

Assessment of knowledge and professional practices in the hospital environment on high-alert drugs

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Abstract

Objective: To assess the knowledge and practices of professionals working in hospitals on potentially dangerous drugs (PPM). **Method:** This is a cross-sectional, quantitative and exploratory study, carried out in a municipal public hospital located in the Metropolitan Region of Fortaleza, Ceará, from August to October 2022. **Results:** The study was carried out in three stages: 1. Situational diagnosis through observation of structural aspects and professional practices. 2. Assessment of the professionals' level of knowledge about MPP. 3. Conducting educational actions. The diagnosis identified weaknesses at all stages in the process of using MPP in the institution, especially in the process of preparation and administration. In the second stage, 39 professionals answered the questionnaire, representing a response rate of 40.2%. Of the total number of professionals, 87.2% (n=34) answered that they did not participate in any training within the 6-month period and the importance of carrying out training was evaluated as fundamental by 100% (n= 39). Of the participants, 53.8% (n= 21) declared to have knowledge about MPP. The educational actions consisted of the application of an educational game with the delivery of informative material. **Conclusion:** Several contextual factors contribute to the non-incorporation of safe practices in the use of MPP in the hospital under study, among which the patient safety culture stands out, and the need for the hospital institution to promote and encourage educational initiatives in these aspects.

Key words: high-alert medication; patient safety; health education.

Avaliação do conhecimento e práticas profissionais em âmbito hospitalar sobre medicamentos potencialmente perigosos

Resumo

Objetivo: Avaliar o conhecimento e práticas dos profissionais que atuam em âmbito hospitalar sobre os medicamentos potencialmente perigosos (MPP). **Método:** Trata-se de um estudo transversal, quantitativo e exploratório, desenvolvido em um hospital público municipal localizado na Região Metropolitana de Fortaleza, Ceará, no período de agosto a outubro de 2022. **Resultados:** O estudo foi desenvolvido em três etapas: 1. Diagnóstico situacional por meio da observação dos aspectos estruturais e práticas profissionais. 2. Avaliação do grau de conhecimento dos profissionais sobre MPP. 3. Realização de ações educativas. O diagnóstico identificou fragilidades em todas as etapas no processo de utilização dos MPP na instituição, sobretudo no processo de preparo e administração. Na segunda etapa 39 profissionais responderam ao questionário, representando uma taxa de resposta de 40,2%. Do total de profissionais 87,2% (n=34) responderam que não participaram de nenhum treinamento no período de 6 meses e a importância de realizar treinamentos foi avaliada como fundamental por 100% (n= 39). Dos participantes 53,8% (n= 21) declararam ter conhecimento sobre os MPP. As ações educativas consistiram na aplicação de um jogo educativo com entrega de material informativo. **Conclusão:** Diversos fatores contextuais contribuem para a não incorporação das práticas seguras no uso dos MPP no hospital em estudo, dentre esses destaca-se a cultura de segurança do paciente, e a necessidade da instituição hospitalar em promover e incentivar iniciativas educacionais nesses aspectos.

Palavras-chave: medicamentos potencialmente perigosos; segurança do paciente; educação em saúde.



Introduction

The medication chain is a complex drug supply system, has a multidisciplinary nature and encompasses several stages such as prescription, dispensing and administration, which involve risks and can lead to errors. In the hospital context, errors are frequent at all stages and it is estimated that a hospitalized patient is subjected to at least one medication error per day, which can threaten their safety and therapeutic results¹.

Adverse Drug Events (ADEs) are defined as “any harm caused by the use of one or more medications for therapeutic purposes, therefore encompassing Adverse Drug Reactions (ADRs) and medication errors²”. Studies carried out in several countries, including Brazil, have identified ADE high incidence, with percentages varying between 2.3% and 21.3% depending on the identification method, which can even lead to deaths and sequelae³.

The World Health Organization recognizes that medication errors are the leading cause of healthcare-acquired injuries, costing approximately \$42 billion annually, nearly 1% of the total global healthcare expenditures⁴.

