

Knowledge about the use of potentially dangerous drugs among hospital health care nurses*

Conhecimento sobre uso de medicamentos potencialmente perigosos entre enfermeiros da assistência hospitalar à saúde

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ABSTRACT

Objective: to characterize the knowledge about the use of potentially dangerous drugs among hospital health care nurses. **Methods:** quantitative, descriptive-exploratory research, with the application of a validated questionnaire, translated and adapted in Brazil, on potentially dangerous medications, with 26 nursing assistants in a university hospital. Univariate and bivariate descriptive statistical analysis of the data was performed using the Statistical Package for Social Science, version 20. Scores $\geq 70\%$ were considered as sufficient knowledge and insufficient knowledge scores $< 70\%$. **Results:** in the first domain of the questionnaire, called Medication Administration, the average percentage of correct answers was 64.6%. In the second domain, Clinical procedures, an average of 53.7% of correct answers was found. The use of electrolytes, chemotherapy and insulin were the main weaknesses in the knowledge of professionals. **Conclusion:** insufficient knowledge about the administration and clinical procedures of potentially dangerous drugs was identified among hospital care nurses in this scenario.

Descriptors: Medication Errors; Potentially Inappropriate Medication List; Hospital Care; Patient Safety.

RESUMO

Objetivo: caracterizar o conhecimento sobre uso de medicamentos potencialmente perigosos entre enfermeiros da assistência hospitalar à saúde. **Métodos:** pesquisa quantitativa, descritiva-exploratória, com aplicação de questionário validado, traduzido e adaptado no Brasil, sobre medicamentos potencialmente perigosos, com 26 enfermeiros assistenciais em hospital universitário. Realizou-se análise estatística descritiva univariada e bivariada dos dados, por meio do *Statistical Package for Social Science*, versão 20. Consideraram-se como conhecimento suficiente escores $\geq 70\%$ ou conhecimento insuficiente escores $< 70\%$. **Resultados:** no primeiro domínio do questionário, denominado Administração dos medicamentos, o percentual médio de acertos foi de 64,6%. No segundo domínio, Procedimentos clínicos, encontrou-se média de 53,7% de acertos. O uso dos eletrólitos, quimioterápicos e de insulina foram as principais fragilidades no saber dos profissionais. **Conclusão:** identificou-se conhecimento insuficiente sobre a administração e os procedimentos clínicos de medicamentos potencialmente perigosos entre os enfermeiros assistenciais hospitalares neste cenário.

Descritores: Erros de Medicação; Lista de Medicamentos Potencialmente Inapropriados; Assistência Hospitalar; Segurança do Paciente.

Introduction

Medication administration is a complex process in the daily practice of nursing professionals, which requires adequate knowledge about pharmacology and technical skills for execution⁽¹⁾. In the hospital environment, drug therapy is widely used as a therapeutic approach to health recovery, the practice of which is associated with potential and real risks to patient safety⁽²⁾.

Research has shown significant rates of medication errors in a hospital environment⁽³⁻⁴⁾. Medication errors are preventable adverse events that can cause harm to the patient and, in critical situations, result in death. The occurrence of this type of failure can be associated with factors such as failures in the prescription and dispensing of drugs, lack of communication among professionals, pharmaceutical procedures, work overload, professional knowledge and attitude, inadequate identification and similar names of the drugs^(2-3,5).

Drugs associated with a higher risk of injuring the patient, due to failures in use, are known as potentially dangerous or highly surveillance drugs and include therapeutic classes, such as neuromuscular blockers, and specific drugs, such as injectable concentrated potassium chloride⁽⁶⁾.

Nursing professionals are an important barrier in preventing errors in the administration of potentially dangerous drugs, as they can act in anticipation, identification and prevention of occurrence. Despite this, errors continue to happen, and the insufficient knowledge of the nursing team on the subject has been reported as the main triggering factor⁽⁷⁾.

Specifically, nurses have a relevant decision-making role in the management of potentially dangerous medications, either by working directly with patients or in the guidance/supervision of nursing teams. Therefore, it is important to identify nurses' knowledge about these drugs, in order to contribute to making positive and critical decisions in the stages

of error prevention. Thus, this study aimed to characterize the knowledge about the use of potentially dangerous drugs among nurses in hospital health care.

