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Article

An analysis of pharmaceutical care for critical patients of an adult Intensive Care Unit

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This work analyzed the pharmacotherapeutic problems identified by the clinical pharmacist in an intensive care unit (ICU) and the acceptance of pharmaceutical interventions in solving these problems. This is a descriptive cross-sectional retrospective study, carried out in the adult ICU of a public hospital. All patients hospitalized during the study period had their pharmacotherapy monitored and those whose stay at the ICU lasted less than 24 hours were excluded. The pharmacotherapeutic problems were classified according to type, cause, acceptability/implementation, mode of intervention, outcome and related pharmacotherapeutic group. 302 patients were followed up and 350 pharmacotherapeutic problems were identified. Most of them were classified as unnecessary drug-treatment (n=186; 53.1%). The most frequent causes were excessive drug administration (n=181; 97.3%), and antimicrobials was the main group of drugs associated to that type of problem. 350 pharmaceutical interventions were performed, highlighting "prescriber informed only" (n=178; 50.9%), with an average acceptability of 90.7%, with those carried out on site being more effective (93.4%). The number of pharmacotherapeutic problems that were totally solved was 282 (80.6%). Clinical pharmacy activities in the ICU identified, prevented and corrected pharmacotherapeutic problems, contributing to the optimization of pharmacotherapy in aspects related to the need, efficacy and safety of treatments.

Keywords: Pharmaceutical Services. Pharmacy Service, Hospitals. Evidence-Based Pharmacy Practice. Patient safety. Intensive care units.

INTRODUCTION

The need, effectiveness and safety of drug treatment has been widely discussed in numerous scenarios since it has impacts on both public health and the economy. Patient care, which once was simpler, less effective, and safer, has become more complex and effective. Yet, it is now more dangerous and error-prone (Brasil, 2014).

In hospitals, the occurrence of adverse drug events (ADEs) can be characterized in such a way that corrective/educational measures allow for prevention and, consequently, the reduction of its rates (Cano, Rozenfeld, 2009). The literature suggests, as a strategy to prevent the occurrence of adverse events, the implementation of safety protocols in the preparation and administration of medicines, electronic prescription, as well as the inclusion of the pharmacist in the multidisciplinary team (Figueiredo *et al*., 2018).

Several studies have shown the benefits of clinical pharmacist interventions in pharmacotherapy (Adriano *et al*., 2022; Belaiche *et al*., 2021; Martins *et al*., 2022; Zhang *et al*., 2021). One of these demonstrated that the pharmacist's clinical interventions reduced the risk for the incidence of adverse effects and drug interactions, thus contributing to the prevention of complications (Dias *et al*., 2018). Another study showed that the implementation of a collaborative medication review system between physicians and pharmacists reduced the prevalence of polypharmacy and potentially inappropriate medications

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for the elderly, contributing to more effective and safer health services (Marques *et al.*, 2019).

In this sense, it has been shown that pharmacists' clinical performance with multi-professional teams allows for the optimization of pharmacotherapy. Clinical Pharmacy in Brazil has advanced to a stage where the performance of pharmacists is more focused on care (CRF-SP, 2019; Fonseca *et al.*, 2017; Leape *et al.*, 1999; Silva *et al.*, 2018).

Thus, the role of the clinical pharmacist in the hospital environment is significantly necessary, since their interventions in pharmacotherapy are able to promote the rational use of medicines, ensuring greater patient safety and consequent cost reduction (Siqueira, Gomes Neto, Gonçalves, 2021). Thus, it is necessary to know the prevalent pharmacotherapeutic problems, their causes as well as the acceptability of pharmaceutical interventions to solve these problems.

The present study evaluated pharmaceutical care in critically ill patients in an adult general ICU. A European methodology was used to characterize the most prevalent pharmacotherapeutic problems identified by the clinical pharmacist, most performed pharmaceutical interventions, acceptance and implementation of interventions, problem solving as well as the effectiveness of different means of communication to carry out the interventions.

OBJECTIVE

The objective of this study was to describe and analyze the pharmacotherapeutic problems identified in the pharmaceutical care process performed by the clinical pharmacist of an intensive care unit and to measure the acceptance of pharmaceutical interventions by the multidisciplinary team in solving these problems.

