Saúde e Pesquisa
DOI: 10.17765/2176-9206.2024v17n1.e12410

Pharmaceutical Interventions in an Adult Intensive Care Unit at a Federal Hospital in Rio de Janeiro

Intervenções Farmacêuticas em Unidade de Terapia Intensiva Adulto de Hospital Federal do Rio de Janeiro

Maria Eduarda Escocard Consendey[1], Thais Ribeiro Pinto Bravo[2*], Thaisa Amorim Nogueira[3]

[1] Specialization in Hospital Pharmacy from the Hospital Pharmacy Residency Program, Universidade Federal Fluminense, Niterói (RJ), Brazil; [2]Master in Applied Sciences for Health Products from the Postgraduate Program in Applied Sciences for Health Products, Universidade Federal Fluminense, Niterói (RJ); [3]Professor in the Department of Pharmacy and Pharmaceutical Administration. Fluminense Federal University. Niterói (RJ), Brazil.

***Autor correspondente**: Thais Bravo – *Emai: thaispbravo@gmail.com*

ABSTRACT
The objective of the study was to identify the profile of Pharmaceutical Intervention in the ICU of a Federal Hospital in Rio de Janeiro between September 2018 and September 2019. The study design is descriptive and observational. Form development and ntervention data collection were carried out using Google Forms . The study obtained 354 interventions, increasing from 38 in 2018 to 309 in 2019. The multiprofessional team's acceptance rate increased from 78.9% to 83.5%. In 2018, the most prevalent drug was omeprazole (13%) and the ATC group that stood out was A (24.1%). In 2019, the most prevalent drug was meropenem (8.6%) and the highlighted ATC group was J (39.4%.) The main types of intervention were drug interactions in 2018 (46.9%) and dose adjustments in 2019 (31.6%). In this way, the study promoted the development of indicators to assess the quality and efficiency of the pharmaceutical service.

Keywords: Pharmaceutical Services. Intensive Care Units. Pharmaceutical Interventions.

RESUMO
O objetivo do estudo foi verificar o perfil de Intervenção Farmacêutica em UTI de um Hospital Federal do Rio de Janeiro entre setembro de 2018 a setembro de 2019. O desenho do estudo é descritivo e observacional. O planejamento de formulários e a coleta de dados das intervenções foram realizados pelo Google Forms . O estudo obteve 354 intervenções aumentando de 38 em 2018 para 309 em 2019. A taxa de aceitação da equipe multiprofissional aumentou de 78,9% para 83,5%. Em 2018, o medicamento mais prevalente foi o omeprazol (13%) e o grupo ATC destaque foi o A (24,1%). Em 2019, o medicamento mais prevalente foi o meropeném (8,6%) e o grupo ATC destaque foi o J (39,4%.) Os principais tipos de intervenção foram interações medicamentosas em 2018 (46,9%) e ajustes de dose em 2019 (31,6%). Desta forma, o estudo promoveu o desenvolvimento de indicadores para avaliar a qualidade e eficiência do serviço farmacêutico.

Palavras-chave: Serviço Farmacêutico. Unidades de Terapia Intensiva. Intervenções Farmacêuticas.

INTRODUCTION

Over the years, Brazilian pharmaceutical laws, resolutions, and normative instructions have evolved to cover more clinical activities, with a greater focus on patient care. In 2013, RDC No. 585 of the Federal Pharmacy Council (CFF) was a major milestone in the area of Clinical Pharmacy (CF) as it regulated the clinical attributes of pharmacists and defined important clinical concepts[1]. Among these, this resolution defined Pharmaceutical Interventions (PI) as acts planned, documented, and carried out by the pharmacist with the aim of optimizing the patient's pharmacotherapy, as well as contributing to the promotion, protection, and recovery of health in line with the Unified Health System (SUS).

Despite the recent prominence of CF in Brazil, literature shows its beginnings dating back to the 1960s in developed countries such as the United States of America (USA), owing to the desire to bring pharmaceutical knowledge closer to the practice of patient care. With the First Granada Consensus in Spain, important definitions emerged regarding critical points in pharmacotherapy to which pharmacists could contribute, specifically to Drug-Related Problems (DRPs)[2,3].

Intensive Care Units (ICUs) emerged in the 1950s and were pioneered by the Copenhagen Municipal Hospital in Denmark. It emerged as a ward where doctors and nurses cared for critically ill patients 24 hours a day with the main aim of restoring and maintaining the functions of vital organs, thereby increasing their chances of survival. Today, its concept transcends physical space, and intensive care can be understood as a system of care that relies on interdisciplinary skills, all with the common goal of preventing further deterioration using technology to protect vital systems such as the respiratory, cardiovascular, and renal systems[4,5].

Combining the need for more active participation by pharmacists (ideally during decision-making by the team) with the fact that ICUs are units where patients are highly vulnerable, technological advances in the areas of diagnosis and therapy, the high number of human resources involved, and the high risk of exposure to hospital infections, strategies for prioritizing the implementation of clinical pharmaceutical services should be aimed at critical units such as ICUs[6,7].

According to the regulation of pharmacists' clinical practice, coupled with data confirming the high potential for preventing adverse events and other problems, especially in the context of intensive care, it can be seen that pharmaceutical interventions can be an initial field of effective insertion of pharmacists in the clinical area, as well as contributing to improving patient safety and even reducing costs for institutions [8-10].

This work has scientific relevance, especially in the current context of the World Health Organization's (WHO) Third Global Patient Safety Challenge, launched in March 2017 ("Medication Without Harm"), which aims to reduce serious and preventable medication-related harm by 50% over the next five years[11]. This study aimed to verify the profile of pharmaceutical interventions administered in an ICU at a federal hospital in Rio de Janeiro.

METHODOLOGY

STUDY DESIGN

The study's design is descriptive and observational. It aimed to verify the pharmaceutical interventions performed in the ICU of a federal hospital in Rio de Janeiro, Brazil.