Medication errors occur when frail systems and/or human factors such as fatigue, poor environmental conditions or insufficient staff, affect professional practices in operationalization of the medication chain. Several strategies to address medication errors’ frequency and impact have been developed, but their implementation is varied. A collective effort is required to support robust actions. In response to this situation, the World Health Organization selected the topic of “*Medication Without Harm*” for the third Global Patient Safety Challenge. The objective of this challenge was to reduce, by 50% and on a global scale, severe medication-related preventable harms by 2022; however, this target has not yet been achieved and initiatives are still being implemented⁵. In Brazil, the National Patient Safety Program (*Programa Nacional de Segurança do Paciente*, PNSP) was launched to contribute to qualifying health care, considering the impact of cases involving medication errors. In this context, there is a need to improve safety in the use of medicines considered as high-alert⁶⁻⁷.

Potentially Dangerous Medications (PDMs), also called High-Alert Medications (HAMs), are those that have a high risk of causing significant harms to the patient as a result of failures in their use process. Errors related to these medications may not occur very frequently; however, their consequences can be more serious, potentially leading to permanent harms or death⁸.

Preventive methods and measures should be established throughout the medication chain, involving everything from PDM packaging, identification, storage, prescription, dispensing, preparation and administration⁹. In addition to that, strategies must be developed to enable professionals to have greater knowledge about proper use of these medications, as well as the early identification of possible problems related to them, intervening when necessary¹⁰. Some studies have highlighted important gaps in the professionals’ knowledge level and practices regarding PDM use¹¹⁻¹³.

In light of the aforementioned, the current study sought to assess the knowledge and practices of health professionals in hospitals regarding PDMs, identifying organizational weaknesses and potentialities, and implementing educational interventions geared towards patient safety in accordance with the institution’s requirements.

Methods

A descriptive and observational study developed from August to October 2022 in a public hospital from Ceará, which is a Unified Health System (*Sistema Único de Saúde*, SUS), medium-size and secondary-complexity unit and a reference for eight municipalities. It has 115 beds distributed across the following care units: Medical, Surgical, Obstetric, Pediatric, Emergency and Neonatal Care clinics and Intensive Care Unit. It has 934 employees making up a multiprofessional team.

Data collection was carried out in three stages, including situational diagnosis through observation of the structural aspects and professional practices. The observations were conducted on a weekly basis throughout the month, in alternate shifts and days and lasting an approximate mean of 15 to 20 minutes per unit, totaling around 20 observation hours, with special attention given to observing diverse teams in their professional practices.

To conduct this stage, a checklist was used based on the Safety Protocol in Drug Prescription, Use and Administration¹⁴ and on the study conducted by Taveira¹⁵. The items observed were related to PDM medical prescription, dispensing, preparation and administration and to access to information.

In the second stage, which consisted in applying a questionnaire to assess the professionals’ knowledge level about PDMs, the target population was comprised by physicians, nurses, nursing technicians, pharmacists and pharmacy assistants who work in the Medical clinic, Surgical clinic, ICU and satellite pharmacy units of the aforementioned hospital. These professionals were chosen randomly, using the work schedule.

Sample calculation considered a 95% confidence level, 5% sampling error and a 50% response rate (probability). Therefore, the sample was estimated at 97 individuals in a universe of 128 professionals. For the calculation, the Raosoft® EZSurvey® calculator, version 2007, available in the Internet public domain, was used.

Health professionals who had an employment contract with the hospital took part in this stage. The exclusion criteria were as follows: professionals who were on vacation, on maternity or medical leave, graduate students, and nursing interns and residents.

The questionnaire was structured using the Google Forms® platform, consisting of 20 questions that addressed aspects related to the degree of theoretical and practical knowledge about PDM use. The instrument was sent to the professionals via electronic means, with answers to be sent from August 29th to September 29th, 2022. As adherence to the electronic questionnaire was low, with few answers obtained during the period established, it was necessary to conduct an active search where the questionnaire was administered in person.

The variables surveyed in this stage were related to characterizing the professionals’ profile, knowledge and practices about PDM. Subsequently, the data were analyzed using a Microsoft Office Excel® spreadsheet, version 2015, with presentation of frequencies and percentages.

