Vilaça SDO, Santana DDS, Alves EDS, Penha SDS, Vale VV, Sousa CJPD, Prete ACL, Sena LWPD, Ribeiro CHMA. Evaluation of potential drug interactions in antimicrobial prescriptions in a hospital. A Cross-sectional study. Pharmacy Practice 2025 Jan-Marc;23(1):3077.
https://doi.org/10.18549/PharmPract.2025.1.3077

Original Research

Evaluation of potential drug interactions in antimicrobial prescriptions in a hospital

Samara de Oliveira Vilaça, Diego da Silva Santana, Elizama de Sá Alves, Soraia dos Santos Penha, Valdicley Vieira Vale, Chriscia Jamilly Pinto de Sousa, Ana Cristina Lo Prete, Luann Wendel Pereira de Sena, Carolina Heitmann Mares Azevedo Ribeiro

Received (first version): 02-Apr-2024 Accepted: 22-May-2024 Published online: 17-Jan-2025

Abstract

Background: Drug interaction is a process that occurs when the effects and/or toxicity of a drug are modified by the previous or simultaneous presence of another drug, which may result in a change in therapeutic efficacy or an increase in the risk of adverse events. **Objective:** to evaluate the potential drug interactions of antimicrobials in prescriptions of patients admitted to a hospital in the State of Para, in 2019. Methods: This is a qualitative-quantitative, retrospective and cross-sectional study, carried out by collecting data from medical records of patients who used antibiotics and were hospitalized in 2019 in a hospital in Para. Drug interactions were assessed using the Micromedex database. **Results:** During the study period, 83% (n = 762) of the patients who were admitted to the institution used antibiotics. There was a male prevalence of 54% (n = 409), the average age was 56 years. 6870 drugs were prescribed, of which 1,727 (25%) were antimicrobials, an average of two antibiotics prescribed per patient. A 52% rate (n = 395) of drug interactions was obtained between antimicrobial drugs and other classes. The drug ciprofloxacin had the highest number of interactions, 42% (n = 165), interacting with 12 different drugs. **Conclusion:** the prescriptions analyzed showed a high index of potential drug interactions. Thus, it is stated that the presence of the pharmaceutical professional inserted in the multiprofessional teams and in the process of evaluating prescriptions in the hospital sector, is of extreme importance and need to reduce risks and increase patient safety in the use of medications.

Keywords: drug interaction; antimicrobials; clinical pharmacist

INTRODUCTION

Drug interaction (DI) is a process that occurs when the effects and/or toxicity of a drug are modified by the previous or simultaneous presence of another drug, which may result in a change in therapeutic efficacy or an increase in the risk of adverse events.[1,2] DI can be classified into three main categories: physical-chemical interactions, pharmacokinetic interactions and pharmacodynamic interactions.[3]

In the hospital environment, it is common for patients to receive multiple medications, which significantly increases the risk of DI with potentially serious consequences for the patient.[4] Despite being present in the hospital routine, many DIs are not identified due to the lack of proper assessment of prescriptions and the absence of a clinical pharmacist in the multidisciplinary health team.[5] Among the relevant interactions in clinical practice, those that occur through the use of antimicrobials stand out, which are one of the most prescribed classes of drugs for therapeutic and prophylactic use.[6] Antimicrobials play a crucial role in the treatment of infections caused by microorganisms, however, their inappropriate use or in combination with other drugs can lead to unwanted effects, such as microbial resistance and toxicity. In the context of hospital care, these drugs represent from 20% to 50% of total drug spending.[7]

In Brazil, the evaluation of drug prescriptions to identify possible pharmacological interactions is an attribution of the clinical pharmacist, as established by Resolution Nº 585/2013 of the Federal Council of Pharmacy.[8] Thus, evaluating the conditions of prescriptions containing antimicrobials will result in the development of practices that guarantee the adequate and rational use of drugs, increasing the effectiveness and safety of the patient.[9]

Therefore, the present study aims to identify and evaluate potential DIs in prescriptions for hospitalized patients who used antibiotics in a hospital in the State of Pará, in the year 2019.

