

Profile of pharmaceutical recommendations in a critical patient unit of a hospital specializing in trauma in Fortaleza/CE

Perfil das recomendações farmacêuticas numa unidade de pacientes críticos de um hospital especializado em traumas de Fortaleza/CE

Francisco Erikson Pereira Gomes¹, Patrícia Bastos Luz², Larisse Mota Marques², Renan Moraes e Silva²

¹ Escola de Saúde Pública do Ceará, Fortaleza, Ceará, Brazil.

² Integrated Multiprofessional Residency in Health, Instituto Doutor José Frota, Fortaleza, Ceará, Brazil.

Corresponding author: Francisco Erikson Pereira Gomes – <https://orcid.org/0009-0000-7705-9391>

– Escola de Saúde Pública do Ceará, Fortaleza, Ceará, Brazil.

E-mail: gomes.erikson2015@gmail.com

How to cite:

Gomes FEP, Silva RM e, Luz PB, Marques LM. Profile of pharmaceutical recommendations in a critical patient unit of a hospital specializing in trauma in Fortaleza/CE. JAFF [Internet]. March 19, 2025 [cited October 8, 2025];10(1). Available from: <https://ojs.jaff.org.br/ojs/index.php/jaff/article/view/1057>

Received on: 08/26/2024

Accepted for publication on: 02/26/2025

doi: 10.22563/2525-7323.2025.v10.e00164e

ABSTRACT

Objectives: To characterize the profile of pharmaceutical recommendations (PR), pharmacotherapy problems encountered, and the patient population evaluated to illustrate the critical role of clinical pharmacists in emergency settings. **Methods:** Cross-sectional, descriptive and quantitative study of the profile of PR, carried out in a critical patient unit of a tertiary hospital specialized in trauma, located in Fortaleza-CE, between January and December 2022. PR and pharmacotherapy problems were classified according to the internal criteria of the service itself. Descriptive statistics were performed, with calculations of absolute and relative frequencies, in addition to the mean and standard deviation of the variables studied. **Results:** We performed 797 PR involving 301 patients, with 66.42 PR per month on average. According to the ATC/WHO, the drugs most involved in PR acted on the digestive tract and metabolism (24.71%, n=197) and the nervous system (23.58%, n=188). The most prevalent problems in pharmacotherapy were: untreated health problem (36.51%, n=291) and unnecessary prescribed medication (12.42%, n=99). The most prevalent PR were: inclusion of medication (28.60%, n=228) and discontinuation of medication (13.55%, n=108). Acceptance of 82.70% of the recommendations was observed (n=659). **Conclusions:** This acceptance rate, achieved even during the first year of a clinical pharmacist's integration into the unit, highlights the vital role of this professional in emergency and urgent care settings, enhancing patient safety and optimizing pharmacotherapy outcomes.

Keywords: Clinical Pharmacy Service; Pharmacotherapy; Patient Safety; Emergency.

RESUMO

Objetivos: Caracterizar o perfil das recomendações farmacêuticas (RF) realizadas, dos problemas na farmacoterapia encontrados, bem como dos pacientes avaliados de modo a mostrar a importância da atuação do farmacêutico clínico no cenário da urgência e emergência. **Métodos:** Estudo transversal, descritivo e quantitativo do perfil das RF realizadas numa unidade de pacientes críticos de um hospital terciário especializado em traumas, localizado em Fortaleza-CE, entre janeiro e dezembro de 2022. As RF e problemas de farmacoterapia foram classificados seguindo os critérios internos do próprio serviço. Foi realizada estatística descritiva, com cálculos de frequências absolutas e relativas, além de média e desvio padrão das variáveis estudadas. **Resultados:** Foram realizadas 797 RF envolvendo 301 pacientes, com média de 66,42 RF/mês. Segundo a ATC/OMS os fármacos mais envolvidos nas RF atuaram no trato digestivo e metabolismo (24,71%, n=197) e sistema nervoso (23,58%, n=188). Os problemas na farmacoterapia mais prevalentes foram: problema de saúde não tratado (36,51%, n=291) e medicamento prescrito não necessário (12,42%, n=99). Já as RF mais prevalentes foram: inclusão de medicamento (28,60%, n=228) e suspensão de medicamento (13,55%, n=108). Observou-se aceitação de 82,70% das recomendações (n=659). **Conclusões:** Essa taxa de aceitação, mesmo no primeiro ano da fixação de um farmacêutico clínico na unidade, destaca a relevância da presença desse profissional no cenário da urgência e emergência, ao proporcionar aos pacientes um cuidado mais seguro e otimizado.

Palavras-chave: Serviço de Farmácia Clínica; Farmacoterapia; Segurança do Paciente; Emergência.