DESCRIPTION OF THE HOSPITAL UNIT

This work was conducted in a large federal hospital in the city of Rio de Janeiro, which

has 450 admission beds and an outpatient unit that provides care for a wide range of specialties. It has an operating room for medium- and high-complexity surgeries with about 20 rooms and nine outpatient surgery rooms.

The hospital's adult ICU, where the work was carried out, has 17 active beds, 10 of which are generally for clinical patients and seven for perioperative patients. This clinic houses critically ill patients, such as those suffering from sepsis and shock (septic, hypovolemic, among others); some types of pre- and postoperative patients, such as those who undergo general surgery, neurosurgery, and vascular surgery; and those who need detailed monitoring, whether invasive or not. The study did not require approval from the Research Ethics Committee (REC), as it intended only to monitor pharmacy services internally.

CREATION OF THE TOOL FOR COLLECTING AND ANALYZING THE INTERVENTIONS

A free online form was developed, available on Google Forms. This form makes data collection and organization simpler and faster because it communicates automatically with Google Spreadsheets.

The tool was developed over a period of 3 months (beginning of March to the end of April 2018) and approved by the pharmacy manager after being tested for approximately a month. One suggested adjustment was to adapt the form to encompass all pharmacy services so that any new interventions could also be entered into the new template. To do this, types of interventions that were not necessarily directly related to clinical pharmacy, but those it could cover efficiently were added.

These interventions were entered into an online data collection system (Google Forms) called the Pharmaceutical Intervention Report, in which the details such as the patient's personal characteristics, date on which the interventions were carried out, name of the pharmacist responsible, professional contacted, type of intervention, drugs used, acceptance, outcome, and pharmaceutical orientation were entered.

As the tool was available on an online platform, its link was saved in the pharmacy's public folder, available to all members who had access to the hospital's internal file network.

The types of PI were adapted from Fideles et al. (2015), Ribeiro et al. (2015), Reis et al. (2013), and Cardinal and Fernandes (2014)[12-15]. These types were chosen along with pharmacists from other services to adapt the tool to all sectors of the pharmacy. Chart 1 illustrates the standardized PI values.

Chart 1. Classification of standardized PI according to their types.

Type of Pharmaceutical Intervention	Concepts
1. Dose*	Increasing or decreasing the dose to suit the patient's clinical condition, weight or creatinine clearance . It also includes the inclusion of the dose in the prescription (when absent).
2. Administration interval*	Increasing or decreasing the administration interval to suit the patient's clinical condition, weight or creatinine clearance . It also includes the inclusion of the interval in the prescription (when absent).
3. Pharmaceutical form*	Modification of the pharmaceutical form to another that is more suitable for the patient or that is available in stock and/or in the hospital's standardization. It also includes the inclusion of the pharmaceutical form in the prescription (when absent).
4. Form of administration*	Modification of the drug's route of administration to another that is more suitable and/or safer, taking into account the characteristics of both the patient and the drug. It also includes the inclusion of the route in the prescription (when absent).
5. Dilution	Modification of the volume or type of diluent of the drug.
6. Duplicate therapy	Drugs with equivalent therapeutic action prescribed for the same patient, or repetition of the same drug in a prescription.
7. Duration of treatment**	Need to interrupt or continue the use of inappropriate drug due to concluding/not concluding treatment, respectively. It includes the inclusion/alteration of the treatment time in the prescription, when appropriate.
8. Contraindications	Need to change/suspend the patient's treatment due to the patient's clinical conditions not being compatible with the use of the prescribed drug.
9. Drug interaction	Modification of the dose, administration interval, scheduling or substitution of the drug due to the presence of drug interactions with clinical relevance
10. Physico-chemical incompatibility	Recommendation on the scheduling or administration of the prescribed drug due to the presence of another drug incompatible with administration via tube or parenteral route in Y.
11. Adverse reaction	Passing on the patient's report or the pharmacist's observation of adverse reactions to the doctor in question, which may (or may not) lead to a change in treatment.
12. Allergy	Modification of prescribed drug due to patient's report of allergies.
13.Omission/ correction of patient characteristics	Request patient information that is essential to ensure the correct handling of the therapy. This field is especially intended for the Chemotherapy sector.
14. Need for additional treatment	Identification of the occurrence of an untreated clinical condition, the need for continued treatment or prophylactic treatment.
15. Therapeutic alternative	Replacing the prescribed drug with another drug that is more suitable for the patient or that is available in stock and/or in the hospital's standardization.
16. Pharmaceutical instructions	Resolution of doubts or other technical knowledge, provided at the request of other professionals in the team (reactive) or when the pharmacist identifies the need (proactive).
17. Provision of medication	Availability of drugs in stock and, if not, the current status of the procurement process or the possibility of moving them between other hospital units.
18. Drug reconciliation	Inclusion of drug therapy based on family reports and/or current prescriptions of the patient prior to the current hospitalization/discharge condition.
19. Illegible prescription	Applicable especially to outpatient care
20. Other	More specific situations, not covered by other types of intervention.

Legend: * (inadequate/omission);** inadequate/suspension of therapy; Source: Authors.

APPLICATION OF THE TOOL

After the tool was implemented in the pharmacy sector, it was used to generate data. All interventions conducted from September 2018 to September 2019 were included, including converting the previous handwritten intervention forms into a computerized tool.

The overall number of interventions, as well as the type of interventions carried out, distributed by frequency, and the rate of acceptance by the clinical team were obtained. Other parameters included the most prevalent drugs during the study period and the grouping of drugs according to the WHO Anatomical Therapeutic Chemical classification (ATC).

The aim was to create indicators that could serve as tools to assess the quality and efficiency of the pharmaceutical service provided, so that future professionals could compare and assess possible improvements.

STATISTICAL TREATMENT

The interventions carried out during the study period were organized in such a way as to obtain descriptive statistical data, with values presented in absolute and/or relative frequency. Data were generated from the final data using the Forms platform.