MATERIAL AND METHODS

A descriptive retrospective cross-sectional study was carried out in the adult ICU of a public hospital in the State of Paraná, Brazil, from July 1, 2019 to March 22, 2020. It is a medium-sized general hospital with 119 beds, which provides low and medium complexity care. The specialties served are medical and surgical clinic, pediatrics, psychiatric emergency and adult ICU. In addition to outpatient services, such as specialized consultations, and a surgical center with four rooms active. The ICU in question has 10 beds for acute and chronically ill patients who need intensive life support.

The population investigated was selected by convenience sampling, and all pharmacotherapeutic follow-ups performed by the clinical pharmacist for patients admitted to the ICU during the conduction of the study were included. Patients whose stay at the ICU lasted less than 24 hours were excluded. The pharmacotherapeutic follow-up of the patients took place throughout the ICU stay.

For the pharmacotherapeutic follow-ups of the 10 beds of the adult ICU, the clinical pharmacy team had a clinical pharmacist (30 hours per week), two hospital pharmacists (30 hours per week) and a pharmacy resident daily (36 hours per week). Daily they evaluated the laboratory data of the patients, the medical records reviewed by the multidisciplinary team and the medical prescriptions were evaluated. Pharmaceutical interventions were performed mainly during multidisciplinary meetings (interventions *in locu*) or whenever a pharmacotherapeutic problem was detected in the process of evaluating medical prescriptions. Interventions by telephone were carried out when the clinical pharmacist could not go to the ICU and in writing, using a specific form, when there was no possibility of telephone contact.

The pharmacist's clinical activities and the pharmacotherapeutic follow-up were performed by monitoring the medications used and the length of the treatments prescribed in order to identify pharmacotherapeutic problems, prevent and/or solve them, with a focus on treatment optimization. The pharmaceutical recommendations were based on and followed the checklist order used in the ICU in question, as well as on laboratory and clinical data of the patients.

The clinical pharmacy team based the pharmaceutical intervention procedures on theoretical references, that is, package inserts of the medicines (printed or available on the Electronic Package Insert Collection of the Brazilian National Health Surveillance Agency - ANVISA), the 2010 National Therapeutic Formulary, printed literature (books, handbooks and clinical protocols),

Clinical Protocols and Therapeutic Guidelines - PCDT by the Ministry of Health, and others. Regarding drug interactions, they used MedScape - Drug Interactions Checker together with the Drugs.com application. As for performing dose calculations and dosage adjustments, we relied on the WebClinicCalc.

The pharmacotherapeutic problems and intervention records attached to the pharmacotherapeutic follow-up forms were quantified and classified according to the guidelines of the PCNE Classification for Drug Related Problems, version 9.00 (PCNE, 2019). The aforementioned document served as a reference for the construction of pharmacotherapeutic follow-up forms and pharmaceutical interventions at the hospital. Pharmacotherapeutic problems were stratified into potential or manifest, considering manifest when a sign or symptom was identified based on laboratory and/or clinical data and potential problem when there were no signs, symptoms or laboratory alterations, but there was a risk of occurrence of these manifestations.

Interventions accepted and implemented as indicated by the clinical pharmacist were classified as "fully implemented". Those implemented with changes like "partially implemented". Interventions not accepted due to disagreement were classified as "no agreement" and when the clinical pharmacist registered a pharmacotherapeutic problem and during the meeting obtained data that made the intervention unfeasible and, consequently, did not perform it, they were classified as "not proposed".

The drugs involved in the identified pharmacotherapeutic problems were classified according to the Anatomic Therapeutic Chemical Code (ATC) (WHOCC, 2020).

The classification process within the Pharmaceutical Care Network Europe (PCNE) domains was performed by three clinical pharmacists. Two of them independently classified the PCNE items on an electronic spreadsheet using Microsoft Office Excel®, version 2019. The third clinical pharmacist grouped the spreadsheets and resolved the differences found in the final classification.

Data regarding identified pharmacotherapeutic problems were classified as to type, cause, acceptability/implementation, mode of intervention and outcome, as well as the related pharmacotherapeutic group and were organized in spreadsheets using Microsoft Office Excel®, version 2019. GraphPad Prism, version 8.4, (GraphPad Prism Software, San Diego, California, United States) was used to obtain descriptive statistics by grouping the data as average, standard deviation, minimum value, maximum value and frequency counts.

This work obeyed all the ethical precepts related to research involving human beings, according to Normative Act nº 466, published on December 12, 2012, by the National Commission for Ethics in Research (CONEP, 2012). The co-participating institution authorized the research conduction at the hospital in question, and the study was approved by the Research Ethics Committee (CAAE: 16869419.1.0000.0104).