Introduction

The report “To Err is Human: Building a Safer Health System”, published by the American Institute of Medicine in 1999, revealed that the health services offered to patients are not as safe as they should be.²⁴ Brazil received, in 2023, 368,895 reports of incidents related to healthcare.²⁸ Between 2008 and 2016, in Brazil, there was an increase in the mortality rate attributed to adverse drug events (ADEs) from 8.70 to 14.40 per 1 million inhabitants.¹⁸ This demonstrates the importance of measures that promote the safe and rational use of medicines, emphasizing the involvement and commitment of the multidisciplinary team in this cause.²⁴

In Brazil, a survey released in 2018 estimated that the financial impact of illnesses and deaths caused by the inappropriate use of medicines amounts to US\$ 18 billion annually, with 53% of these problems being preventable.²² Data from eight retrospective studies and four prospective studies show that up to 28% of emergency room visits were associated with medicines. Among these, 70% could have been avoided, and up to 24% resulted in hospitalizations.³¹ To identify and prevent drug-related problems, many accredited hospitals have been working to implement clinical pharmacy (CP) and pharmaceutical care services.³⁴

In the mid-1960s, in the United States, CP emerged with the aim of optimizing pharmacotherapy and patient clinical outcomes. The CP approach seeks, among other objectives, to prevent and monitor drug effects and ADEs, as described by Carter in 2017.¹² In this context, the role of the clinical pharmacist is essential to promote the rational use of medicines. This professional intervenes and actively contributes to patient care, aiming to achieve more favorable clinical results. In addition, their role aims to improve patients' quality of life, while reducing costs associated with medicines and medical-hospital supplies. This practice not only directly benefits patients but also offers an efficient way to manage healthcare resources.³⁰

In Brazil, pharmaceutical care has as theoretical frameworks the Resolution of the Federal Pharmacy Council No. 585 (August 29, 2013), which regulates clinical responsibilities of the pharmacist, and the competency framework for clinical practice;¹³ the Resolution of the Collegiate Board No. 675 (October

31, 2019), a national milestone for the development of clinical responsibilities of pharmacists working in intensive care units (ICUs);¹⁵ the National Guidelines for Pharmaceutical Care within SUS;⁸ the Booklet 1: Pharmaceutical services in primary healthcare;⁶ the Booklet 2: Training for implementing clinical pharmacy services;⁷ and the book Pharmaceutical Services Directly for the Patient, Family, and Community: Contextualization and Conceptual Framework.¹⁴

In Brazil, CP services have been consolidating their space in hospitals over the last decades. Among the pharmacist's clinical activities is the technical analysis of prescriptions, which allows the identification of inconsistencies related to potentially harmful medicines, thus generating one or more pharmaceutical recommendations (PRs) to optimize pharmacotherapy.¹⁹ In addition, CP performs medication reconciliation, therapeutic drug monitoring, health condition management, health screening, health education, and analysis of clinical and laboratory parameters for follow-up, as well as recommendations to the healthcare team, patients, and caregivers.¹⁴ With the introduction of these services, patients receive actions aimed at the rational use of medicines.¹⁹

In this context, critically ill patients in emergency units often face complex medical interventions, including the administration of a wide range of medicines. Prescribing, administering, and monitoring these medicines represent significant challenges due to vulnerabilities, comorbidities, and the need to carefully balance risks and benefits.⁴⁰ When placed in the context of a trauma hospital, these challenges gain another layer of complexity, since many patients suffer severe and multiple injuries, requiring even more intensive care.³⁷

Thus, the clinical pharmacist working in the emergency department provides clinical decision support and can intercept healthcare-related errors, preventing them from harming patients.²⁹ For example, care transitions can be improved through medication reconciliation, thereby reducing drug-related problems. Furthermore, being a professional qualified to recognize ADEs and adverse drug reactions, the clinical pharmacist generates PRs, notifications, and facilitates the identification of patient safety risks.²⁰

Therefore, clinical pharmacy practice in critical care units goes beyond verifying drug interactions and appropriate doses. It includes adapting pharmacological therapies to the individual needs of each patient, considering clinical changes, possible ADEs, and patient context.⁴ PRs are essential to promote the safety and effectiveness of drug therapy,⁷ where small errors in prescribing, administering, dispensing, and monitoring can have serious consequences.¹

International literature on the role of the emergency clinical pharmacist is still relatively scarce. In Brazil, this gap is even more evident, with few systematized studies on the subject. The increasing complexity of care in emergency settings reinforces the need for research that documents and critically analyzes the activities performed by these professionals. Recording these practices is essential not only to understand their inclusion and evolution in the Brazilian context but also to support a detailed evaluation of their impact on the multidisciplinary team and, above all, on the safety, effectiveness, and quality of patient care. Thus, research in this area can significantly contribute to the improvement of healthcare services and the consolidation of the role of the emergency clinical pharmacist in optimizing clinical outcomes.

Objectives

To characterize the profile of the pharmaceutical recommendations (PRs) made, the problems in pharmacotherapy identified, as well as the patients evaluated, in order to demonstrate the importance of the clinical pharmacist's role in the emergency and urgent care setting

Methodology

This is a cross-sectional, descriptive, and quantitative study of the profile of pharmaceutical recommendations (PRs) made by clinical pharmacists from January to December 2022, in an intensive care unit known as the "Orange Room", which provides care to adult trauma patients in clinical instability, serving as support for the resuscitation room. The unit has 16 fully occupied beds and is located in the emergency department of the Instituto Doutor José

Frota (IJF), a public tertiary-level hospital in Fortaleza, Ceará.

The hospital has 664 beds³⁵ and is a reference center in Northern and Northeastern Brazil for urgent and emergency care, high-complexity trauma, acute poisonings, and severe vascular and neurological injuries. In addition, the institution's care profile includes patients with multiple fractures, exposed fractures, cervical injuries, traumatic brain injuries, deep cuts and perforations, burns, and poisonings caused by chemical substances, pesticides, medications, plants, and venomous animals³³.