RESULTS

COMPUTERIZED TOOL

The purpose of the computerized tool is to facilitate the recording of pharmaceutical interventions, enabling faster data collection and analysis. The tool was adapted so that all sectors of the pharmacy, not just the Clinical Pharmacy sector, could use it. The tool, called "Pharmaceutical Intervention Report," was divided into 4 sections.

General aspects of the intervention are described in the first section (Figure 1A). The first was the name of the responsible pharmacist, which should always be filled in the same way to make it easier to group data. The pharmacy sector is important so that each pharmacy subsector can keep track of the number of interventions and sequence of their respective services. This is especially important when it comes to archiving copies of prescriptions that require interventions, where the acronym code and number can be written as determined. This date can be entered in two fields. The first, "date of event" is the field used to record the date on which the object of the intervention was found. The "date of action" field was designed for cases in which the pharmacist was unable to carry out their intervention on the day the event first appeared.

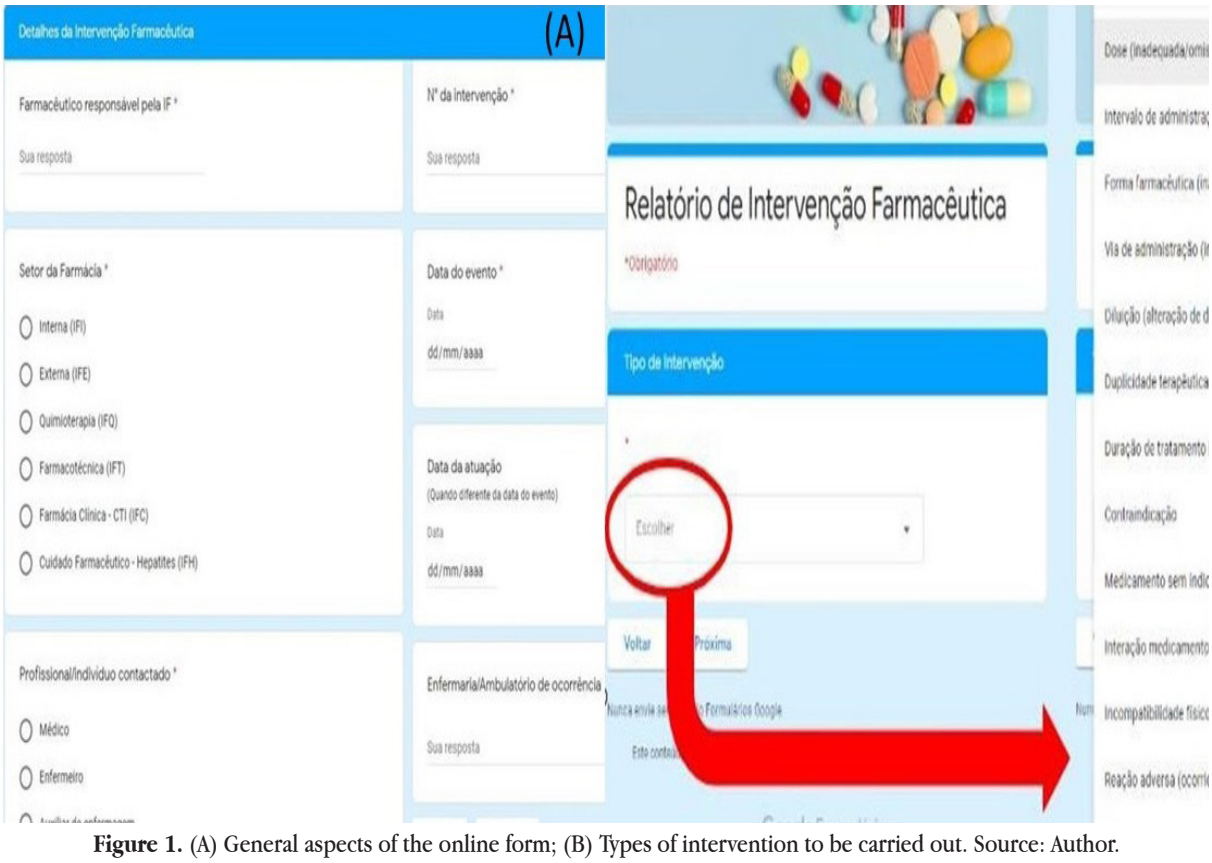

Figure 1. (A) General aspects of the online form; (B) Types of intervention to be carried out. Source: Author.

The last field in the first section, " Infirmary/Ambulatory of occurrence" was used to fill in interventions from the Internal Pharmacy, Pharmacotechnics or External Pharmacy, in which there is a range of possibilities of clinics involved in the event (e.g. pediatrics, medical clinic, gynecology, gastroenterology, among others).

After completing the data in the first section, we move on to the second section, which was responsible for selecting the type of intervention. These were designed to address the possible errors in any sector of the pharmacy unit, as shown in Figure 1B.

For the types of intervention listed, with the exception of "omission/correction of patient characteristics" and "pharmaceutical guidance," the next section of the tool goes on to fill in the information about the drug(s), as illustrated in Figure 2A. In the first field, "Drug involved," we opted for the word "drug" due to the lower possibility of misinterpretation, since the name of the drug is obligatorily the name of the active substance, minimizing the chances of drugs being filled in by their trade names, for example.

