursing Science, University of Tampere, 33014 Tampere, Finland

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ABSTRACT

Background: Nursing students' competence has been found inadequate in mastering of pharmacotherapy regulations and prescriptions, pharmacology, medical calculations, fractional and decimal numbers, and mathematics on the whole.
Objectives: The study investigated the efficacy of an additional medication administration web course in increasing nursing students' self-evaluated competence on medication administration.
Design: Finnish nursing students self-evaluated their medication administration competence before and after the web-based medication course. Design was quasi-experimental.
Participants: 244 students answered the questionnaire before and 192 after the web course.
Methods: An online self-evaluation questionnaire was developed to measure students' competence on basic pharmacotherapy, intravenous medication and infusion, blood transfusion and epidural medication. The data was analysed with SPSS 18.0 software using descriptive analyses and comparing sum variables with Man-Whitney *U*-test.
Results: The medication administration web course, which took 8 h on average, significantly improved self-evaluated competence of nursing students in all the fields.
Prior to the education most defects were found in matters concerning compatibility and adverse effects of pharmaceuticals and solutions and in epidural medication competency. The education strengthened all these competencies.
Conclusions: It is necessary to revise medication administration before graduation and web-based learning can be used in it.

Introduction

Reducing medication errors to improve patient safety is a fundamental target on today's health care agenda (Page and McKinney, 2006). Organizational processes of medication administration and nurses' and nursing students' education have improved (Sung et al., 2005). In Finland, the Ministry of Social Affairs and Health published a guide in 2006 with the purpose of standardising pharmacotherapy and related division of responsibility. The aim has been to standardise pharmacotherapy education with national recommendations, and the recommended minimum extent is nine ECTS credits in nursing education (Ministry of Education and Culture, 2006). The contents, implementation manner and amount of pharmacotherapy education vary depending on the educational institution both in Finland and abroad (Ministry of Social Affairs and Health, 2006; Manias, 2009).

Literature

Finnish nurses work as independent nursing experts and implement medical care in accordance with physicians' instructions. Responsibility for implementation of pharmacotherapy and monitoring of patients' condition are emphasised in nursing. (Ministry of Social Affairs and Health, 2006; Finnish Nurses Association, 2013.) Nurses' responsibility has increased and tasks such as assessment of the need for treatment, venous cannulisation, implementation of intravenous medication and blood transfusions have been transferred from physicians to nurses (Partanen et al., 2004). As a rule, newly graduated nurses only have a short

* Corresponding author. Tel.: +358 503732949.
E-mail addresses: sari.mettiainen@tamk.fi (S. Mettiäinen), katja.luojus@pshp.fi (K. Luojus), satu.salminen@kktavasti.fi (S. Salminen), meeri.koivula@uta.fi (M. Koivula).

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orientation at the workplace and thus the nursing education has to give them good readiness for implementation of pharmacotherapy.

Registered nurses are expected to be competent in implementing safe pharmacotherapy immediately after graduation (Wright, 2008), but the education does not necessarily provide sufficient competence for this (Bullock and Manias, 2002). The possibilities of pharmacotherapy have increased and the forms and dosage of pharmaceuticals have developed (Hughes and Ortiz, 2005; Ndosi and Newell, 2009). As pharmacotherapy is more and more demanding, pharmacotherapy teaching is also more and more challenging (Kvist and Vehviläinen-Julkunen, 2007).

Nursing students' competence has been found inadequate in mastering of pharmacotherapy regulations and prescriptions (Murtola, 1999), pharmacology (Bullock and Manias, 2002; Veräjäkorva and Leino-Kilpi, 2003; Grandell-Niemi, 2005), medical calculations (Walsh, 2008; Reid-Searl et al., 2010), fractional and decimal numbers, and mathematics on the whole (Brown, 2002; Johnson and Johnson, 2002).

Medication administration errors are one of the most common adverse events (Manno, 2006) and many of them are potentially preventable (Baker et al., 2004; Harding and Petrick, 2008). Medication errors arise from both individual and system failures such as busy work environment or procedures (Dean et al., 2002). Human factors often lie behind recurrent medication errors (Ulanimo et al., 2007). Harding and Petrick (2008) found that contributing factors for medication errors made by nursing students were rights violations, system factors, and knowledge and understanding.