The study population consisted of all patients admitted to the Orange Room who had their prescriptions reviewed by clinical pharmacists during 2022, with the sample comprising only those who received at least one PR between January and December 2022. No restrictions regarding sex, gender, age, or socioeconomic status were applied for patient selection. PRs made for pediatric patients, those related to drug shortages, and those whose outcomes were not finalized before or after the patient's admission to the unit were excluded.

Clinical pharmacists performed pharmaceutical anamnesis, using the SOAP method as a structured approach to document patient progress, divided into four sections: subjective data, objective data, assessment, and plan³². Designed to facilitate access to data and optimize pharmacotherapy, this method has proven essential to improve communication within the multiprofessional healthcare team.²⁵

Subsequently, daily reassessments of patients' clinical conditions and the results of PRs and other clinical interventions were carried out. The PRs were systematically recorded in the patients' electronic medical records (Ars Vitae®). Furthermore, clinical pharmacists relied on several databases to support patient care, such as the IJF Pharmacotherapeutic Guide 2022, mobile application databases like Sanford Guide®, UpToDate®, Micromedex®, and Medscape®, as well as scientific articles, institutional protocols, and medical documents from national and international health organizations.

Data were collected from electronic medical records, processed, and entered into a Google Sheets® spreadsheet standardized by the institution's clinical pharmacy service, organized according to the

following variables: PR date, medical record number, sex, age, care unit, diagnosis, pharmacotherapy problem, PR description, PR type, acceptance, and medication involved. The PRs and pharmacotherapy problems were classified following the internal criteria of the clinical pharmacy service, inspired by the methodology outlined in Workbook 2: Training for the Implementation of Clinical Pharmacy Services.⁷ The variables obtained were analyzed and interpreted through descriptive statistics, including absolute and relative frequencies, means, and standard deviations.

The risks of this study consisted mainly of potential data breaches. However, this risk was minimized by restricting data sharing exclusively among the researchers. This was ensured by requiring login and password access, which were not shared with other services. In addition, the spreadsheet containing the tabulated data was locked so that only the researchers' emails had access and editing permissions.

The main diagnostic hypotheses of the patients whose prescriptions were evaluated were classified according to the 11th revision of the International Classification of Diseases (ICD-11) of the World Health Organization (WHO).⁴² The medications involved in drug-related problems were categorized according to drug type, organ or system of therapeutic action, and chemical and pharmacological properties, based on the second level of the Anatomical Therapeutic Chemical (ATC/WHO) classification.⁴³ The acceptance of the recommendations was classified as either accepted or not accepted.

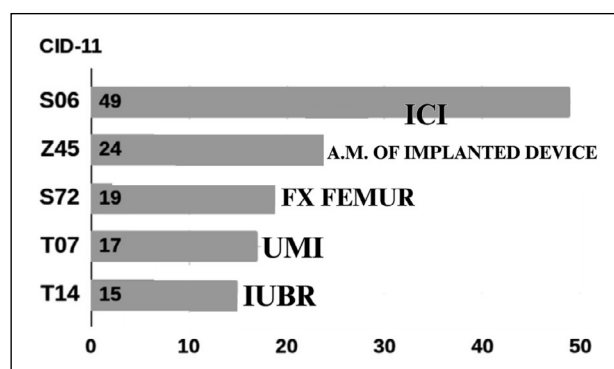
The study was approved by the IJF Research Ethics Committee, under opinion no. 6.672.855, in accordance with the resolutions of the Brazilian National Health Council no. 466, of December 12, 2012¹⁶, and no. 510, of April 7, 2016,¹⁷ which regulate the guidelines and standards for research involving human subjects in Brazil.

Results

During the period from January to December 2022, 4345 complete medical prescriptions, additions and suspensions were evaluated, with a median of 395 prescriptions validated in the assessed period. A total of 797 Pharmaceutical Recommenda-

tions (RF) were carried out, involving 301 patients, resulting in an average of 66.42 RF/month. Elderly patients (age ≥ 60 years, $n=157$; 52.34%) and males ($n=205$; 68.1%) were the most prevalent. During the study period, the average length of stay in the Orange Room was 3.34 days and the average bed occupancy rate was 82.68%.

Figure 1. Profile of the most prevalent diagnoses of patients admitted to the Orange Room, IJF, Fortaleza, during the year 2022.



Source: Ars Vitae electronic medical records, 2024.

Legend: ICI = Intracranial Injury, A.M. of Implanted Device = Adjustment and Handling of Implanted Device, Fx Femur = Fracture of femur, UMI = Unspecified Multiple Injuries, IUBR = Injury of Unspecified Body Region.

The present study identified a total of 797 medications involved in the pharmaceutical recommendations (PR), comprising 126 distinct active substances. Among them, the most frequent were: enoxaparin 7.65% ($n=61$), omeprazole 5.65% ($n=45$), phenytoin 4.14% ($n=33$), furosemide 3.76% ($n=30$), and piperacillin + tazobactam 3.51% ($n=28$). According to the second level of the ATC/WHO classification, the most prevalent categories were: digestive tract and metabolism 24.71% ($n=197$), nervous system 23.58% ($n=188$), blood and blood-forming organs 15.30% ($n=122$), anti-infectives for systemic use 12.67% ($n=101$), and cardiovascular system 8.65% ($n=69$), as shown in Table 1.