RESULTS

All the 312 patients admitted to the ICU during the period covered by the study had their respective pharmacotherapy monitored. However, nine individuals who died and a patient who was transferred less than 24 hours after being admitted were excluded from the population. Among the remaining 302 patients, the most frequent morbidities were arterial hypertension (50%), pneumonia (38.6%) and septic shock/septicemia (35.2%), with an average of 4.0 morbidities per patient (standard deviation (SD): ± 2.0; minimum: one morbidity; maximum: 9 morbidities). The average length of stay of patients was 8.9 days (SD ± 8.7; minimum: 1 day; maximum: 51 days). 65.2% of them were discharged to ward and 5.6% were transferred to other hospitals. Most patients were male (57.3%) and the population consisted mainly of people over the age of 60 years (64.6%; n = 195). The average age was 62.9 years (SD: ± 17.6 years; minimum: 15 years; maximum: 93 years) (Table I).

TABLE I - Characteristics of the population of the intensive care unit

Variable	n (%)
Sex	
Male	173 (57.3%)
Female	129 (42.7%)
Age range (years)	
15-30	22 (7.3%)
31-45	26 (8.6%)
46-60	59 (19.5%)
61-75	106 (35.1%)
>75	89 (29.5%)
Discharge from the ICU	
Nursery	197 (65.2%)
Transfer	17 (5.6%)
Death	88 (29.1%)
Length of stay in the ICU (days)	
<10	222 (73.5%)
11-20	52 (17.2%)
21-30	16 (5.3%)
31-40	8 (2.7%)
>41	4 (1.3%)

ICU: Intensive Care Unit

Throughout the study period, 350 pharmacotherapeutic problems were identified in 146 of the 302 patients, with a mean of 1.2 (SD: ± 1.68; Minimum: 0; Maximum: 12), of which 75.1% (n = 263) were classified as potential problems, while 24.9% (n = 87) manifest problems. The acceptance of proposed interventions due to a manifest problem reached 88.2% against 95.7% in those classified as potential.

The classification process showed that most problems were related to unnecessary drug-treatments (53.1%), followed by treatment safety (22.6%) and treatment effectiveness problems – "Untreated symptoms or indication" (14.0%). When correlating the three most frequent causes of problems, it was identified that 97.3% of the occurrences of unnecessary medication treatment were due to excessive medication administration (number of doses). The main cause of adverse drug events was high doses of medication, which led to 44 occurrences (55.7%). Finally, 29 (59.2%) of the 49 situations involving symptoms and untreated indications were due to no or incomplete treatment (Table II).

TABLE II – Distribution of pharmacotherapeutic problems and stratification according to their causes

Problem	N (%)	Cause of the pharmacotherapeutic problem	n (%)
Unnecessary drug-treatment	186 (53.1)	Duration of treatment too long	181 (97.3)
		No indication for drug	3 (1.7)
		Too many drugs prescribed for indication	1 (0.5)
		Other causes	1 (0.5)
Adverse drug event (possibly) occuring	79 (22.6)	Drug dose too high	44 (55.7)
		Inappropriate combination of drugs, or drugs and herbal medications, or drugs and dietary supplements	11 (13.9)
		Dosage regimen too frequent	7 (8.9)
		Other causes	17 (21.5)

TABLE II – Distribution of pharmacotherapeutic problems and stratification according to their causes

Problem	N (%)	Cause of the pharmacotherapeutic problem	n (%)
Untreated symptoms or indication	49 (14.0)	No or incomplete drug treatment in spite of existing indication	29 (59.2)
		Prescribed drug not available	11 (22.4)
		No medication reconciliation	8 (16.4)
		Other causes	1 (2.0)
Effect of drug treatment not optimal	16 (4.6)	Inappropriate timing of administration or dosing intervals	3 (18.8)
		Drug under-administered	3 (18.8)
		Other causes	10 (62.4)
Unclear problem/ complaint. Further clarification necessary	16 (4.6)	Dose timing instructions wrong, unclear or missing	13 (81.2)
		Prescribed drug not available	2 (12.5)
		Other causes	1 (6.3)
		---	-
Problem with cost-effectiveness of the treatment	4 (1.1)	Inappropriate drug form (for this patient)	3 (75.0)
		Inappropriate drug according to guidelines/formulary	1 (25.0)
		---	-

Among the 302 patients followed up by the clinical pharmacist, 48.3% (n=146) had interventions in their pharmacotherapy. Considering these patients, we obtained an average of 2.4 interventions per patient (SD: ± 1.70; Minimum: 1; Maximum: 12), with up to three interventions per patient predominating. Interventions classified as 'prescriber informed only' had 178 occurrences (50.9%), followed by 56 (16.0%) 'dosage changed to…' and 36 (9.1%) 'drug paused or stopped'. The need to indicate a medication (drug started) was the fourth most frequent type of intervention, that is, 31 occurrences (8.9%). Interventions to correct counting in the number of doses of antimicrobials were the ones that most qualified as 'prescriber informed only', totaling 89.3% (n=159) (Table III).