Methods

Quantitative, descriptive-exploratory research, carried out with nursing assistants from a Brazilian university hospital, with urgent and emergency services, located in the Northeast Region, in the countryside of Sergipe, Brazil. The hospital had 112 operational beds, 32 of which were for adult medical clinic, 12 for pediatric clinic, 20 for surgical clinic, 10 for adult intensive care, 41 for emergency care (23 observation beds, 15 semi-intensive beds and three for intensive care) and two operating rooms with post-anesthetic recovery.

The nursing workforce consisted of 202 professionals, 162 (80.2%) of whom were technical and/or auxiliary and 40 (19.8%) of higher education. This hospital was in a transition period from the state to the federal public administration, during the data collection of the present research, from December 2016 to February 2017. Most employees were still linked to temporary employment contracts and/or redistribution plans to other hospitals.

The sample plan included the assistance nurses of the institution, who were contacted personally by the researcher, at moments considered more relaxed during the shift or when desired/planned by the professional, in a reserved place. The final sample consisted of 26 nurses, considering the reasons for exclusion: legal leave (n=5), did not answer the questionnaire, after three attempts to contact (n=5), and refusal to participate (n=4). Because the questionnaire was developed for the exclusive measurement of knowledge about potentially dangerous drugs by nurses⁽⁸⁾, nursing technicians and assistants were not included in the sample.

This questionnaire was developed and validated by the Chinese, with face, content and construct

validations; internal consistency was evaluated using the Kuder-Richardson formula 20 reliability coefficient (KR-20), obtaining a satisfactory value, with $\alpha=0.74^{(8)}$. For application in Brazil, the instrument was translated, culturally adapted, evaluated and validated, through the face and content validities of the instrument, with subsequent pre-test⁽⁹⁾. It is a self-administered instrument, with 20 statements (17 false and 3 true), “true”, “false”, “I don’t know” answer options and a final score of 100 points, divided into two domains: the first, on medication administration, addresses storage, prescription, dispensing and administration particularities; and the second, about clinical procedures related to administration, particularities such as routes of administration and dosages⁽⁹⁻¹⁰⁾.

The data were tabulated in Microsoft Office Excel and analyzed in the Statistical Package for the Social Sciences, version 20 for Windows. Descriptive statistical analysis was performed using univariate and bivariate techniques to obtain the distribution of absolute and relative frequencies, considering the significance level of 5%. For classification of knowledge, scores $\geq 70\%$ were considered as good knowledge and scores $< 70\%$, as low knowledge⁽¹⁰⁾. The data are presented in tables.

Ethical and legal aspects in research involving human beings were respected and the project was approved by the Research Ethics Committee, with Presentation Certificate for Ethical Appreciation No. 62175516.0.0000.5546 and opinion No. 1,875,657/2016.

Results

The study data showed a predominance of females (65.4%) among the 26 participating nurses, with an average age of 35.5 years, a minimum age of 26 and a maximum age of 50 years. Most professionals had a time of training and experience ≤ 10 years (73.0%), with an average of 8.6 years of training, a minimum of four and a maximum of 20 years. The average length of professional experience was eight years,

with a minimum of three and a maximum of 20 years. Among the participants, 23 (88.5%) of the nurses had postgraduate degrees, with a predominance of specialization, 22 (95.6%). Regarding the sector of activity in the university hospital, 12 (46.2%) worked in the emergency room, followed by the sectors of medical clinic, 4 (15.4%); intensive care unit; 4 (15.4%); surgical clinic, 3 (11.5%); pediatrics, 2 (7.7%); and surgical center, 1 (3.8%).

Information about nurses’ employment relationships showed that 14 (53.8%) of the participants had two or more bonds, compared to 12 (46.2%) who worked only in the investigated hospital. It should be noted that, among the professionals who had two or more bonds, seven worked in the emergency room and one in the intensive care unit. Data on the application of the questionnaire on potentially dangerous drugs with hospital assisting nurses, with a percentage of correct answers and errors in the responses of the participants to the first (medication administration) and the second (clinical procedures) domains of the questionnaire, with ranking of correct answers, are described in Tables 1 and 2, respectively.