Drug therapy problems were identified, and their quantities and frequencies are presented in Table 2. The most frequent were: untreated health problem 36.51% ($n=291$), unnecessary prescribed medication 12.42% ($n=99$), low therapeutic convenience 10.29% ($n=82$), inappropriate selection 9.78% ($n=78$), and overdose 7.66% ($n=61$).

Table 1. Drugs involved in pharmaceutical recommendations classified according to the second level of the Anatomical Therapeutic Chemical Code/WHO. Fármacos envolvidos nas recomendações farmacêuticas classificadas em conformidade com o segundo nível da *Anatomical Therapeutic Chemical Code/OMS*.

ATC/WHO Category	%	n
Alimentary tract and metabolism	24.71%	197
Nervous system	23.58%	188
Blood and blood-forming organs	15.30%	122
Anti-infectives for systemic use	12.67%	101
Cardiovascular system	8.65%	69
Various	7.02%	56
Systemic hormonal preparations. excluding sex hormones and insulins	3.51%	28
Dermatologicals	1.75%	14
Respiratory system	1.15%	9
Musculoskeletal system	1.15%	9
Sensory organs	0.50%	4
Genitourinary system and sex hormones	0.00%	0
Antineoplastic and immunomodulating agents	0.00%	0
Antiparasitários, Antiparasitic products, insecticides and repellents	0.00%	0
Total	100%	797

Source: authors' own elaboration.

Table 2. Drug therapy problems detected during the year 2022.

Pharmacotherapy problem	%	n
Untreated health problem	36.51%	291
Unnecessary prescribed medication	12.42%	99
Low therapeutic convenience	10.29%	82
Inappropriate selection	9.78%	78
Overdose	7.66%	61
Inadequate/absent posology	4.65%	37
Underdose	4.52%	36
Prescription/typing error	3.01%	24
Inadequate/absent dilution or reconstitution	2.88%	23
Others	8.28%	66
Total	100%	797

Source: Ars Vitae electronic medical record, 2024.

Among the pharmaceutical recommendations (PR), the most frequent were: drug inclusion 28.60% (n=228), drug discontinuation 13.55% (n=108), dose adjustment 13.17% (n=105), drug substitution 12.05% (n=96), and posology adjustment 5.27% (n=42), as shown in Table 3.

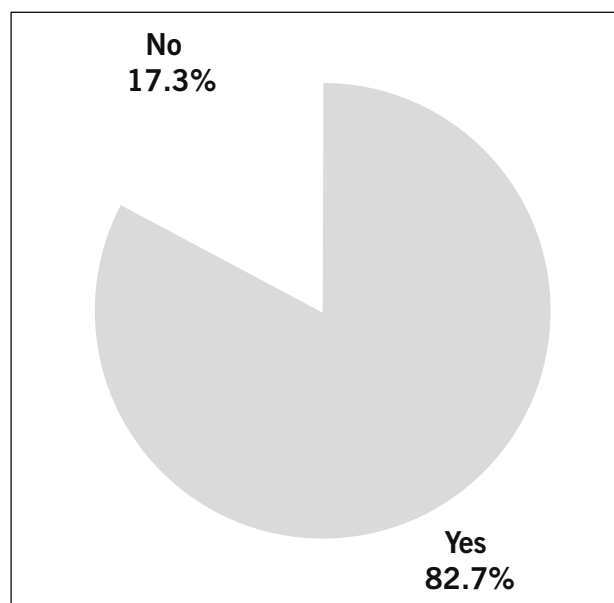
Table 3. Pharmaceutical recommendations made by clinical pharmacists in the Orange Room during the year 2022.

Pharmaceutical recommendations	%	n
Drug inclusion	28,60%	228
Drug discontinuation	13,55%	108
Dose adjustment	13,17%	105
Drug substitution	12,05%	96
Posology adjustment	5,27%	42
Route of administration adjustment	3,76%	30
Dilution/reconstitution adjustment or inclusion	3,27%	26
Drug acquisition	3,02%	24
Laboratory test request	2,88%	23
Infusion time/rate adjustment or inclusion	1,51%	12
Others	12,92%	103
Total	100%	797

Source: Ars Vitae electronic medical record, 2024.

Of the 797 pharmaceutical recommendations (PR) made, an acceptance rate of 82.70% (n=659) was obtained. These results are illustrated in Graph 2.

Figure 2. Acceptance of pharmaceutical recommendations.



Source: Ars Vitae electronic medical record, 2024.

Discussion

The age group in the present study showed a predominance of patients over 60 years old 52.34% (n=157), predominantly male 68.1% (n=205), indicating a high number of elderly patients. Two stu-

dies conducted in reference institutions for urgency and emergency support this finding. The first, conducted in an intensive care unit (ICU) of a university hospital in a municipality in the Midwest region of Brazil in 2016, presented a similar population of patients aged 60 years or older 62.26% (n=315)³. The second, conducted in an ICU of a public hospital in Santa Catarina in 2017, showed the most prevalent age group as patients aged 64 years or older 46% (n=25), mostly male 68% (n=37).¹⁹ Functional changes resulting from aging lead to gradual loss of muscle mass, strength, and power, as well as decreased reflexes and gait speed, making this patient profile more prone to injuries.¹⁰

The profile of the most prevalent diagnoses in this study, classified according to ICD-11, included intracranial trauma, which represented 49 cases (16.28%), adjustment and management of implanted devices, with 24 cases (7.97%), and femoral fracture, with 19 cases (6.31%) (Figure 1). These findings are consistent with a study conducted in the polytrauma unit of Cajuru University Hospital, covering the period between December 2016 and February 2018. In that study, the most frequently injured areas were the face, with 295 cases (21.78%), head and neck, with 366 cases (27.03%), and upper limbs, totaling 471 cases (34.78%)²³. The incidence of facial trauma and intracranial injuries is significant in emergency care, especially in polytrauma services. Both studies point out that these injuries often coexist due to anatomical proximity and the mechanism of impact involved.