TABLE III - Distribution of pharmaceutical interventions. Intensive care unit of the Municipal Hospital of Maringá. 2020. (n=350)

Pharmaceutical intervention	n (%)
Prescriber informed only	178 (50.9)
Dosage changed to …	56 (16.0)
Drug paused or stopped	32 (9.1)
Drug started	31 (8.9)
Intervention discussed with prescriber	10 (2.8)
Instructions for use changed to …	10 (2.8)
Formulation changed to …	8 (2.3)
Drug changed to …	7 (2.0)
No Intervention	6 (1.7)
Intervention proposed to prescriber	6 (1.7)
Prescriber asked for information	3 (0.9)
Other intervention (specify)	3 (0.9)

Out of the 350 pharmaceutical interventions performed, 317 (90.7%) were accepted by the multi-professional team and 282 (80.6%) were fully implemented. Considering the ones that were not accepted, 10 (2.8%) cases were due to lack of agreement with prescribers. The acceptance of the conducts of the pharmacist on the spot in the ICU was higher (93.4%) than those on the telephone (77.8%) and in writing (58.8%). Implementation was also greater when performed by the pharmacist together with the multidisciplinary team or the doctor on duty (82.4%) against 77.8% and 52.9% on the telephone and in writing, respectively (Table IV).

TABLE IV - Stratification of pharmaceutical interventions regarding the form of intervention used in terms of acceptance/ implementation (n=350)

Form of intervention	N	Acceptance	n (%)	Implementation	n (%)
In loco	306	Accepted	286 (93.4)	Fully implemented	252 (82.4)
		Not accepted	17 (5.6)	No agreement	8 (2.6)
		Others	3 (1.0)	Intervention not proposed	2 (0.7)
Telephone	27	Accepted	21 (77.8)	Fully implemented	21 (77.8)
		Not accepted	3 (11.1)	Not feasible	2 (7.4)
		Others	3 (11.1)	Intervention not proposed	3 (11.1)
In writing	17	Accepted	10 (58.8)	Fully implemented	9 (52.9)
		Not accepted	1 (5.9)	No agreement	1 (5.9)
		Others	6 (35.3)	Acceptance unknown	6 (35.3)

Of the possible outcomes for pharmacotherapeutic problems that received a pharmaceutical intervention, the most common was a fully resolved problem (n=282; 80.6%). Problems that were not resolved totaled 56 cases (16.0%), and of these, the main factor for non-resolution was the prescriber's lack of collaboration, which accounts for 47 (83.9%). Observing the three problems with the highest incidence (Table II), the one with the highest total resolution was "unnecessary medication treatment", with 83.9%. while "untreated symptoms or indication" had the lowest rate of resolution (69.4%).

Among the accepted and fully implemented interventions, 256 (90.8%) had some impact on medicines intake and 60 medicines and / or pharmaceutical presentations were the object of such interventions. 207 interventions (80.9%) resulted in a medication being excluded, 38 (14.8%) in the incorporation of a new one, and 11 (4.3%) in a medication being replaced by a more suitable one. Antimicrobials were the group of drugs with the highest number of interventions (n=202; 78.9%), followed by general nutrients (n=16; 6.2%) and prokinetic agents and medication to prevent stress ulcers (n=11; 4.3%). The exclusion of antimicrobials was suggested in 189 (73.8%) interventions, whereas the group of general nutrients was included into pharmacotherapy in 15 (5.9%). Prokinetic agents and medication to prevent stress ulcers were replaced in 5 (2.0%) out of 11 interventions (Table V).

