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Evaluation of nurses' knowledge and understanding of obstacles encountered when administering resuscitation medications

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SUMMARY

Aim: The aim of the study was to develop and validate an instrument to evaluate nurses' knowledge and to understand the obstacles that they encounter when administering resuscitation medications.
Background: Insufficient knowledge is a major factor in nurses' drug administration errors. Resuscitation involves situations in which doctors issue oral orders, and is inherently highly stressful. Sufficient knowledge is vital for nurses if they are to respond quickly and accurately when administering resuscitation medications.
Methods: A cross-sectional study was conducted. A questionnaire (20 true-false questions) developed from literature and expert input, and validated by subject experts and one pilot study, was used to evaluate nurses' knowledge of resuscitation medications. Stratified sampling and descriptive statistics were applied.
Results: A total of 188 nurses participated. The overall correct answer rate was 70.5% and the greater the nurse's work experience the higher the score. Only 8% of nurses considered themselves to have sufficient knowledge and 73.9% hoped to gain more training about resuscitation medications. The leading obstacle reported was "interruption of the drug administration procedure on resuscitation" (62.8%). Seventeen out of 20 questions achieved a discriminatory power of over 0.36, indicating good to excellent questions. In the study, a total of 16 resuscitation medication errors were reported by the participants, in which the errors involved atropine (five cases), epinephrine (three cases) and others (eight cases). The errors mainly involved misinterpretation of orders, insufficient knowledge and confusing certain drugs for other look-alike drugs.
Conclusion: Evidence-based results strongly suggest that nurses have insufficient knowledge and could benefit from longer working experience and additional training about resuscitation medications. Further research to validate the instrument is needed and the education of nurses regarding resuscitation medications is recommended.

Introduction

Medication errors have been found to be associated with increased stress in nurses (Duggan et al., 1996). Resuscitation is a complex, fast-paced, time-critical process, often occurring in crowded, uncontrolled situations; an extremely stressful task that requires competent nurses. Nurses must respond promptly to the needs of an unstable patient, often with limited information and time. Performance may not be optimal under such conditions, especially when nurses are not well trained in responding to stressful circumstances (Andersen et al., 2010).

A Danish study reported that incidents related to cardiac arrests represented 0.9% of the total number of incidents reported to the study's database (Andersen et al., 2010). Ornato et al. (2012) analysed information from 118,387 in-hospital cardiac arrest (IHCA) cases and identified resuscitation errors in approximately one third of them, usually with significantly worse outcomes than the group with no such errors. In a previous study we analyzed 259 administration errors and indicated that when CPR is implemented to resuscitate a patient, CPR itself becomes a high-alert condition and requires special precautions because nurses easily commit administration errors (Sheu et al., 2009). Nolan (2000) has pointed out that stress, high stakes and hurried activities are involved and the odds of errors are increased four-fold. Resuscitation also involves a doctor's oral orders for high-alert life-saving medications. Implementing resuscitation requires competent nurses with sufficient knowledge of medications.

Research studies have suggested that both system and human errors are responsible for medication errors. Phillips et al. (2001) have reported seven system failures accounting for 78% of 264 preventable medication errors. System errors, such as a critical shortage of nurses, increased numbers of high-acuity patients, a multiplicity of complex technologies, increased pressure to reduce costs accompanied by demands to improve quality of care, the use of high-alert medications with a narrow therapeutic index, and newly graduated nurses with little working experience, have all contributed to an error-prone environment (system) (Hicks et al., 2004). Qualitative research has also reported the top

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five factors resulting in medication errors as: workload, poor skill, interruptions, lack of concentration and insufficient knowledge (Gladstone, 1995). Our previous research indicated that the three main factors that nurses believed to be involved in medication errors were "personal neglect," "heavy workload" and "new staff" (Tang et al., 2007). Lack of nursing experience and unclear orders have been judged by oncology specialists to be the major factors resulting in chemotherapy errors (Schulmeister, 1999). Another study has indicated that nurses' insufficient drug calculation skills contribute to 1.5–4.9% of error rates in infusion-preparation tasks (Parshuram et al., 2008). These studies have all demonstrated that multiple factors contribute to medication errors.

Many interventions have been tried and applied in order to reduce medication errors. To reduce the number of prescribing errors, the computerized physician order entry (CPOE) system has been developed to eliminate illegible orders, unusual dosages and contraindications. This can reduce prescribing errors by 93% (Kaushal et al., 2003). Use of a bar code system further reduces dispensing and administration errors (Larrabee and Brown, 2003). Besides these two well-known systems other interventions have been applied which include changes in work schedules (CWS), intravenous system (IS), modes of education (ME), medication reconciliation (MR), pharmacist involvement (PI), protocols and guidelines (PG) and support systems for clinical decision making (SSCD). Four intervention types (CWS, ME, MR and PG) have demonstrated reduced medication errors (Manias et al., 2012). To avoid incorrect selection of medications and reduce variation in drug administration processes, various strategies, such as standardization, simplification and centralization have been suggested, especially for high-alert medications (Laffel and Blumenthal, 1989). As for resuscitation procedure, the Resuscitation Council (UK) (2010) and European Resuscitation Council (ERC) (2010) have all provided clear guidelines to follow. These guidelines cover electrical treatment, clinical intervention, drug treatment and others. They provide a standardised pathway for all staff to response during resuscitation, including correct medications and treatments and mutual understanding in role-taking.