In the last stage, taking as a reference the results obtained in the previous ones, educational actions were carried out in the hospital units with the objective of providing information about PDMs and covering the main gaps found in the previous stages (situational diagnosis, assessment of knowledge level and practices on PDMs).



The project that resulted in preparation of this article was submitted to the Research Ethics Committee of the Federal University of Ceará, with Approval Opinion number 5,587,484.

Before data collection, all health professionals were informed about the study objectives and methodology, ensuring anonymity, information confidentiality and freedom to withdraw their participation at any moment. Those who accepted to participate in this study signed the Free and Informed Consent Form.

In the questionnaire, the participants were asked to self-assess their knowledge level about PDMs. The respondents stated having fair (53.8%, n=21), or sufficient (43.6%, n=17) knowledge. One participant (2.6%) deemed his knowledge as insufficient.

In relation to the knowledge of the institution's standardized PDM list, 51.3% (n=20) stated that they were aware of it. As for the knowledge about the existence of an institutional protocol or SOP with guidelines on the PDM safe use, 74.4% (n=29) answered that they knew the document.

The questionnaire had an item that included the definition of PDMs, which was considered correct by 100% (n=39) of the professionals.

In relation to the prescription, when asked about the recommendation to use abbreviations in the name of medications, chemical formulas, dosage, concentration and administration route (Question 10) 69.2% (n=27) stated that it would not be recommendable to use abbreviations, 25.6% (n=10) indicated that it was recommendable, and 5.1% (n=2) answered that they did not know.

In relation to storage, when asked about the assertion that PDMs must be stored in specific locations, separated from each other and from other medications and identified with red labels, 87.2% (n=34) agreed with the statement, 7.7% (n=3) did not know how to answer, and 5.1% (n=2) did not agree. In relation to the need to use capital and bold letters to highlight parts of medication names with similar spellings or sounds in order to avoid medication exchanges and causing errors, 89.7% (n=35) agreed with the assertion, 5.1% (n=2) did not know how to answer and 5.1% (n=2) did not agree.

Results

During the first study stage, the professional practices and organizational conditions were identified in visits to the Medical and Surgical clinic units, Intensive Care Units (ICU) and satellite pharmacies. Chart 1 describes the medication chain phases and the main findings based on the observations made.

A total of 39 health professionals answered the questionnaire in the second study stage, representing a 40.2% response rate. The majority of this percentage belonged to the Nursing team (64.1% n=25), were women (76.9%; 30), aged from 25 to 30 years old (28.2%; 11), and had been working in the institution for 2 to 4 years (30.8%; 12), particularly in the Surgical clinic (33.3%; 13), as shown in Table 1.

When asked about their participation in any training during the last six months, 87.2% (n=34) of the professionals answered that they had not attended any training session in the period. Of those who had, all (n=5) belonged to the Pharmacy team. The importance and need to carry out PDM training was evaluated as fundamental by all (n=39) participants.

Chart 1. Phases of the medication chain and organizational practices/conditions observed in the visits carried out. CE, 2022.

Medications chain phase	Organizational practices and conditions observed
Prescription	Computerized medication prescription: containing items such as the patient's full name, bed and ward number, dose, pharmaceutical form, administration route and medication dosage, without identifying the institution, infusion time and speed or medical record number, and the PDMs did not have any differentiation from other medications; Some professionals prescribe with the trade name, using abbreviations in the administration routes and measurement units. Chemical formulas were also observed to prescribe sodium chloride (NaCl) and potassium chloride (KCl), for example.
Dispensing	Suitable locations. Pharmacists analyze prescriptions and carry out scheduling before separation the medications begins and pharmacy assistants separate prescriptions individually; however, prescriptions are not double-checked. PDMs are dispensed following the same protocol as other medications, even though the hospital has a Standard Operating Procedure (SOP) designed for this process. For transportation of the PDMs, different packaging with red warning identification is not used; they are dispensed in transparent plastic bags, along with other medications prescribed to the patient.
Storage	a) In the satellite pharmacies, the medications are divided and placed in plastic boxes identified with name and dose and the PDMs have a red label, but there are no labels on each individual package. Medications with similar sounds and spellings are highlighted in capital and bold letters. PDMs under refrigeration: they do not have any warning identification on the refrigerator. b) In the hospitalization units, PDMs are stored in drawers, listed in bed order, where they remain with other medications for the patient's use. These PDMs do not have any warning identification and are identified with handwritten white ribbons containing the bed number, delivery time and, in some cases, the name of the medication.
Preparation and administration	a) In the Medical and Surgical clinics, it was observed that medications were prepared simultaneously for different patients, as well as the administration of medications to patients, which were prepared by another professional in the unit. The medications are taken to the patient on trays with various preparations for different patients. b) ICU: more appropriate professional practices were observed in PDM preparation and administration.