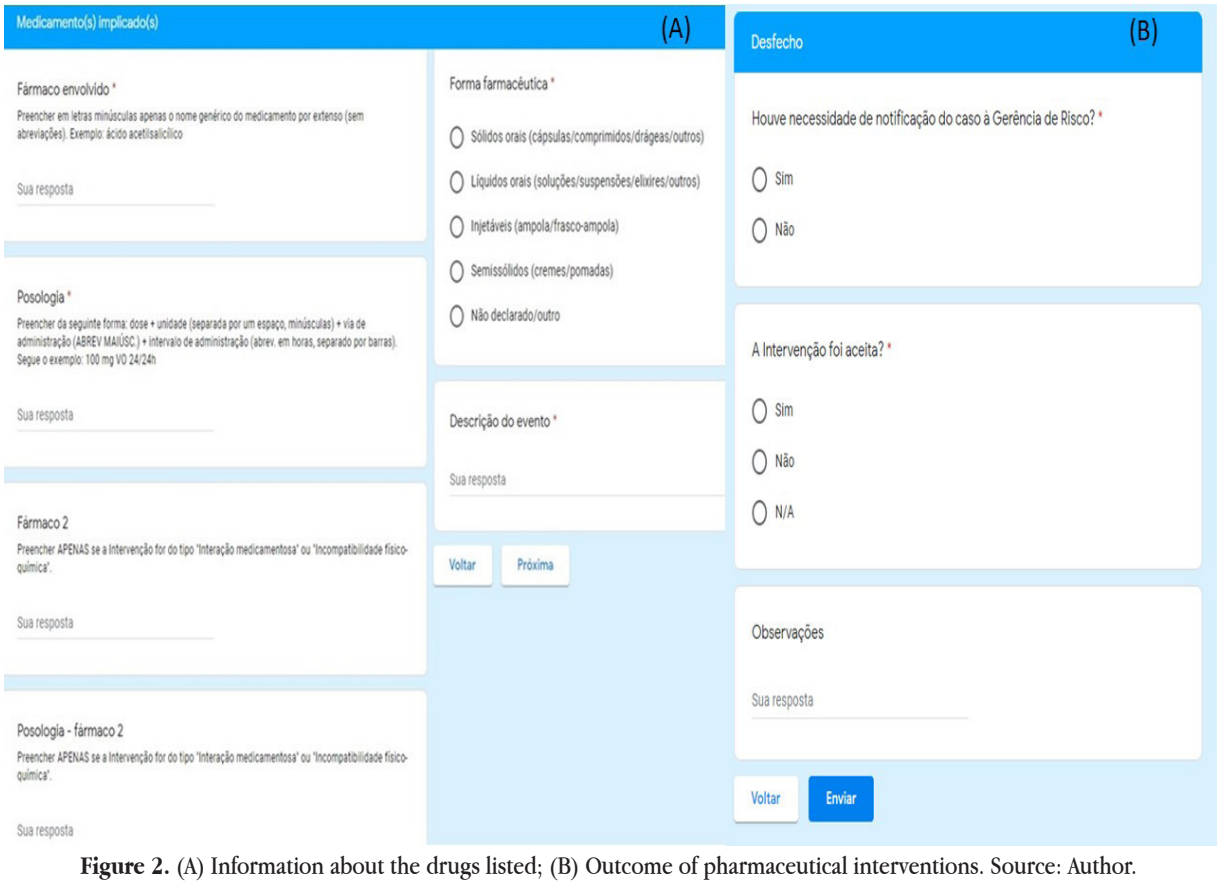

Figure 2. (A) Information about the drugs listed; (B) Outcome of pharmaceutical interventions. Source: Author.

The fourth and final section of the form, illustrated in Figure 2B, was designed to record the outcomes of pharmaceutical interventions. The first field, which is multiple-choice, is designed to mark interventions that should or have already been notified to the unit's Risk Management, since the hospital is part of the Sentinel Hospital Network. Examples of notifiable events include the involvement of potentially dangerous drugs or other situations, such as errors that lead to patient harm or near harm.

The answer to the question "Was the intervention accepted?" is one of the most important questions on the form as it informs on the percentage of teams' acceptance of what was carried out. An intervention can only be considered acceptable if it leads to an effective change that solves a problem. However, if the prescription returns remain unchanged on the day after the intervention, they should automatically be considered unacceptable, and this outcome should be recorded in the form.

The last field on the form, "Observations," is where the changes made after the intervention are described, if the intervention was accepted, or a justification for why it wasn't, if possible are recorded. It is a compulsory, albeit short, field that confirms what actually happened after the intervention.

We went on to choose the "nature of the guidance," which can be passive/reactive when it comes from the team or the patient, or active when it comes from the identification of a need by the pharmacy team.

The guidance description allows the pharmacist to describe the event in as much detail as possible. The last field in the section allows the "Sources/bibliographies" used to provide this information to be filled in. There is no field to determine the acceptance of guidance, as most of this guidance is requested by teams outside the pharmacy (predominantly nursing), and proactive interventions are not easily observed.

NUMBER OF INTERVENTIONS AND ACCEPTABILITY

During the study period, 354 pharmaceutical interventions were administered in the ICU. In 2018, the total number of interventions was 38, increasing to 309 in 2019. These were added to the seven pharmaceutical guidelines recorded, generating a total of 316 interventions in the year (Figure 3). This growth may be explained by the recent implementation of clinical services in the ICU, which took place in 2018. In 2019, with a better-established routine, the clinical service became better able to produce interventions.