TABLE V - Distribution of pharmaceutical interventions by pharmacotherapeutic groups according to insertion, exclusion or replacement. 2020. (n=280)

Drugs/pharmacotherapeutic groups	Exclusion	Insertion	Replacement	Total
	n (%)	n (%)	n (%)	n (%)
Antimicrobials	189 (73.8)	10 (3.9)	3 (1.2)	202 (78.9)
General nutrients	1 (0.4)	15 (5.9)	-	16 (6.2)
Propulsives and drugs to prevent stress ulcer	5 (2.0)	1 (0.4)	5 (2.0)	11 (4.3)
Analgesics	3 (1.2)	1 (0.4)	1 (0.4)	5 (1.9)
Systemic hormonal preparations	1 (0.4)	3 (1.2)	-	4 (1.6)
Diuretics	-	3 (1.2)	-	3 (1.1)
Antiarrhytmics	2 (0.8)	-	-	2 (0.8)
Solvents and diluting agents	-	1 (0.4)	1 (0.4)	2 (0.8)
Corticosteroids	1 (0.4)	1 (0.4)	-	2 (0.8)
Psycholeptics	1 (0.4)	1 (0.4)	-	2 (0.8)
Antihypertensives	-	2 (0.8)	-	2 (0.8)
Muscle relaxants	1 (0.4)	-	-	1 (0.4)
Hypnotics and sedatives	-	-	1 (0.4)	1 (0.4)
Preventive treatment of deep vein thrombosis	1 (0.4)	-	-	1 (0.4)
Antiepileptics	1 (0.4)	-	-	1 (0.4)
Antihistamines for systemic use	1 (0.4)	-	-	1 (0.4)
Total	207 (80.9)	38 (14.8)	11 (4.3)	256 (100.0)

DISCUSSION

The clinical performance of the pharmacist had identified numerous pharmacotherapeutic problems, especially those related to the unnecessary use of medications. By intervening in these problems, the clinical pharmacist contributed not only financially to avoid unnecessary drug use, but also to avoid possible adverse drug effects, reduce possible drug interactions, adjust dosages for renal function in a timely manner, avoid overloading biological systems (mainly kidney and liver), in addition to contributing to the prevention of the emergence of bacterial resistance to antimicrobials.

These failures were evidenced most of the times by the wrong evolution in the prescriptions from one day to the next and can be prevented by an electronic prescription system together with the performance of a clinical pharmacist. A study conducted in an American hospital showed that a clinical pharmacist working with the medical team, with the support of an electronic error reporting system, led to an increase in the number of identified errors that would possibly go unnoticed, thus, preventing harm to patients (Weant, Cook, Armitstead, 2007).

As in Klopotowska *et al*. (2010), our data showed that the type of drugs with the highest incidence of pharmacotherapeutic problems were antibacterials (23.4% of the cases). The authors also identified that the main reason for errors involving antibacterials is related to errors in monitoring pharmacotherapy. The literature states that the most common contributions by pharmacists in multi-professional visits include the review of current pharmacotherapy, the review of antibiotic therapy, dosage adjustments according to organic disorders, such as liver and kidney, in addition to ensuring adequate prophylaxis for conditions with potential for damage (Mailman, Semchuk, 2018).

Problems related to untreated signs and symptoms were also evidenced and the indication of a medication to the therapeutic regimen of patients in ICUs is relatively complex because, their clinical condition, the large number of medications already used, well-established clinical protocols and other factors make the indication of a medication something less common and more complex than other interventions. These factors can be noticed in our results, where the indication of a new drug reached only 8.9% of the pharmacotherapeutic problems and general nutrients was the group of drugs that were most frequently included in therapy. As in our results, Aguiar *et al*. (2018) found that adding a new drug to a patient's therapy was classified as the seventh most frequent type of intervention (1.9%).

The lack of a drug necessary for a patient's clinical condition can be as harmful as unnecessary use. Was demonstrated by Leguelinel-Blache *et al.* (2014), that pharmacotherapeutic problems of omission of some therapeutic agent occur mainly at the time of admission of patient to the hospital. Differently, our findings indicated as the main cause of omission of a necessary treatment, a condition that should not occur, with the correct execution of the checklist by multiprofessional team of the ICU. Corrections of electrolyte levels should be monitored daily and reported during the multidisciplinary meetings.

The complexity of the therapy and procedures performed in the ICU sector can expose patients to errors that may lead to complications and, in some cases, to death. So, an integrated performance of pharmaceutical professionals with multidisciplinary teams is necessary to detect these errors and stop them from happening (Klopotowska *et al*., 2010; Kohn, Corrigan, Donaldson, 2000).