In the first domain of the questionnaire, the average percentage of correct answers was 64.6%. Data on medication administration by professionals showed that the highest error rate (80.8%) was found in item 1.4, referring to multiple concentrations for the same medication. Item 1.10, on the differentiation in labels for medicines with similar names, was the one with the highest rate of correct answers (96.2%). Item 1.3, on the storage of insulin and heparin, obtained 92.3% of correct answers; in turn, item 1.6, about the correct storage of potassium chloride (KCl 19.1%), represented the second item with the highest error rate (46.2%). The highest percentage of “don’t know” responses was 27.0%, being found in item 1.8, which dealt with the transdermal patch of fentanyl as a medication for controlled use. The storage of neuromuscular blockers, such as atracurium, also acquired a 15.4% “don’t know” response, in addition to an error rate of 30.8% among nurses.

Table 1 – Description of the participants' responses to the first domain, Drug Administration, of the Questionnaire on Potentially Dangerous Drugs. Sergipe, SE, Brazil, 2017

Item/ Domain 1	Issue focus	*Answer Pattern (T/F)	Hits (%)	Error (%)	Does not know (%)	Ranking
1.1	Use "ampoule" or "vial" to express the dose instead of "mg" or "g"	F	76.9	19.2	3.9	4 ^o
1.2	Use "U" instead of "unit" for dose expression	F	61.5	38.5	0	6 ^o
1.3	For convenience, heparin and insulin should be stored together	F	92.3	7.7	0	2 ^o
1.4	Medicines must have multiple concentrations to allow choice	F	0	80.8	19.2	10 ^o
1.5	Oral administration of potassium is preferable to intravenous administration	T	57.7	34.6	7.7	7 ^o
1.6	Potassium chloride 19.1% is in frequent use, so it should have easy access	F	50	46.2	3.8	9 ^o
1.7	Use "tablespoons" for pediatric dose expression	F	88.5	11.5	0	3 ^o
1.8	Treat the fentanyl transdermal patch as a controlled drug	T	69.2	3.8	27	5 ^o
1.9	Neuromuscular blockers, such as atracurium, should be stored in an easily accessible place	F	53.8	30.8	15.4	8 ^o
1.10	Medicines with similar names must be differentiated on the label	T	96.2	3.8	0	1 ^o
Average			64.6	27.7	7.7	

*T:True; F: False

Table 2 – Description of the participants' responses to the second domain, Clinical procedures, of the questionnaire on Potentially Dangerous Drugs. Sergipe, SE, Brazil, 2017

Item/ Domain 2	Issue focus	*Standard Response (T/F)	Hits (%)	Error (%)	Does not know (%)	Ranking
2.1	In mild allergic reactions with erythema, rapidly administer an ampoule of epinephrine 1: 1000 via IV	F	76.9	7.7	15.4	2 ^o
2.2	In emergency cases, administer quickly (1 to 2 minutes) 10 ml of 10% Calcium Gluconate	F	30.8	30.8	38.4	9 ^o
2.3	10% Calcium Gluconate and 10% Calcium Chloride are the same medicine and can be substituted for each other	F	73.1	7.7	19.2	3 ^o
2.4	"Cc" or "mL" are used to express the dose of insulin	F	88.5	7.7	3.8	1 ^o
2.5	In calculating the dose of chemotherapy, weight is used for adults and body surface for children	F	46.2	7.7	46.1	8 ^o
2.6	In emergencies such as ventricular fibrillation, administer 19.1% KCl IV bolus	F	61.5	26.9	11.6	5 ^o
2.7	If the patient's situation requires it, add 10 ml of 19.1% KCl to the ringer's pouch and administer with rapid drip speed	F	50.1	15.4	34.5	6 ^o
2.8	The insulin syringe can be replaced by the 1 ml syringe and the tuberculin syringe	F	26.9	65.4	7.7	10 ^o
2.9	Administer 500 ml of 20% NaCl with rapid drip to patients with low sodium levels	F	50	23.1	26.9	7 ^o
2.10	Chemotherapy access can be used for blood collection and medication administration in general	F	69.2	15.4	15.4	4 ^o
Average			57.3	20.8	21.9	