The drugs most involved in the pharmaceutical recommendations (PRs) were: enoxaparin 7.65% (n=61), omeprazole 5.65% (n=45), phenytoin 4.14% (n=33), furosemide 3.76% (n=30), and piperacillin + tazobactam 3.51% (n=28). In the study by Neves et al. (2023), the most frequent were: meropenem 7.77% (n=38), phenytoin 6.54% (n=32), enoxaparin 6.34% (n=31), omeprazole 4.91% (n=24), and tranexamic acid 4.70% (n=23).²⁷ The authors also reported that phenytoin, enoxaparin, and omeprazole were among the drugs most frequently involved in PRs, results similar to those found in this study. Another study conducted in the pediatric ICU of a university hospital in Rio Grande do Sul found different results: dipyrone 8.6% (n=50), vitamin K 5%

(n=29), vancomycin 4.8% (n=28), ketamine 4.3% (n=25), paracetamol 4.1% (n=24), midazolam 3.6% (n=21), omeprazole 3.6% (n=21), morphine 2.7% (n=16), and furosemide 2.4% (n=14) were among the most involved drugs.⁹ These results differ from the present study mainly because it involved a pediatric unit, where the admission profile predominantly consisted of patients with respiratory dysfunction and postoperative conditions.

In the present study, the five therapeutic classes most frequently involved in PRs, according to the second level of the ATC/WHO classification, were drugs acting on the digestive system and metabolism 24.71% (n=197), nervous system 23.58% (n=188), blood and hematopoietic organs 15.30% (n=122), anti-infectives for systemic use 12.67% (n=101), and cardiovascular system 8.65% (n=69) (Table 1). This profile is consistent with a study conducted in the ICU of a hospital specialized in urgency and emergency in Goiânia/GO, which showed the following prevalence profile: systemic anti-infectives 23.72% (n=116), nervous system 23.11% (n=113), blood and blood-forming organs 19.22% (n=94), cardiovascular system 13.70% (n=67), and digestive system and metabolism 9.82% (n=48).²⁷

The most frequent PR was drug inclusion 28.60% (n=228) (Table 3), often linked to the problem of untreated health condition 36.51% (n=291) (Table 2). This is justified by the fact that the unit treats critically ill patients with high turnover and short average hospital stay, which leads the care team to prioritize stabilizing patients, resulting in more discrepancies between previous home therapy and current pharmacotherapy. With medication reconciliation performed by clinical pharmacists, chronic medications, comorbidities, and allergies were identified, generating PRs and optimizing patient care.²⁶ The second most frequent PR was drug suspension 13.55% (n=108) (Table 3), associated with the pharmacotherapy problem of unnecessary prescribed medication 12.42% (n=99) (Table 2). This highlights the importance of the pharmacist in deprescribing processes. Notably, 10.18% (n=11) of these suspensions were related to the discontinuation of phenytoin used for neuroprotection/prophylaxis of secondary seizures after traumatic brain injury when use exceeded the recommended 7 days.³⁸

A cross-sectional, retrospective, quantitative, and descriptive study conducted at a University Hospital in Sergipe, a reference open-access institution for urgency and emergency care, with data from January to November 2021, followed 357 patients and identified 506 PRs. The most prevalent were: initiation of drug therapy 24.5% (n=124), individualization/correction of dosage 20.5% (n=104), substitution for a safer and/or more effective drug 18% (n=91), correction of prescription inconsistencies 11% (n=56), and correction of preparation and/or administration 9% (n=45). These results are similar to those of the present study, probably due to the comparable hospital profile¹¹.

The acceptance rate of PRs 82.70% (n=659) (Figure 2) is consistent with previous studies. For example, in an ICU of a hospital specialized in urgency and emergency in Goiânia/GO, PR acceptance was 84.25% (n=412),²⁷ while in another ICU, this time in a similar hospital in Santa Catarina, acceptance was 64% (n=426),²⁷ differing from the present study. The similarity of the first study's results is likely related to the fact that both were conducted during the first year of implementation of clinical pharmacy services in their respective units.²⁷ The ICU in the second study also cares for oncological patients in addition to emergency cases, which may partly explain the divergence in results.¹⁹ These findings reinforce the relevance of clinical pharmacy in health institutions to ensure the safe and rational use of medicines, also demonstrating the success of integrating pharmacists into the care team in urgency and emergency settings.³⁶

This study highlights the importance of the pharmacist's active role in intervening and preventing possible failures at the time of prescribing, especially when PRs are performed with medical students and residents. As prescribers in training, they may face specific challenges related to clinical experience and pharmacotherapy knowledge. In this context, the pharmacist's presence as an integral member of the healthcare team is essential in identifying potential prescribing errors, reviewing pharmacotherapy, and discussing safe and evidence-based practices with trainees². Early PRs can help prevent medication-related errors, minimize risks, and promote safer and more effective clinical practice. Therefore, interprofessional integration between pharmacists, medical

students, and residents is essential to foster quality and safety in the prescribing process²¹.