Table 1. Profile of the professionals that answered questionnaire about PDMs in a municipal hospital. CE, 2022.

Professionals	Nurse	Pharmacist	Physician	Nursing technician	Pharmacy assistant	Total
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Gender						
Female	6 (85.71)	2 (50.0)	2 (100)	14 (77.77)	6 (75.0)	30 (76.9)
Male	1 (14.3)	2 (50.0)	0 (0.0)	4 (22.22)	2 (25.0)	9 (23.08)
Age group						
18-24	2 (28.6)	0 (0.0)	0 (0.0)	5 (27.7)	1 (12.5)	8 (20.5)
25-30	4 (57.1)	1 (25.0)	1 (50.0)	3 (16.6)	2 (25.0)	11 (28.2)
31-39	0 (0.0)	2 (50.0)	1 (50.0)	3 (16.6)	1 (12.5)	7 (17.9)
40-49	1 (14.3)	1 (25.0)	0 (0.0)	3 (16.6)	0 (0.0)	5 (12.8)
50-59	0 (0.0)	0 (0.0)	0 (0.0)	3 (16.6)	4 (50.0)	7 (17.9)
60+	0 (0.0)	0 (0.0)	0 (0.0)	1 (5.5)	0 (0.0)	1 (2.6)
Time working in the institution						
<6 months	0 (0.0)	0 (0.0)	0 (0.0)	6 (33.3)	3 (37.5)	9 (23.1)
7 months-1 year	5 (71.4)	0 (0.0)	2 (100)	1 (5.55)	0 (0.0)	8 (20.5)
2-4 years	2 (28.6)	2 (50.0)	0 (0.0)	7 (38.8)	1 (12.5)	12 (30.8)
5-10 years	0 (0.0)	1 (25.0)	0 (0.0)	2 (11.1)	2 (25.0)	5 (12.8)
>10 years	0 (0.0)	1 (25.0)	0 (0.0)	2 (11.1)	2 (25.0)	5 (12.8)
Sectors						
Medical Clinic	1 (14.3)	0 (0.0)	0 (0.0)	1 (5.5)	0 (0.0)	2 (5.1)
Surgical Clinic	3 (42.8)	0 (0.0)	0 (0.0)	10 (55.5)	0 (0.0)	13 (33.3)
Satellite Pharmacy 1	0 (0.0)	2 (50.0)	0 (0.0)	0 (0.0)	5 (62.5)	7 (17.9)
Satellite Pharmacy 2	0 (0.0)	2 (50.0)	0 (0.0)	0 (0.0)	3 (37.5)	5 (12.8)
ICU	3 (42.8)	0 (0.0)	2 (100)	7 (38.9)	0 (0.0)	12 (30.8)

When preparing and administering PDMs, everyone (n=39) answered that it was advisable to double check with the pharmacy upon receipt by nurses, during preparation and administration. When asked about the simultaneous preparation of PDMs and other medications for different patients at the same time, as well as the administration of medications prepared by another professional, 76.9% (n=30) answered that it would not be correct to carry out this practice, 17.9% (n=7) answered yes and 5.1% (n=2) did not know.

The questionnaire applied during the study had an open question, which allowed recording suggestions and doubts about PDMs. This space was answered by 69.2% (n=27), where in relation to the doubts, only 3.7% (n=1) of answers were obtained.

Some of the answers to the question were as follows:

“Why do doctors prescribe medications considered PDMs in such a short period of time from one to another if they cause such devastating effects that are often administered alone?” (Nursing Technician; Surgical Clinic).