Providing a single hospitalized patient with a single dose of a single medication requires correctly executing 80 to 200 individual steps (Barbara and Blakeney, 2003). Not all the above necessary and preventable steps, however, are applicable for a resuscitation situation. In resuscitation, nurses must instinctively respond to the doctor's oral order without having the time to recheck or find references before giving a resuscitation medication. Various strategies have been suggested to reduce medication errors, including the use of a computerized physician order entry (CPOE) (Kaushal et al., 2003; King et al., 2003), having a clinical pharmacist review orders (Folli et al., 1987), and bar-code technology (Cummings et al., 2005), but these strategies are not practicable during resuscitation (Andersen et al., 2010; Kozer et al., 2004). To eliminate medication errors, some research has focused on nurses' medication calculation skills (Grandell-Niemi et al., 2003; Polifroni et al., 2003; Wright, 2007). Others have focused on reducing distractions and interruptions during the administration of medications (Paleseal et al., 2009; Pape et al., 2005). In this study, however, we emphasize the importance of nurses' pharmacological knowledge of resuscitation medications. Sufficient knowledge regarding resuscitation medications is vital for nurses to maximize the possibility of survival for victims of cardiopulmonary arrest (Kozer et al., 2004). This study aimed to develop and validate an instrument to evaluate nurses' knowledge and to understand the obstacles that they encounter when administering resuscitation medications. To our understanding, there is no established and valid tool for evaluating nurses' knowledge in this field.

Methods

Methodology

A cross-sectional study design was conducted. A questionnaire was developed comprising 20 true–false questions to evaluate nurses' knowledge of resuscitation medications. Nursing staff in a teaching hospital were our target participants. Content, construct and face validity were applied to validate the 20 true-false questions and the whole questionnaire. Descriptive statistics were used to analyze responses. The study was conducted in Taiwan in 2011.

Participants

By convention, the value of estimated effect size in a two-group test of mean difference (e.g., between ER and OPD nurses) is in the range of .02 to .04 (Polit and Beck, 2008). In this study, therefore, the number of questionnaires needed was calculated by power analysis with an α level of 0.05, a power (1-β) of 0.08 and effect size of 0.3. The estimated minimal number of questionnaires was 174 (Polit and Beck, 2008). Considering that the response rates in previous studies were between 80% and 98%, we set a response rate of 90%, and therefore planned to recruit 193 nurses to participate in our study.

We conducted our research in a large teaching hospital with a total of 1135 nurses. The nurses worked in emergency rooms (ERs) (55), intensive care units (ICUs) (252), medical wards (222), surgical wards (130) and pediatric and obstetric wards (37), as well as other departments. Using stratified sampling, we recruited 40 participants from each of the ER, ICU, medical and surgical wards and 28 participants from obstetric and pediatric wards. The total number of participants was 188 (98.9% response rate; 188/190).

Instrument development

The questionnaire was in four parts. Part 1 comprised 20 true-false questions to evaluate nurses' knowledge of resuscitation medications. Part 2 was intended to gain an understanding of background characteristics that contributed to nurses' knowledge. Part 3 involved nurses' self-evaluation of their resuscitation medication knowledge and the obstacles that they encounter. Part 4 was for the collection and analysis of known resuscitation medication errors.

Part 1: nurses' knowledge

For Part 1, on the basis of a literature review, clinical expert consultation and researchers' experience, 25 questions were developed. After expert opinion had been consulted (content validity), we deleted five questions for redundancy and the remaining 20 questions (5 points/question $\times$ 20 = 100 scores) were used to evaluate nurses' knowledge of resuscitation medications.

Part 2: contributing factors

This part aimed to analyze participants' personal data and work-related experience, including age, education, position, ward and working years, CPR experience, and training that may have contributed to knowledge of resuscitation medications.

Part 3: self-evaluation

Part 3 was designed to determine participants' subjective self-evaluation of the following three factors concerning resuscitation medications:

a. Obstacles encountered (12 obstacles presented as multiple choice statements).
b. Knowledge level (five levels from "sufficient" to "extremely insufficient.")
c. Training needs (three options: "need", "no comment" and "no need.")

Part 4: resuscitation error events

Participants were asked to describe known medication errors that had occurred in the course of CPR. In order to provide a free and safe environment in which to answer this part of the questionnaire, a highly anonymous design was applied with no identification of patients, nurses, or hospitals involved.