The participation and integration of the clinical pharmacist with the ICU team optimizes not only the detection of problems related to pharmacotherapy, but also their resolution, since the acceptance and implementation of pharmaceutical interventions on the spot proved to be more efficient. This is due to aspects related to the understanding of what is proposed by the pharmacist, as well as the opportune time of pharmacotherapy checking involving the whole team. A study conducted in the Northeast of Brazil showed that collaborative medication reviews (CMRs) involving pharmacists and doctors led to the optimization of prescription quality indicators. Joint action by these professionals resulted in 98.8% of acceptance of the interventions proposed by the pharmacist (Marques *et al*., 2019). Thus, the multidisciplinary meetings in the ICU are an opportune moment for the daily review of pharmacotherapy, since the use of drug therapy is highlighted in these meetings and the clinical pharmacist can point out identified pharmacotherapeutic problems to the team and correct them.

We did not find in the literature a single parameter that would determine which level of acceptance of pharmaceutical interventions is considered to be optimal. However, a review carried out by Pilau, Hegele and Heineck (2014) indicates that acceptance levels above 71% are considered to be high, reaching up to 98.4%. These values, according to the authors, highlight the clinical value of the pharmaceutical services provided. Taking this parameter as a basis, this study had a satisfactory result with regard to the acceptance of the interventions, since it reached 90.6%. Yet, we do not recommend the use of the written form exclusively, since its acceptance was only 58.8%.

Pharmaceutical interventions performed both in potential and manifest pharmacotherapeutic problems reached satisfactory values acceptance by the multidisciplinary team, since both situations are clinically important and require a careful look on the part of the clinical pharmacist and the multiprofessional team. The greater acceptance of interventions in problems classified as potential pharmacotherapy, demonstrated the

importance of the pharmacist's clinical performance in avoiding potentially harmful situations to patients that, in general, were ignored by the other members of the ICU health team.

The clinical performance of the pharmacist in the multidisciplinary team led to an effective resolution of 80.6% of the problems related to pharmacotherapy and this data reaffirms the fundamental role of this professional in health services. Our data do not allow us to state the impact of pharmaceutical interventions on the length of stay in the ICU or even on the mortality rate, however, we can say that there were gains in the quality of care provided, as well as in the quality of life of patients.

The data identified in this study corroborate what has been described in the literature on the profile of patients admitted to this ICU. Studies conducted in ICUs of other hospitals in Brazil demonstrate a higher bed occupancy rate by male individuals (Dias *et al*., 2018; Oliveira *et al*., 2010; Silva *et al*., 2018). The national household sample survey revealed that, in general, men care less about their health than women and throughout the period during which the study was carried out, the average number of consultations sought by women was 3.9 against 1.8 for men (Brasil, 2010).

Knowing the population to be assisted is essential for the pharmacist's clinical activities to be more effective and to achieve positive impacts on the quality of care provided as well as on the patient's quality of life. The higher prevalence of individuals with systemic arterial hypertension, pneumonia and septic chock/septicemia, as well as advanced age, should be observed to direct the type of problems that the pharmacist will encounter. Elderly patients, in general, are more affected by chronic diseases such as hypertension and diabetes and acute diseases more seriously weaken this public. We must still consider that the prevalence of polypharmacy in this group is a complicating factor.

This work provides information on the use of different means of intervention with the multidisciplinary ICU team of a medium-sized hospital that does not count on an electronic prescription system. It also presents an adaptation of the PCNE 9.0 for classifying pharmacotherapeutic problems, thus, allowing for the development of work forms. Moreover, it corroborates data available in the literature, revealing which pharmacotherapeutic problems prevail in an average national ICU, thus, allowing strategies to implement pharmaceutical services aimed at the clinic.

Regarding the limitations of the study, data were collected from secondary sources (pharmacotherapeutic monitoring forms) and no pharmacoeconomic analysis was carried out, as the data collected did not consider a series of expenditures on inputs, as well as costs related to equipment, human resources and others.

CONCLUSION

The clinical pharmacy activities at the ICU where the research was carried out allowed us to identify, prevent and correct problems related to the use of medication, thus, contributing to the optimization of pharmacotherapy in aspects related to the need, effectiveness and safety of the treatments.

The unnecessary use of drugs was the most prevalent pharmacotherapeutic problem in the studied period and the use beyond the indicated was the main cause for its occurrence. Problems involving the use of antimicrobials in addition to those indicated were the most prevalent, revealing an important area of action for the pharmacist, since the proposed interventions reached high values of acceptance and implementation. As for the method used to carry out the pharmaceutical interventions, those carried out verbally (*in locu*) to the prescriber and/or the multidisciplinary team during the meetings, achieved greater resolution of the DRPs than the other modalities.

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