“It’d be interesting to include handling, dilution and route of the most used medications in the sector in Nursing stations.” (Nursing Technician; Surgical Clinic).

“Having a list of PDM names in the medication room.” (Nursing Technician; ICU)

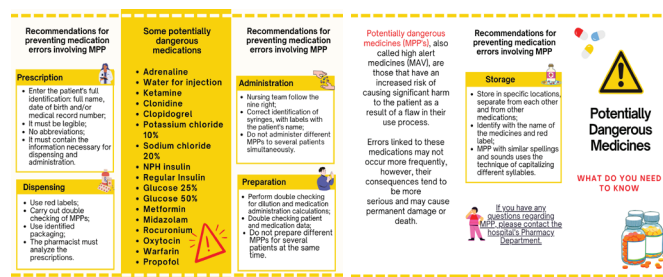
“Always having the names of all PDMs attached in the pharmacies.” (Pharmacy Assistant; Satellite Pharmacy)

“Continuous training.” (Pharmacist)

“Offering mini-courses on PDMs to increase the professionals’ knowledge level.” (Nurse; Surgical Clinic).

The educational actions carried out in the third and final stage served to reinforce all the information regarding safe PDM use for the professionals. Nurses, nursing technicians, pharmacists and pharmacy assistants from the units involved in the study participated. It was not possible to have the participation of the medical team from any of the units mentioned. Educational leaflets (Figure 1) were distributed, which prepared based on weaknesses in the professionals’ practices and knowledge found in the previous stages of this study. The leaflets provided information on the following topics: What are PDMs; List of some of the institution’s standardized PDMs and recommendations for preventing errors involving PDMs in prescription, dispensing, administration, preparation and storage.

Figure 1. Educational leaflet distributed to the professionals.



Source: Prepared by the authors, 2022.

The educational game (Figure 2) was produced with a colorful rug, 110 cm wide by 180 cm long, made in EVA with five squares and use of a die. It allowed up to three people to play simultaneously. To advance in the game, the participants had to give the correct answer to the questions included on the card given to them.

Figure 2. Educational game with questions and answers about PDMs.



Source: Prepared by the authors, 2022.

Discussion

In relation to the professional practices, weaknesses were identified in all stages of the PDM chain, indicating that actions aimed at improvements need to be systemic and multidisciplinary. A positive aspect was the fact that the institution has a computerized system that minimizes some risks, although they still use abbreviations, acronyms and commercial names. In a systematic review that included 19 studies, a 71% reduction in prescription errors was observed after implementing electronic prescription systems with clinical decision support in hospitals¹⁶. However, attention must be paid to incorporating the recommendations of the protocol for safe medication use.

In relation to the PDM dispensing process in the institution under study, it took place in an environment with adequate organizational conditions. Nonetheless, the prescriptions were not adequately verified and their transportation to the health units was not properly executed. Therefore, improvements would be necessary for safe dispensing of these medications. This process encompassed the pharmacist's effective involvement in the technical evaluation of prescriptions, taking into account the recommendations outlined in the protocol for safe medication use¹⁴. Pharmacists are key professionals in the safety context for PDM use, as they can identify and prevent risks related to concentration, physical-chemical compatibility, drug interactions, dose, pharmaceutical form, and drug administration routes and times⁶.

Despite the presence of a red label on the bins to indicate the PDMs, where the medications are stored during transportation, different packaging with red warning identification is not used. Instead, they are dispensed in transparent plastic bags, along with other medications prescribed for the patient. A similar result was found in a study carried out at a university hospital¹⁷.

When asked about the use of abbreviations, preparation of PDMs and other medications for different patients at the same time, and administering medications prepared by another professional, most of the respondents stated that it was not correct to carry out such practices. However, the observational study verified use of abbreviations in some prescriptions, simultaneous preparation and transportation of several medications at the same time, on the same tray. Thus, it is noticed that, although they possess theoretical knowledge, this does not translate into safe practices.

It is known that there will always be prescribed work, permeated by norms and prescriptions about what and how tasks should be carried out, which will guide workers' action so as to get to the real work: the one that actually happens¹⁸. Thus, prescribed and

real work will never be exactly the same; there is space for the creation and production of new knowledge. However, when it comes to patient care, safe practices (prescribed) are expected to be incorporated into the professionals' routine (real), contributing to patient safety.