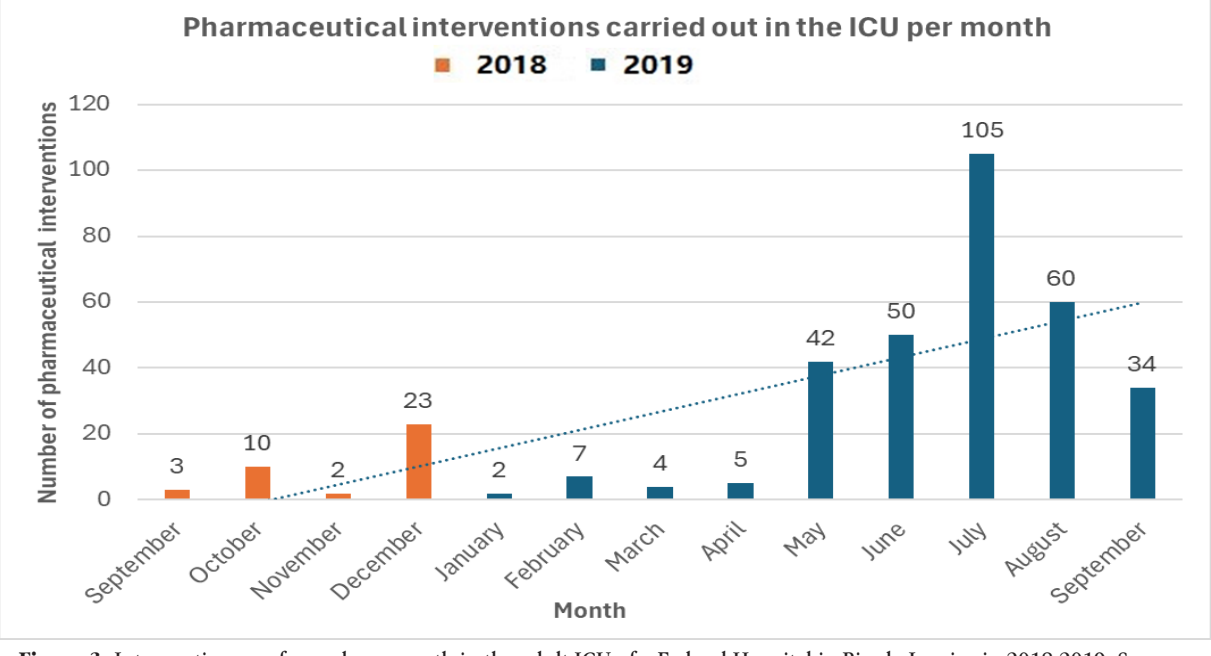

Figure 3. Interventions performed per month in the adult ICU of a Federal Hospital in Rio de Janeiro in 2018-2019. Source: Authors.

The total number of PI, when compared to that reported in the literature, was lower, but the difference in contexts and structures between hospital units seems to be a key factor in explaining these discrepancies. A study conducted by Reis et al. (2013) at the Clinical Hospital of the University of Paraná, for example, carried out a prospective study on the interventions carried out by the hospital's clinical pharmacists[14]. This study reached a total of 933 interventions in one year, but it refers to a hospital unit with exclusively electronic prescriptions. In addition to the intensive care sector for adults, the cardiology ICUs and the cardiology ward were also included.

Ribeiro et al. (2015) reported on PI performed by the Clinical Pharmacy sector of a small private institution (60 rooms) in Salvador, Bahia, between 2012 and 2014[13]. The authors observed a significant increase in the overall number of interventions performed each year: 206 in 2012, 925 in 2013 and reaching 1215 in 2014. This was explained by the fact that 2012 was the year the service was established, with only one clinical pharmacist without exclusive dedication, evolving during the study period to four clinical pharmacists working 44 hours a week, each responsible for an intensive care clinic, participating in multidisciplinary visits twice a week, and partially responsible for a semi-intensive care clinic.

High variability in the number of interventions per month was observed in the

mean and standard deviation calculations between the two periods studied. The average number of PI in the months of 2018 was 6.5 PI/month (SD ± 9.67), rising to 34 PI/month, but with a SD ± 34.54, which is of little statistical relevance. Comparing these results with those presented by Medeiros and Moraes (2014), who analyzed interventions carried out over 25 days in the general adult ICU of a large hospital in Recife, it can be seen that the authors analyzed 94 prescriptions, of which 56 were carried out, which is close to that described in the present study[8].

In addition to an increase in the overall number of interventions conducted from one year to the next, the staff acceptance rate increased from 78.9% to 83.5%, as shown in figure 4.

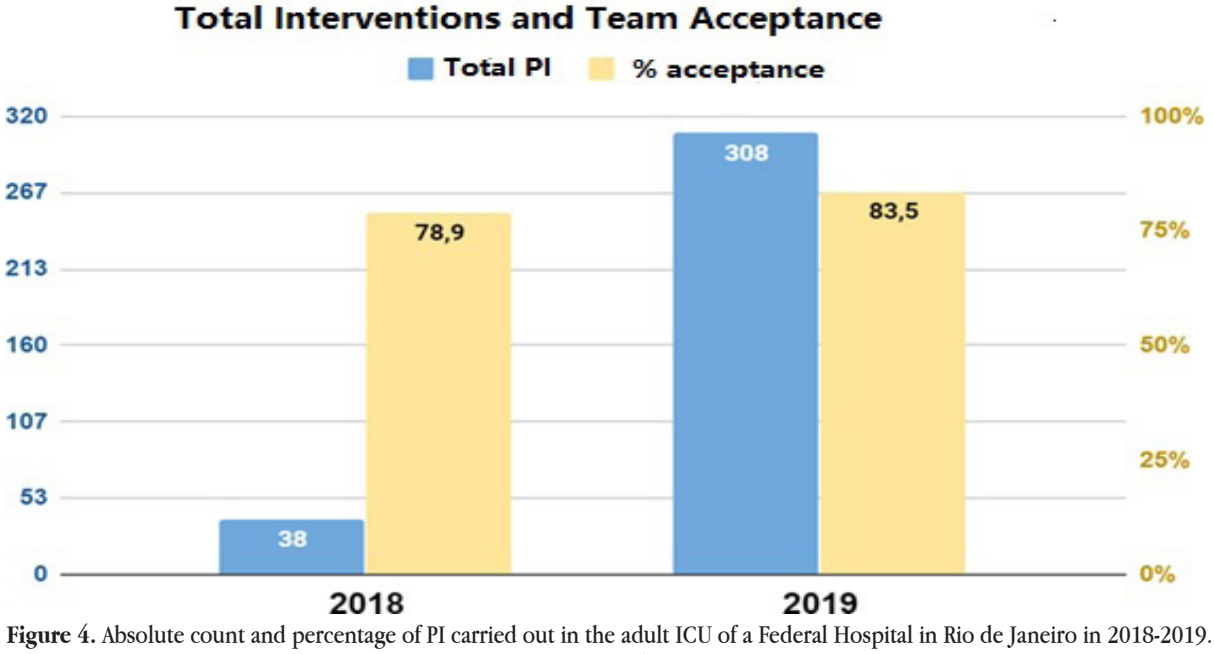

Figure 4. Absolute count and percentage of PI carried out in the adult ICU of a Federal Hospital in Rio de Janeiro in 2018-2019. Source: Authors.