Furthermore, the uninterrupted presence of a team of clinical pharmacists working 24 hours a day, including weekends, proved unfeasible, which, to some extent, weakened the pharmacist's bond with the care team. In addition, the absence of a day-shift team until the end of the first semester of 2022 likely had a negative impact on the acceptance rate of PRs, due to disruptions in continuity of patient care.⁵ These gaps in healthcare professional availability may compromise care coordination and quality, highlighting the need for strategies to ensure adequate coverage at all times.

Although the intermittent presence of pharmacy residents provided an updated perspective for the care team, facilitating early identification of drug-related problems and offering evidence-based solutions, their rotation among various care units limited the establishment of solid relationships with the care team. This limitation affected the acceptance of proposed PRs.⁴¹ These restrictions underscore the importance of continuous and structured development of clinical pharmacy services to maximize the potential of clinical interventions. They also emphasize the need to promote safer and more efficient care by ensuring pharmacists remain in specific units for longer periods, fostering stronger mutual trust and more effective collaboration among healthcare professionals, ultimately leading to better patient outcomes and a more cohesive work environment.

Moreover, the lack of an economic evaluation of the impact of PRs for the health institution represents an important gap in both literature and clinical practice. Although PRs have the potential to improve patient outcomes and optimize resources, the absence of specific economic studies makes it difficult to fully understand their financial impact. The lack of pharmacoeconomic analyses prevents quantification of the costs associated with performing PRs compared to potential economic benefits, such as shorter hospital stays, reduced medication-related complications, and improved operational efficiency. Therefore, it is essential for future research to address this gap by conducting comprehensive economic evaluations, providing a holistic view of the impact of PRs on health institutions, and su-

porting evidence-based decision-making and efficient allocation of financial resources.³⁹

Final Considerations

The results of this study provide a solid and detailed understanding of pharmacotherapy problems and pharmaceutical recommendations (PRs) in a critical care unit, highlighting both the profile of these PRs and the importance of the clinical emergency pharmacist. In this regard, when evaluating the profile of the 797 PRs, an acceptance rate of 82.70% (n=659) was obtained. This acceptance rate, even in the first year of the allocation of a clinical pharmacist in the unit, underscores the relevance of the presence of this professional in the emergency and urgent care setting, as it provides patients with safer and optimized care, promoting rational drug use.

In Brazil, studies addressing the profile of PRs in emergency/urgent care and emergency room settings are still scarce, therefore this study may contribute to and guide other researchers in the field to explore aspects not covered in this investigation.

Acknowledgments

We thank the Clinical Pharmacy Management and the Center for Studies of the Instituto Doutor José Frota for their support in the development of this work.

Authors' Contributions

Gomes FEP, Silva RM: Scientific and intellectual contributions to the study design; Gomes FEP, Silva RM, Luz PB, Marques LM: Contributions to data collection, analysis, and interpretation; Critical review; Contributions to final approval.

Conflicts of Interest

The authors declare no conflict of interest.

Funding

The authors declare that this research received no funding.

Data Availability Statement

The data will be made available upon request. The datasets generated and analyzed during the current study are available upon request to the corresponding author.

Responsible Reviewers

Kerilin Rocha, Leonardo Kister, and Pedro Augusto Rodrigues

References

1. Almeida JCA, Andrade KVF. Intervenções farmacêuticas para a promoção do uso racional de medicamentos em hospitais: uma revisão. *Infarma - Ciências Farmacêuticas*. 2022;34(1):13-24. DOI: 10.14450/2318-9312.v34.e1.a2022.pp13-24.
2. Angonesi D, Rennó MUP. Dispensação farmacêutica: proposta de um modelo para a prática. *Ciência & Saúde Coletiva*. 2011;16(10):3883-3891. DOI: 10.1590/S1413-81232011001000024.
3. Araújo EO, Viapiana M, Domingues EAM, Oliveira GS, Polisel CG. Intervenções farmacêuticas em uma unidade de terapia intensiva de um hospital universitário. *Rev Bras Farm Hosp Serv Saúde*. 2017;8(3):25-30. DOI: 10.30968/rb-fhss.2017.083.005.
4. Arredondo E, Udeani G, Horseman M, Hintze TD, Surani S. Role of clinical pharmacists in intensive care units. *Cureus*. 2021;1-9. DOI: 10.7759/cureus.17929.
5. Brasil. Ministério da Saúde. Portaria nº 3.390, de 30 de dezembro de 2013. Brasília/DF; 2013. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2013/prt3390_30_12_2013.html [cited April 7, 2024].
6. Brasil. Ministério da Saúde. Cuidado farmacêutico na atenção básica: caderno 1: serviços farmacêuticos na atenção básica à saúde. 1ª ed. Brasília/DF; 2014. 105 p. Available from: https://www.gov.br/saude/pt-br/composicao/sectics/qualifarsus/eixo-cuidado-antigo/arquivos/servicos_farmaceuticos_atencao_basica_saude_led.pdf
7. Brasil. Ministério da Saúde. Cuidado farmacêutico na atenção básica: caderno 2: capacitação para implantação dos serviços de clínica farmacêutica. 1ª ed. Brasília/DF; 2014. 303 p. Available from: https://www.gov.br/saude/pt-br/composicao/sectics/qualifarsus/eixo-cuidado-antigo/arquivos/cuidado_farmaceutico_atencao_basica_saude_2_led.pdf
8. Brasil. Ministério da Saúde. Diretrizes nacionais do cuidado farmacêutico no âmbito do sistema único de saúde (SUS). Brasília/DF; 2023. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2024/prt4379_17_06_2024.html [cited April 8, 2024].