Samara de Oliveira VILAÇA. Universidade Federal do Pará, Brasil. samaralivi@hotmail.com
Diego da Silva SANTANA. Escola Superior da Amazônia, Brasil. diegodssantana@hotmail.com
Elizama de Sá ALVES. Escola Superior da Amazônia, Brasil. elizama0sa@gmail.com
Soraia dos Santos PENHA. Escola Superior da Amazônia, Brasil. sol_penha@yahoo.com.br
Valdicley Vieira VALE. Escola superior da Amazônia, Brasil. valdicleyvale@gmail.com
Chriscia Jamilly Pinto de SOUSA*. Universidade Federal do Pará, Brasil. jamillysousa@ufpa.br
Ana Cristina Lo PRETE. Universidade São Judas Tadeu, Brasil. analoprete@gmail.com
Luann Wendel Pereira de SENA. Universidade Federal do Sul e Sudeste do Pará, Brasil. luannsena@unifesspa.edu.br
Carolina Heitmann Mares Azevedo RIBEIRO. Universidade Federal do Pará, Brasil. carolmheitman@hotmail.com

Article distributed under the Creative Commons Attribution-NonCommercial-NoDerivs 4.0 International (CC BY-NC-ND 4.0) license

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)

© the Authors

METHODS

This is a quali-quantitative, retrospective and cross-sectional study, conducted in a municipal hospital in the State of Pará, with analysis of prescriptions of hospitalized patients in the year 2019.

The hospital is small and offers general care with an urgent and emergency entry point, as well as admission to the adult medical clinic. The institution has 44 active beds, 41 of which are clinical beds, 02 semi-intensive care beds and 01 isolation bed.

Data were collected through the medical records of patients who were hospitalized during the study period. Only data from adult patients (age >18 years) who used antimicrobial drugs during the hospitalization period were included, those who had a prescription for herbal medicines and/or a prescription for active ingredients such as vitamins, mineral salts and components of the diet. The data extracted from the medical records were: sex; age; diagnosis using the international disease code (ICD); Names and quantities of prescribed medications.

Data were recorded in spreadsheets in the Microsoft Office Excel 2016 program. Data were distributed in absolute and relative frequencies and the analysis to assess associations was performed using the chi-square and Fisher's exact tests, with a significance level of 5% ($p < 0.05$). For the analysis and classification of potential DIs involving antimicrobials, the Micromedex® database "Drug Interactions Tool", version 2.0, was used as a bibliographic source. According to the available information, DIs were described in terms of potential adverse reactions and classified according to severity (mild, moderate and severe), which takes into account the risk of clinical effects, and according to the mechanism of interaction (pharmacokinetic, pharmacodynamic, physical -chemical).

For the age criterion, an adult was defined as any person aged 18 years or over (up to 59 years), and elderly as any person aged 60 years or over.

The research was approved by the Research Ethics Committee of the Federal University of Pará (UFPA) with CAAE number: 37307620600000018.

RESULTS

Prescriptions were collected from 919 patients. However, based on the criteria used, 157 patients were excluded. Therefore, 83% (n=762) of patients admitted from January to December 2019 at the hospital under study used antimicrobials. The average number of drugs prescribed per patient was 09 (nine), ranging from 02 (two) to 20 (twenty). It was also found that 86% (n=656) of patients had five or more prescription drugs, which is classified as polypharmacy.

According to Table 1, there was a prevalence of males 54% (n=416). Regarding age, the average was 36 years (18 - 106), with a prevalence of adults 54% (n=409), the elderly represented 46% (n=353) of hospitalizations. The most prevalent ICDs among hospitalized patients were: infection of the respiratory system with 29% (n=223), infectious and parasitic diseases with 18% (n=140), and diseases of the genitourinary system with 17% (n=127).