In the literature, similar proportions have been found in relation to the teams' acceptance rate of interventions. Reis et al. (2013) reported an acceptance rate of 76.32% over a one-year period, which is slightly lower than the result found in this study in 2019, but with a much larger sample[14]. Ribeiro et al. (2015) recorded acceptance percentages ranging from 84 to 93% over three years of observation[13].

The results are nearly identical to those obtained by Malfará et al. (2018) and Medeiros and Moraes (2014), which can be explained by the different patient profiles of the former (pediatric ICU) and the short evaluation period of the latter (25 days)[8,10].

MOST PREVALENT DRUGS

In 2018, there were a total of 54 drugs involved in 38 interventions, which was due to a drug interaction or physicochemical incompatibility intervention involving more than one drug. Out of these 54, 33 different drugs were administered. The most prevalent drug was omeprazole (13%), possibly because of the polypharmacy with which the patients were treated, followed by levothyroxine (9.3%). The other three drugs that appear three times are simvastatin, phenytoin, and amiodarone. The other drugs appeared only once or twice. Table 1 shows the 25 most prevalent drugs used during both evaluation periods.

Table 1. Most prevalent drugs, in absolute and percentage counts, in the PI carried out in the ICU of a Federal Hospital in Rio de Janeiro in 2018 and 2019.

Drug	2018 n(%)	2019 n(%)
Amikacin	0 (0)	12 (3,8)
Amiodarone	3 (5,6)	4 (1,3)
Bromopride	0 (0)	14 (4,4)
Cefepime	0 (0)	6 (1,9)
Clopidogrel	2 (3,7)	4 (1,3)
Dexmedetomidine	0 (0)	5 (1,6)
Dipyrone	0 (0)	6 (1,9)
Enoxaparin	0 (0)	21 (6,7)
Ertapenem	0 (0)	4 (1,3)
Phenytoin	3 (5,6)	7 (2,2)
Heparin	0 (0)	5 (1,6)
Hydralazine	0 (0)	8 (2,5)
Ferric hydroxide	0 (0)	4 (1,3)
Levothyroxine	5 (9,3)	3 (1)
Meropenem	2 (3,7)	27 (8,6)
Metoclopramide	0 (0)	10 (3,2)
Metronidazole	2 (3,7)	1 (0,3)
Noradrenaline	0 (0)	8 (2,5)
Mineral oil	2 (3,7)	0 (0)
Omeprazole	7 (13)	25 (7,9)
Piperacillin/ tazobactam	2 (3,7)	10 (3,2)
Polymyxin B	0 (0)	7 (2,2)
Sinvastatin	3 (5,6)	2 (0,6)
Teicoplanin	0 (0)	16 (5,1)
Vancomycin	0 (0)	14 (4,4)

Source: Authors.

In 2019, there was a significant change in the prevalence of medications and anatomical groups, which can be explained by the large differences in data obtained from one year to the next. Of the 308 interventions, 316 drugs were involved, 82 of which differed from each other. The most common was meropenem, which may cause resistance to other beta-lactam agents and because its use is more restricted to the hospital setting, which was the subject of 27 PI, corresponding to 8.6% of the total. Omeprazole came in second place, appearing 25 times (7.9%), while enoxaparin was the third most common drug, appearing 21 times (6.6%).

Grouping these drugs by the first sublevel of the ATC classification showed that the most prevalent anatomical group in 2018 was the digestive tract and metabolism (A), accounting for 24.1% of the total, followed by the cardiovascular system (C), accounting for 22.2%, and systemic anti-infectives (J), accounting for 14.8% of the total. Compared to 2019, systemic anti-infectives (J) were the main focus of PIs in 2019, accounting for 124 (39.4%), followed by drugs for the gastrointestinal tract (A - 62, 19.7%), and drugs related to blood and hematopoietic organs (B - 45, 14.3%).

Similar results were observed by Fideles et al. (2015), in which the main drugs involved in PI were teicoplanin, meropenem, omeprazole, polymyxin B, and piperacillin/tazobactam[12]. When analyzed from the perspective of ATC classification, there was also a predominance of anti-infectives for systemic use (52.7% of FI), followed by drugs for the gastrointestinal tract and metabolism (12.4%), cardiovascular system (11.9%), and nervous system (10%).

Reis et al. (2013) found that 27% of PI targeted drugs related to the gastrointestinal tract and metabolism, systemic anti-infectives ranked second (20.6 %), and drugs related to the blood and hematopoietic organs appeared in 17.3% of PI cases[14]. The results of both these studies are consistent with those of the present study, especially because they were conducted in adult ICUs.

MOST PREVALENT TYPES OF INTERVENTIONS

In 2018, the most prevalent intervention was “drug interaction,” accounting for 23 cases

or 46.9% of frequency. The drugs most frequently involved in this type of PI were omeprazole (6, 27.3%), levothyroxine (5, 22.7%), simvastatin (3, 13.6%), and clopidogrel and amiodarone (2, 9.1%).

In 2019, the most common type of PI was "dose (inadequate/omission)", corresponding to a frequency of 31.6% (n=97). Meropenem was the predominantly involved drug, being used 21 times, corresponding to 21.6% of the total drug usage, followed by vancomycin, teicoplanin (both 9; 9.3%), and enoxaparin (7; 7.2%). Other drugs that played a significant role in dose adjustments included amikacin (6.2%), piperacillin/tazobactam, omeprazole, and polymyxin B (5.2%).