According to Calliari (1995), the more education persons have, the less likely they are to make errors. It is possible to improve nurses' ability in medication calculation (Bayne and Binder, 1988; Binder and Bayne, 1991), pharmacodynamics and pharmacokinetics (Hamner and Morgan 1991) by using routine or periodical tests and giving some support in maintaining the skills.

According to Page and McKinney (2006) nursing education has the potential to make a substantial contribution to medication safety. They challenge all professionals to develop and share innovative ideas that lead to good practice (Page and McKinney, 2006). There is urgent need to maximize the medication administration ability of new nurses to improve their self-confidence in clinical situations (Sung et al., 2008).

E-learning education based on self-directed learning has been expanding recently (Sung et al., 2008). Virtual learning environments offer a safe environment to study the material at one's own pace (Heidari and Galvin, 2002). In the virtual environment, it is possible to explain mathematical concepts, problems and formulas with illustrative examples (Wright, 2005). Self-evaluation tests can be used to motivate and encourage students to assess their own learning (Knight, 2001).

Method

Medication administration web course

In this study the focus is on an additional medication administration web course, which was completed in Moodle e-learning platform. The course aimed at updating students' competence and providing them with better abilities to implement pharmacotherapy in working life. The course consisted of four parts: basics of pharmacotherapy, intravenous medication and infusion, epidural medication, and blood transfusions. The material included texts, multimedia tools such as illustrations and short videos to enhance learning, and a web-based question delivery system for self-assessment and learning. There was also a final test which participants had to pass. Testing as a final activity has been found to increase learning outcomes compared with spending an equal amount of time studying without a test (Kromann et al., 2009).

This clinical practice oriented e-learning programme on medication administration was developed and is widely used in Finland. Self-learning modules, such as this web course, are a cost-effective and timesaving method which is easily available for new staff or students without scheduled lectures and is especially good for repeated topics such as medication (Kang, 2002; Sung et al., 2008).

Aims of the study

The study aimed at establishing the usefulness of the additional medication administration web course for graduating students' competence.

The studied questions were:

1 At what level is the perceived medication administration competence of nursing students prior to the web course?
2 How nursing students' perceived medication administration competence developed along with the web-based medication administration education?
3 How nursing students assessed the web-based medication administration education?

Data collection

The target groups were emergency care, nursing, midwifery and public health nursing students of a Finnish polytechnic (university of applied sciences). The students had studied pharmacotherapy and medical calculations during their first, second, third and fourth study year. Clinical pharmacotherapy skills had been practised during lessons and supervised clinical training periods. Prior to graduation, the students revised their competence on a web-based medication administration course. Participation was voluntary but recommended and 89% of the graduating students participated.

The data collection method was an e-form questionnaire. The research data was formed by students evaluating their medication administration competence before and after the web-based education. The students ($N = 244$) filled in an electronic self-assessment form before the web course in a classroom. They had the possibility to study the web-based material for approximately two weeks independently. Then they made a medication administration competence test in a classroom under supervision and after that filled in a voluntary self-evaluation questionnaire ($N = 192$). The results of the competence test are not available for this study, and thus the data is formed by students' self-evaluations before the web-based education and after it.

Instruments

The self-evaluation instrument for medication administration competence was developed based on the web course material. There were 27 questions on the online self-evaluation questionnaire; basics of pharmacotherapy (9 questions), intravenous medication and infusion (8 questions), epidural medication (3 questions), and blood transfusions (2 questions). The questions can be seen in Table 1. The emphasis of the questions was on core materials such as basics of pharmacotherapy, intravenous medication and infusions, and fewer questions were made on blood transfusion and epidural medication. The scale 1 = poor, 2 = inadequate, 3 = quite good, and 4 = good was found to be exact enough to measure the perceived competence. In addition, the post-education questionnaire form had six questions concerning the students' opinions on the web-based medication administration education.