Table 1. Profile of patients admitted to a hospital in the State of Para, in 2019

Profile	male		female		Total	
	%	N	%	N	%	N
Gender	54%	416	46%	346	100%	762
Age group						
18-60 years	55%	226	45%	183	54%	409
over 60 years old	54%	190	56%	163	46%	353
CID						
A - Some infectious and parasitic diseases	59%	82	41%	58	18%	140
B - Some infectious and parasitic diseases	69%	11	31%	5	2%	16
C - Neoplasms	50%	1	50%	1	0,3%	2
D - Diseases of the blood and hematopoietic organs and some immune disorders.	37%	7	63%	12	3%	19
E - Endocrine, nutritional and metabolic diseases.	69%	25	31%	11	5%	36
F - Mental and behavioral disorders	0%	0	0%	0	0%	0
G - Diseases of the nervous system	0%	0	100%	2	0,3%	2
H - Disease of the eyes and adnexa / Diseases of the ears and mastoid process	50%	1	50%	1	0,3%	2
F - Disease of the circulatory system	45%	10	55%	12	3%	22
J - Disease of the respiratory system	54%	121	46%	102	29%	223

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)
© the Authors

K - Disease of the digestive tract	34%	18	56%	35	7%	53
L - Disease of the skin and subcutaneous tissue	77%	33	33%	10	6%	43
M - Diseases of the musculoskeletal system and connective tissue.	100%	5	0%	0	0,7%	5
N - Diseases of the genitourinary system.	39%	50	61%	77	17%	127
R - Symptoms, signs and abnormal clinical and laboratory findings, not classified elsewhere.	40%	6	60%	9	1%	15
S -Injury, poisoning and some other consequences of external causes.	100%	4	0%	0	0,5%	4
T -Injury, poisoning and some other consequences of external causes.	78%	40	22%	11	7%	51
Not identified	100%	2	0%	0	0,3%	2
		416		346		762

Source: Authors, 2021

During the analyzed period, a total of 6,870 drugs were prescribed, of which antibiotics accounted for 25% (n= 1,727) of this total. During this period, 18 different active principles of antibiotics were used. On average, each patient was prescribed two different antibiotics. Ceftriaxone was the most frequently prescribed antibiotic, accounting for 37% (n=631) of total prescriptions. Among patients receiving ceftriaxone, 54% (n=342) were male and 46% (n=289) female. This antimicrobial substance was the most prescribed antibiotic for both sexes, as shown in Table 2.

Clindamycin presents a great difference in relation to gender, with a higher number of prescriptions, 93% (n=235) for men, and only 7% (n=18) for women, and may be the first choice treatment for upper respiratory tract infection (Table 2).

In Table 3, you can see that 23% (n=395) of DI were identified between the prescribed antibiotics and the other drugs. The most prevalent DIs occurred among: quinolones and hypoglycemic agents, opioids and glucocorticoids; macrolides with opioids, glucocorticoids and antihypertensives. The pharmacodynamic mechanism of interaction was the most frequent, present in 57% (n=223) of interactions and pharmacokinetic in 43% (n=172) of interactions. Interactions classified as serious were the most prevalent and corresponded to 52% (n 206), of which 60% (n=110) were prescriptions for elderly patients.

The drug that presented the highest number of IMs was ciprofloxacin, with 42% (n=165) and interacting with 12 different drugs, followed by gentamicin with 17% (n=67) of IMs with five different drugs.