This can be explained by the fact that one of the Clinical Pharmacy's main pharmacotherapeutic monitoring strategies in 2019 was in relation to patients using antimicrobials, due to the perception of the need for greater attention to adjustments based on kidney function and weight, often going unnoticed by the medical team. This year, a tool was created to monitor all patients taking antimicrobials, making it possible to suggest adjustments.

The study that is most similar in terms of results to the present study is one conducted by Reis et al. (2013), who reported the PI of individualizing or correcting the dosage as the most frequent (50.4% of the total), motivated by the 46.7% of DRPs related to the dose[14]. The second most common type of PI was drug discontinuation (19.0%), followed by replacement with a safer, more effective, cost-effective, or available presentation and/or pharmaceutical form (7.5%). The need for additional medication, although categorized as DRPs rather than PIs, was found in 5.25% of patients. This similarity can be explained by patient profiles, which included only adult care units.

Fideles et al. (2015) found a year-on-year increase in PIs related to dose adjustment, from 8.7% of the total to 16.7% in the last year of observation, with the second most frequent PI in the third year of observation[12]. However, the most representative interventions were related to diluting medicines, also increasing from 10.8% to 18.5%.

There were only seven pharmaceutical guidelines, of which 6 were related to the reconstitution or dilution of medicines. Most of them were reactive in nature; that is, they were asked to answer a question from the team, usually the nursing staff. It was decided to separate the guidelines from the other interventions in the study because, although they arose from doubts related to the care of patients being treated in the ICU, they were not patient-specific situations but rather clarifications of technical situations for the team, which modified the procedure applied to patients in general.

With regard to the professionals to whom PI were assigned, from 2018 to 2019, there was an increase in the number of professionals working with doctors, from 86.8% to 97.5, and a consequent decrease in the number working with nurses, from 13.2 to 2.5. This can be explained by the fact that pharmaceutical guidance is more closely related to care provided by the nursing team, whereas prescription changes are resolved only by doctors.

However, it is worth noting that during clinical practice, the effective participation of clinical pharmacists is intrinsically related to nursing, with this category having an important impact on the services provided.

Thus, although the recorded PI was very much directed at the medical team due to prescription changes, these data do not truly reveal routine clinical practice, as the pharmacy's work with the intensive care nursing team is fluid and constant.

POSSIBLE INDICATORS

This study aimed to analyze the profile of PI from a hospital's Clinical Pharmacy service based solely on the internal records of the pharmacy sector. Quality indicators can be devised to make service evaluations even more sensitive.

Based on this, an indicator can also be proposed to assess the ratio of interventions per patient analyzed (Chart 2).

Chart 2. Proposed quality indicators and their formulas.

Nº	Proposed indicators	Formulas
1	**Overall PI rate***	*n*° total PI carried out in the period *n*° *total* of prescriptions analyzed in the same period
2	**Average PI per patient**	Σ *n*° PI performed by each patient *n*° *total* of *pa*tients
3	**Average number of patients analyzed per day***	Σ *n*° patients analyzed daily analysis period (days)
4	**Average PI per day***	Σ *n*° PI carried out daily analysis period (days)
5	**Average time allocated to the CP service in the ICU***	Σ hours allocated to CP daily analysis period (days)
6	**Average time spent per patient***	Σ *n*° patients analyzed daily Σ hours allocated to CP daily
7	**Ratio of PI to patients discharged as outcome**	Σ PI in patients who were discharged *n*° total of patients discharged
8	**Ratio of PI to patients who died as an outcome**	Σ PI in patients who died *n*° total of patients who died
9	**PI per number of rounds**	*n*° PI performed during rounds in a period *n*° rounds participated in the same period
10	***Rate of PI during rounds***	*n*° PI performed during rounds in a period *n*° total PI carried out in the same period

Source: Authors.

Patients in the ICU, except those who go through the UPO, are usually hospitalized for a prolonged period, which makes it possible for clinical pharmacists to carry out pharmacotherapeutic follow-up. Such follow-up allows the same patient to benefit more than once from the care provided by the pharmacy service, which probably occurred during the study period. This follow-up indicator will make it possible to assess the success of or need for improvement in relation to pharmacotherapeutic follow-up provided by a clinical pharmacist.

Another possible indicator, based on a previous study, would be to evaluate the confluence between the patient's clinical outcome (discharge to the ward or death) and the number

of interventions performed on the individual. Although it is difficult to infer this indicator from the results obtained, it may be important in the future to reflect greater safety in the care provided to patients through Clinical Pharmacy services.

In addition, Rudall et al. (2016) developed other suitable indicators for comparing the quality between units in the UK, as this was the aim of their study[16]. The average number of patients reviewed daily, average number of interventions performed per day, total number of items prescribed per number of interventions, average number of hours per day spent on clinical activities in the ICU, and average time spent per patient were recorded and analyzed.

As participation in the ICU's interdisciplinary rounds is one of the services' most important tasks, it would also be interesting to determine the number of rounds in which pharmacists participated. Based on this, it is possible to study the association between the number of interventions performed during or outside the round, which is often essential and has a greater impact[2].

The relationship between the number of interventions and the number of rounds participated in, together with a possible study of the economic impact of these interventions, could also corroborate the importance of pharmacists' dedication to clinical activities within this service.

LIMITATIONS

This study had some limitations. Regarding the study design, despite the long period chosen for data collection, there were some biases in relation to the regularity of provision of clinical pharmacist services. In January 2019, for example, the presence of a clinical pharmacist in the ICU was only possible during the second half of the month.

Another difficulty encountered was standardizing the typology of interventions; each study reported in the literature contained different classifications of PI, making comparison difficult. This study did not categorize the DRPs separately from PIs because the PI categorized in more detail in relation to the observed event was considered less susceptible to recording errors, thus simplifying the process. This difficulty was previously reported by Fideles et al. (2015)[12].