*T:True; F: False

The average of correct answers in the second domain of the questionnaire was 57.3%. According to the answers, the item with the highest percentage of correct answers (88.5%) was 2.4, which addressed the unit of insulin dose in ml or cc; in turn, the item with the highest error rate (65.4%) was 2.8, which discussed the replacement of the insulin syringe, with a rate of 26.9%, in correct answers among professionals. The approach on the use of 10.0% calcium Gluconate in emergency presented a percentage of correct answers and errors in 30.8%, representing the second item with the highest percentage of errors by the participants. The response rate “does not know” with a higher percentage (46.1%) was found in item 2.5, which dealt with the dosage of chemotherapy for adults and children, presenting a rate of 46.2% in correct answers and constituting the third question with less hits. No statistically significant relationships were found between the participants’ sociodemographic data and knowledge about potentially dangerous drugs.

Discussion

The main difficulties encountered in conducting the study were related to the application of the questionnaire, as the professionals were afraid to respond to an instrument that could assess their knowledge as erroneous. Thus, the researcher reinforced the ethics and benefits of research, and even in the face of some refusals, he was accessible and available to wait patiently during the professional’s shift, since he could not be taken home.

The study limitation was related to the development in a single hospital, with a relatively small sample of nurses and a descriptive approach to the data. Therefore, it points out the need to conduct multicentric research, with comparative analyzes, and evaluations of the type before and after training on the subject, even with control groups.

The strength of the study was to reveal a profile that can serve as a comparison to other Brazilian studies, as well as to similar hospitals. Despite being a lo-

cal context, the data highlighted the need to reinforce nurses’ knowledge, which may reflect on safer nursing practice and better guidance of work teams. Nursing teaching institutions can pay attention to the areas of greatest knowledge deficiency, presented in the study, and thus develop specific teaching programs. For health institutions, the need to adopt permanent education strategies with professionals is reinforced to contribute to patient safety.

The length of experience and the continuous encouragement of the institution can represent important factors for the involvement of professionals in health care and in continuing education activities for the necessary improvement of the profession, directly influencing patient safety⁽¹¹⁾.

In Brazil, there is a greater performance of nursing professionals between 26 and 50 years old, with a tendency for a decrease in the workforce of nurses up to 60 years old. In addition, the average salary of nurses, which is in the range of R\$ 2,000, which can influence the performance in other bonds, without observing, in most cases, the increase in substantial income; furthermore, the exhaustive routine can compromise the professional’s biopsychosocial health and, consequently, influence the assistance provided⁽¹²⁾.

Continuing education strategies are essential for improving nurses’ knowledge and practice⁽¹³⁾. With regard to knowledge about potentially dangerous drugs, the average number of correct answers found, in the present study, on important aspects in their administration (64.6%), was close to the finding in a study carried out with nurses in Palestine, in which an average of correct answers in 58.9%, which may be related to the greater number of nurses participating in the study (n=301)⁽¹⁰⁾.

In medication administration, the highest number of concentrations and multiple dosages can represent a risk factor for the occurrence of errors⁽¹⁰⁾. Thus, data that revealed the belief in the existence of multiple concentrations of potentially dangerous drugs among the nurses in the study evidenced the lack

of knowledge about important aspects that may favor medication errors in patient care, reinforcing the importance of the immediate adoption of measures that prevent this occurrence.

Methods to avoid medication errors, according to safe practices in the use of high-risk drugs, include reducing the number of pharmaceutical presentations; standardization of presentations; use, whenever possible, of the lowest concentration presentation/formulation; limitation of the number of presentations and concentrations available, as well as the elaboration of educational materials easily accessible to professionals^(4,14).

The reduction of medication errors is associated with the adoption of educational strategies, such as the production of educational materials; organizational, such as the elaboration of institutional protocols; and technological, such as the implementation of computerized systems⁽¹⁴⁾. Thus, the importance of care with medicines with similar names and commonly used in the institution is highlighted, and the parts of the names that differentiate them should be highlighted, and preferably stored in separate locations⁽⁴⁾.