9. Brito AM, Negretto GW, Martinbiancho JK, Zamberlan S. Análise de intervenções farmacêuticas utilizando um instrumento de acompanhamento farmacêutico em uma unidade de terapia intensiva pediátrica. *Clin Biomed Res*. 2022;112-120. DOI: 10.22491/2357-9730.119401.
10. Camargo FF, Lima EC. Os impactos do envelhecimento no condicionamento físico: uma análise das atuais diferenciações por faixas etárias dos índices da portaria do comando-geral 076/2016 PMPR. *RECIMA21*. 2023;4:1-17. DOI: 10.47820/recima21.v4i6.3388.
11. Cardoso DS, Barros IMC, Lisboa JS, Matos LEO, Santos GP. Intervenções do farmacêutico clínico na identificação e prevenção de problemas relacionados à farmacoterapia em um hospital de ensino terciário. *Research, Society and Development*. 2022;11:1-9. Available from: <https://doi.org/10.33448/rsd-v11i14.35760>
12. Carter BL. Evolution of clinical pharmacy in the US and future directions for patient care. *J List HHS Author Manuscripts*. 2017;169-77. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4821736/>
13. Conselho Federal de Farmácia. Resolução nº 585 de 29 de agosto de 2013. Brasília, DF; 2013. Available from: <https://www.cff.org.br/userfiles/file/resolucoes/585.pdf>. [cited July 20, 2023].
14. Conselho Federal de Farmácia. Serviços farmacêuticos diretamente destinados ao paciente, à família e à comunidade: contextualização e arcabouço conceitual. 1ª ed. Brasília, DF; 2017. 182 p. Available from: https://www.cff.org.br/userfiles/Profar_Arcabouco_TELA_FINAL.pdf
15. Conselho Federal de Farmácia. Resolução nº 675, de 31 de outubro de 2019. Brasília, DF; 2019. Available from: <https://www.in.gov.br/web/dou/-/resolucao-n-675-de-31-de-outubro-de-2019-228899312>. [cited October 10, 2023].
16. Conselho Nacional de Saúde. Resolução nº 466, de 12 de dezembro de 2012. Brasília, DF; 2012. Available from: https://bvsms.saude.gov.br/bvs/saudelegis/cns/2013/res0466_12_12_2012.html [cited March 1, 2024].
17. Conselho Nacional de Saúde. Resolução nº 510, de 07 de abril de 2016. Brasília, DF; 2016. Available from: [saudelegis/cns/2016/res0510_07_04_2016.html](https://bvsms.saude.gov.br/bvs/saudelegis/cns/2016/res0510_07_04_2016.html). [cited March 1, 2024].
18. DATASUS. Departamento de Informática do SUS. Brasília, DF; 2018. Available from: <http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sim/cnv/ext10uf.def>. [cited June 13, 2023].
19. Dias D, Wiese LPL, Fernandes FM, Pereira E. Avaliação de intervenções clínicas farmacêuticas em uma UTI de um hospital público de Santa Catarina. *Rev Bras Farm Hosp Serv Saúde*. 2018;1-5. Available from: https://www.researchgate.net/publication/335841273_Avaliacao_de_intervencoes_clinicas_farmaceuticas_em_uma_UTI_de_um_hospital_publico_de_Santa_Catarina DOI: 10.30968/rbfhss.2018.093.005
20. Farmer BM, Hayes BD, Rao R, Farrell N, Nelson L. The role of clinical pharmacists in the emergency department. *J Med Toxicol*. 2017;114-6. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6013729/#:~:text=ED%20pharmacists%20provide%20real%2Dtime,34%2C%2045%E2%80%93347%5D>
21. Floren LC, Pittenger AL, Wilting I, Irby DM, Cate OT. Medical residents' informal learning from pharmacists in the clinical workplace. *Med Sci Educ*. 2023;33:1-10. DOI: 10.1007/s40670-023-01784-1.
22. Freitas GRM, Neyeloff JL, Neto GB, Heineck I. Drug-related morbidity in Brazil: a cost-of-illness model. *Value Health Reg Issues*. 2018;150-157. DOI: 10.1016/j.vhri.2018.07.002.
23. Guizzo WA, Souza BS, Weihermann V, Silva AB, Jabur GR, Stahlschmidt CMM, et al. Trauma em Curitiba: avaliação multifatorial de vítimas admitidas em um hospital universitário. *Rev Col Bras Cir*. 2020;1-10. DOI: 10.1590/0100-6991e-20202408.
24. Kohn LT, Corrigan JM, Donaldson MS, et al. To err is human: building a safer health system. Institute of Medicine (US) Committee on Quality of Health Care in America; 1st ed. Washington (DC): National Academies Press (US); 2000. ISBN: 0-309-51563-7.
25. Leal GSS, Silva MDP. Case study: pharmacotherapeutic follow-up of a diabetic patient using the SOAP method. *Braz J Dev*. 2022;8:43879-43896. DOI: 10.34117/bjdv8n6-089.