Non-incorporation of safe practices in health services is influenced by several contextual factors, among which the patient safety culture stands out; an aspect that has been extensively investigated. Another central element in this scenario is leadership support, providing an appropriate context for continuous improvements¹⁹.

Regarding the practice of identifying PDMs with handwritten white ribbons, which is being implemented at the institution under study, it requires a thorough review as it contradicts the current recommendations, which require PDMs to be identified differently from medications in general, typically through alerts and visual identification²⁰. Preventing medication errors is based on knowledge, early detection and improvements in health professionals' performance²¹.

In the stage of assessing the knowledge level about PDMs, questions were prepared in order to assess the participants' knowledge about the stages of prescription, preparation, administration and storage processes, which cover the PDMs in the hospital unit. Most of the professionals answered that their knowledge was fair; that they had not attended any training in the last six months, and that carrying out qualification sessions at the institution would be fundamental. Some studies show that lack of knowledge and training among health professionals about PDMs is one of the factors contributing to the occurrence of drug administration errors²², and that educational strategies are fundamental to promote safe PDM use⁸.

In relation to knowing about the institution's standardized PDMs list, some of the professionals did not know it. Other studies²³⁻²⁴ corroborate these findings, where the low availability of the PDM list, as well as of information about maximum PDM doses and concentrations, is a reality in hospitals.

In this context, one of the strategies to avoid errors associated with PDMs is to increase the availability of diverse information about these medications, with wide dissemination of the PDM list in the institution. This was mentioned by the questionnaire respondents, who cited the importance of having the PDM list posted in their workplace, as well as the need for training on the theme. These reports reinforce what was observed in the professional practices and highlight the educational actions that were carried out at the institution, as the last stage of this study.

Another important aspect was related to double-checking: although the professionals mentioned that it was essential to do it, when asked about this knowledge, it was not observed in the work practices. According to Reis (2018)⁶ appropriate PDM use is correlated with the implementation of surveillance systems and barriers to prevent errors, with double-checking being considered an effective measure, both during the drug dispensing by the pharmacy and during their preparation and administration by the Nursing team. The protocol for safe medication use¹⁴ also recommends this practice.

The educational actions carried out in this study consisted of a question-answer game applied to the professionals with subsequent distribution of information leaflets about PDMs, with the objective of strengthening important information about their safe use.

Permanent Education is defined as on-the-job learning, seeking to incorporate theoretical and practical aspects into everyday services. It is a powerful tool for training and developing health professionals with a view to meeting the real needs of the population they care for. And in this context, considering that the majority of the workforce corresponds to the Nursing team, they end up participating more effectively in the educational initiatives, and it is important to think about strategies to increase adherence of other professionals, especially physicians²⁵.

Potentially Dangerous Medications are key components of Drug Therapy, and it is fundamental to establish educational strategies for health professionals and to implement surveillance systems and barriers to prevent errors and severe harms⁶. However, the most effective actions to incorporate safe practices in PDM use should not only involve in-service training, but improved infrastructure and an enhanced patient safety culture¹⁹.

Conclusion

The results of this study showed that the professionals have theoretical knowledge about PDMs and their recommendations for preventing errors, although it was noticed that they do not put their knowledge into practice. This reflects the patient safety culture where the everyday practice becomes the main source of experience that determines the professionals' attitudes and actions.

In relation to the structural conditions, weaknesses were found that can be solved through measures such as implementing an electronic prescription system with visual alerts for PDMs and identification tools for PDMs, from prescription to administration.

Various contextual factors contribute to not incorporating safe practices in PDM use in the hospital under study, among which the patient safety culture stands out, as well as the need for the hospital institution to promote and encourage educational initiatives.

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Collaborators

EGC participated in the following stages: choosing the topic and preparing the research project; survey of the data collected; data interpretation; and writing of the article. ACBP and PRMS collaborated in the paper statistics and in interpretation of the results. MPM contributed writing the article and in the relevant critical review of the intellectual content.

Conflicts of interests

The authors declare no conflicts of interest.

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