Ways of storing neuromuscular blockers and using and storing potassium chloride also showed high error rates among nurses. Neuromuscular blockers present particularities in use and storage, and must be stored separately and labeled with an alert identification for the risk of inappropriate use, mainly due to the erroneous administration being associated with significant damage or the death of the patient; similar packaging and labeling, lack of knowledge about improper use and storage are among the main reasons for lethal adverse events involving these drugs⁽¹⁵⁾.

In the administration of medications, intravenous infusions can occur continuously or intermittently, quickly between 3 and 5 minutes, in 30 minutes, or in periods of 1 to 3 hours, considering factors such as patient conditions and possible complications⁽¹⁶⁾. The concentration of the substance is an important factor to be considered. Knowledge about potassium chloride, for example, is fundamental in therapy, since po-

tassium imbalances can bring serious consequences to patients' lives and require immediate action in health, which can cause arrhythmias, paralysis and weakness; in intravenous administration, the potassium concentration should not exceed 20 mEq/h (100–150 mEq/day)⁽¹⁷⁾.

The data on clinical procedures with potentially dangerous drugs investigated in the present study showed a correct rate (57.3%), close to that found in a study carried out in Palestine, in which a 60.9% correct rate was identified⁽¹⁰⁾. The main deficiency found among participating nurses regarding clinical procedures was related to the replacement of the insulin syringe with the 1 ml or the tuberculin.

Insulin is a drug that requires precision in the dosage administered, errors related to its use can cause serious damage, such as prolonged exposure to hypoglycemia and consequent confusion, fainting or convulsion⁽¹⁴⁾, period of exacerbated hyperglycemia or even death of the patient; these events are mainly associated with preparation and infusion⁽¹⁸⁾. Thus, the replacement of the unit syringe with the one for mL or tuberculin can contribute to the error in the preparation and administration of insulin, resulting in hypoglycemia and hyperglycemia that will bring consequences to the patient.

Aspects about the speed of administration of 10% calcium gluconate should also be addressed by health institutions with professionals, due to the limited knowledge shown in the study. The speed of infusion of calcium gluconate should be slow, since the rapid infusion is associated with bradycardia or asystole; in symptomatic cases of hypocalcemia, the administration of 1 to 2 g of calcium gluconate is allowed in 10 to 20 minutes⁽¹⁷⁾.

The lack of knowledge about chemotherapy calculations, evidenced among the study participants, demonstrated that nurses may not be used to using chemotherapy drugs, which is probably due to the lack of chemotherapy treatment in the institution where the collection was performed. However, as most nursing professionals can work in more than one health

institution, knowledge of this information is essential to avoid the occurrence of errors associated with the administration of chemotherapy drugs⁽¹¹⁾.

In addition, the gradual increase in the role of nurses in palliative care assistance to patients with cancer and other chronic diseases, mainly related to aging, has demonstrated the importance of knowledge and practice of procedures, such as hypodermoclysis for medication administration, due to subcutaneous route is being well supported by these patients. However, the use of this action can be associated with complications that, although they are mostly easily reversible and with low potential to cause damage, reinforce the relevance of care with the administration of medications by professionals⁽¹⁹⁾.

Data found in this study pointed to an urgent need for permanent education with health care professionals. Nursing and health institutions are co-responsible for the permanent education of professionals, as a way to guarantee safe and risk-free health care, due to the importance of patient safety^(11,13).

Conclusion

Insufficient knowledge about the administration and clinical procedures of potentially dangerous drugs was identified among hospital assisting nurses, mainly related to the use of electrolytes, chemotherapy and insulin. Therefore, it is essential to adopt professional, institutional and educational actions, with a priority focus on these drugs, to improve safety in the use of medicines.

Collaborations

Santos GO and Farre AGMC contributed to the conception, design, analysis and interpretation of data, writing, relevant critical review of the intellectual content and final approval of the version to be published. Santana ITS, Rocha HMN, Carvalho AA, Santos GKBB and Matos ALP collaborated with a relevant critical review of the intellectual content, writing of the article and final approval of the version to be published.

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