CONCLUSION

This study promoted the creation of a questionnaire with the intention of recording the PI carried out in the ICU; however, its acceptance by the unit's pharmacy service made it the main tool for recording the PI of all the unit's subsectors. Easy access and use by all hospital pharmacists expands the opportunity to obtain and analyze data, which is important in institutions without a medical record/electronic prescribing and dispensing system. These analyses have helped create indicators that are used to evaluate the service and improve continuously, with the ultimate goal of increasing patient safety, especially with regard to the rational use of drugs. As the data presented are mainly descriptive, it would be interesting to implement and use the quality indicators proposed for the unit's clinical pharmacy sector, as they can be used to propose changes and strategies for correcting deficiencies more easily, thus fostering continuous improvement.

REFERENCES

1. Conselho Federal de Farmácia. Resolução nº 585 de 29 de agosto de 2013. Regulamenta as atribuições clínicas do farmacêutico e dá outras providências. Diário Oficial da União da República Federativa do Brasil, Brasília, DF, 2013.[Acesso em: 10 jun. 2019.] Disponível em <http://www.cff.org.br/userfiles/file/resolucoes/585.pdf>.

2. Day RL, Goyan JE, Herfindal ET, Sorby DL. The Origins of the Clinical Pharmacy Program at the University of California, San Francisco.

DICP. 1991;25(3):308-314. doi: https://doi.org/10.1177/106002809102500318.

3. Comité de Consenso. Tercer Consenso de Granada sobre problemas relacionados con medicamentos (PRM) y resultados negativos asociados a la medicación (RNM). Ars Pharmaceutica, Granada. 2007[Acesso em 16 jun. 2019.]; 48, 1:5-7. Disponível em: <http://www.saude.sp.gov.br/resources/ipgg/assistencia-farmaceutica/tercerconsensodegranadasobreproblemasrelacionadosconmedicamentosprmyresultado snegativosasociadosalamedicacionrnm.pdf>.

4. Berthelsen PG, Cronqvist M. The first intensive care unit in the world: Copenhagen 1953. Acta Anaesthesiol Scand. 2003;47(10):1190-1195. doi: https://doi.org/10.1046/j.1399-6576.2003.00256.x.

5. Marshall JC, Bosco L, Adhikari NK, Connolly B, Diaz JV, Dorman T, Fowler RA, Meyfroidt G, Nakagawa S, Pelosi P, Vincent JL, Vollman K, Zimmerman J. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. J Crit Care. 2017;37:270-276. doi: https://doi.org/10.1016/j.jcrc.2016.07.015.

6. Leape LL, Cullen DJ, Clapp MD, Burdick E, Demonaco HJ, Erickson JI, Bates DW. Pharmacist participation on physician rounds and adverse drug events in the intensive care unit. JAMA. 1999; 21;282(3):267-70. doi: https://doi.org/10.1001/jama.282.3.267.

7. Beccaria LM, Pereira RAM, Contrin LM, Lobo SMA, Trajano DHL. Eventos adversos na assistência de enfermagem em uma unidade de terapia intensiva. Rev bras ter intensiva [Internet]. 2009;21(3):276–82. doi: https://doi.org/10.1590/S0103-507X2009000300007.

8. De Medeiros RDA, Moraes JP. Intervenções farmacêuticas em prescrições médicas na unidade de terapia intensiva. Rev. Bras. Farm. Hosp. Serv. Saúde, São Paulo. 2014; 5, 2:26-29.

9. Kane-Gill SL, Kirisci L, Verrico MM, Rothschild JM. Analysis of risk factors for adverse drug events in critically ill patients*. Crit Care Med. 2012;40(3):823-828. doi: https://doi.org/10.1097/CCM.0b013e318236f473.

10. Malfará M, Pernassi M, Aragon D, Carlotti A. Impact of the clinical pharmacist interventions on prevention of pharmacotherapy related problems in the paediatric intensive care unit. Int J Clin Pharm. 2018;40(3):513-519. doi: https://doi.org/ 10.1007/s11096-018-0632-x.

11.de Deus CJ, de Araújo XL, Pereira SPP, Pontes OD, Almeida FMR, Tavares SPP, Souza GA. Autoavaliação dos Núcleos de Segurança do Paciente em um estado do norte do Brasil. Saud Pesq. 2023;16(2):e-11100 - e-ISSN 2176-9206. doi: https://doi.org/10.17765/2176-9206.2023v16n2.e11100.

12. Fideles GMA, Alcântara-Neto JM de, Peixoto Júnior AA, Souza-Neto PJ de, Tonete TL, Silva JEG da, et al. Recomendações farmacêuticas em unidade de terapia intensiva: três anos de atividades clínicas. Rev bras ter intensiva [Internet]. 2015;27(2):149–54. doi: https://doi.org/10.5935/0103-507X.20150026.

13. Ribeiro VF, Sapucaia KCG, Aragão LAO, Bispo ICDS, Oliveira VF, Alves, BJ. Realização de intervenções farmacêuticas por meio de uma experiência em farmácia clínica. Revista Brasileira de Farmácia Hospitalar e Serviços de Saúde, São Paulo. 2015; 6:4.

14. Reis WCT, Scopel CT, Correr CJ, Andrzejevski VMS. Analysis of clinical pharmacist interventions in a tertiary teaching hospital in Brazil. einstein (São Paulo) [Internet]. 2013;11(2):190–6. doi: https://doi.org/10.1590/S1679-45082013000200010

15. Cardinal L, Fernandes C. Intervenção farmacêutica no processo da validação da prescrição médica. Rev. Bras. Farm. Hosp. Serv. Saúde, São Paulo. 2014;5,2:14-19.

16. Rudall N, McKenzie C, Landa J, Bourne RS, Bates I, Shulman R. PROTECTED-UK - Clinical pharmacist interventions in the UK critical care unit: exploration of relationship between intervention, service characteristics and experience level. Int J Pharm Pract. 2017;25(4):311-319. doi: https://doi.org/10.1111/ijpp.12304.

Received: 19 jan. 2024
Accepted: 27 feb. 2024