26. Lombardi NF, Mendes AEM, Lucchetta RC, Reis WCT, Fávero MLD, Correr CJ. Análise das discrepâncias encontradas durante a conciliação medicamentosa na admissão de pacientes em unidades de cardiologia: um estudo descritivo. *Rev Latino-Am Enfermagem*. 2016;1-7. DOI: 10.1590/1518-8345.0820.2760.
27. Neves ER, Júlio CD, Viana GD, Pereira JA. Análise das intervenções farmacêuticas clínicas em unidade de terapia intensiva de um hospital de urgência e trauma. *Rev Cient Esc Est Saúde Pública Goiás “Cândido Santiago”*. 2023;9:1-16. DOI: 10.22491/2447-3405.2023.V9.9b9.
28. Notivisa. Agência Nacional de Vigilância Sanitária. Incidentes relacionados à assistência à saúde: resultados das notificações realizadas no Notivisa - Brasil, janeiro a dezembro de 2023. Brasília (DF); 2024. Available from: <https://www.gov.br/anvisa/pt-br/centraisdeconteudo/publicacoes/servicosdesaude/relatorios-de-notificacao-dos-estados/eventos-adversos/2023/brasil>. [cited January 31, 2024].
29. Oliveira WL, Carvalho ARA, Siqueira LP. Performance of the hospital pharmacist in the intensive care unit (ICU). *Res Soc Dev*. 2021;10:1-9. DOI: 10.33448/rsd-v10i14.22578.
30. Patel P, Zed PJ. Drug-related visits to the emergency department: how big is the problem?. *Pharmacotherapy*. 2002;22:915-923. DOI: 10.1592/phco.22.11.915.33630.
31. Pereira LRL, Freitas O. A evolução da atenção farmacêutica e a perspectiva para o Brasil. *Rev Bras Ciênc Farm*. 2008;44:601-612. Available from: <https://www.scielo.br/j/rbcbf/a/d9zrdFQ-dY8tSqMsCXQ8WWBC/?format=pdf&lang=pt>
32. Podder V, Lew V, Ghassemzadeh S. SOAP notes. StatPearls Publishing LLC. 2023. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK482263/>
33. Prefeitura Municipal de Fortaleza. Instituto Dr. José Frota (IJF). Fortaleza (CE); 2020. Available from: <https://catalogodeservicos.fortaleza.ce.gov.br/categoria/saude/servico/301>. [cited August 11, 2023].
34. Rosa AW, Silva SR, Jesus RA, Teixeira DG, Alexandre MM, Zardeto-Sabec G. Classification of pharmaceutical interventions carried out in an intensive care unit. *Braz J Dev*. 2020;6:40165-40176. DOI: 10.34117/bjdv6n6-524.
35. Secretaria da Saúde do Estado do Ceará. Governo do Ceará e Prefeitura de Fortaleza inauguram última etapa do IJF2. Fortaleza (CE); 2020. Available from: <https://www.saude.ce.gov.br/2020/09/29/governo-do-ceara-e-prefeitura-de-fortaleza-inauguram-ultima-etapa-do-ijf2/>. [cited September 19, 2023].
36. Souza LB, Souza DM, Souza SM, Silva DR, Aguiar NC. Importância do farmacêutico clínico no uso seguro e racional de medicamentos no âmbito hospitalar. *Pensar Acadêmico*. 2018;16:109-124. DOI: 10.21576/rpa.2018v16i1.360.
37. Souza LA, Sousa EMR, Machado YAF, Moreno HJB, Kapiche SS, Cruz GS, et al. Processo de enfermagem na assistência às vítimas de trauma em um hospital no interior do Estado de Rondônia. *Braz J Dev*. 2022;8:42092-42110. DOI: <https://doi.org/10.34117/bjdv8n5-608>
38. Temkin NR, Dikmen SS, Wilensky AJ, Keihm J, Chabal S, Winn HR. A randomized, double-blind study of phenytoin for the prevention of post-traumatic seizures. *N Engl J Med*. 1990;323:497-502. DOI: 10.1056/NEJM199008233230801.
39. Tiguman GB, Junior RM. Economic impact of pharmaceutical interventions on healthcare services from Brazil: a systematic review. *Rev Bras Farm Hosp Serv Saúde*. 2020;1-10. DOI: 10.30968/rbfhss.2020.114.0512.
40. Turnbull AJ, Donaghy E, Salisbury L, Ramsay P, Rattray J, Walsh T, et al. Polypharmacy and emergency readmission to hospital after critical illness: a population-level cohort study. *Br J Anaesth*. 2020;415-422. DOI: 10.1016/j.bja.2020.09.035.
41. Wang C, Li M, Huang Y, Xi X. Factors influencing clinical pharmacists' integration into the clinical multidisciplinary care team. *Front Pharmacol*. 2023;1-17. DOI: 10.3389/fphar.2023.1202433.
42. World Health Organization. International statistical classification of diseases and related health problems (ICD). Geneva; 2022. Available from: <https://www.who.int/standards/classifica->

tions/classification-of-diseases . [cited May 15, 2023].

43. World Health Organization. Anatomical Therapeutic Chemical (ATC) classification. Geneva; 2022. Available from: <https://www.who.int/tools/atc-ddd-toolkit/atc-classification>. [cited June 27, 2023].