Table 2. Antimicrobials prescribed in the year 2019, in a hospital in the State of Para

Prescribed Antibiotics	**Male**		**Female**		**Total**	
	%	**N**	**%**	**N**	**%**	**N**
Ceftriaxone	54%	342	46%	289	37%	631
Clindamycin	93%	235	7%	18	15%	253
Gentamicin	46%	97	54%	115	12%	212
Metronidazole	60%	112	40%	73	11%	185
Oxacillin	66%	114	34%	59	10%	173
Ciprofloxacin	51%	41	49%	40	5%	81
Ampicillin	53%	33	47%	29	3%	62
Cefepime	44%	12	56%	15	2%	27
Chloramphenicol	46%	12	54%	14	1%	26
Azithromycin	59%	10	41%	7	0,9%	17
Clarithromycin	47%	8	53	9	0,9%	17
Vancomycin	54%	6	46%	5	0,7%	11
Ceftadizyme	44%	4	56%	5	0,5%	9
Cephalothin	86%	6	14%	1	0,4%	7
Imipenem	57%	4	43%	3	0,4%	7
Amikacin	40%	2	60%	3	0,3%	5
Crystalline Penicillin	67%	2	33%	1	0,2%	3
Amoxicillin	0%	0	100%	1	0,1%	1
Total	**60%**	**1040**	**40%**	**687**	**100%**	**1727**

Source: Authors, 2021

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)
© the Authors

Table 3. Antimicrobial drug interactions identified in patient prescriptions in a hospital in the State of Para in 2019. Classified according to the type of interaction, mechanism of interaction and classification in relation to age group

Substance 1	Substance 2	type of interaction	Interaction mechanism	Classification	Interaction				Total	
					18-59		60 or +			
					%	N	%	N	%	N
Amikacin Oxacillin Pharmacodynamics	Amikacin Oxacillin Pharmacodynamics	Amikacin Oxacillin Pharmacodynamics	Chemical inactivation of the aminoglycoside	Light	50%	1	50%	1	0,6%	2
Amikacin Furosemide Pharmacokinetics	Amikacin Furosemide Pharmacokinetics	Amikacin Furosemide Pharmacokinetics	Additive or Synergistic Toxicity	Serious	40%	2	60%	3	1%	5
Ampicillin Atenolol Pharmacokinetics	Ampicillin Atenolol Pharmacokinetics	Ampicillin Atenolol Pharmacokinetics	Decreased bioavailability of atenolol	Light	0%	0	100%	1	0,2%	1
Ampicillin Gentamicin Pharmacodynamics	Ampicillin Gentamicin Pharmacodynamics	Ampicillin Gentamicin Pharmacodynamics	Chemical inactivation of the aminoglycoside	Light	17%	1	83%	5	1%	6
Azithromycin Clarithromycin Pharmacodynamics	Azithromycin Clarithromycin Pharmacodynamics	Azithromycin Clarithromycin Pharmacodynamics	Additive Effects on the QT Interval	Serious	0%	0	100%	2	0,6%	2
Azithromycin Aminophylline Pharmacokinetics	Azithromycin Aminophylline Pharmacokinetics	Azithromycin Aminophylline Pharmacokinetics	Increased serum concentrations of theophylline	Moderate	25%	1	75%	3	1%	4
Azithromycin Ciprofloxacin Pharmacodynamics	Azithromycin Ciprofloxacin Pharmacodynamics	Azithromycin Ciprofloxacin Pharmacodynamics	Increased risk of QT prolongation.	Serious	56%	5	44%	4	2%	9
Azithromycin Morphine Pharmacodynamics	Azithromycin Morphine Pharmacodynamics	Azithromycin Morphine Pharmacodynamics	Increased Morphine and respiratory and CNS depression.	Serious	33%	1	67%	2	1%	3
Ciprofloxacin Aminophylline Pharmacokinetics	Ciprofloxacin Aminophylline Pharmacokinetics	Ciprofloxacin Aminophylline Pharmacokinetics	Decreased excretion of theophylline by raising plasma levels	Serious	50%	5	50%	5	3%	10
Ciprofloxacin Dexamethasone Pharmacodynamics	Ciprofloxacin Dexamethasone Pharmacodynamics	Ciprofloxacin Dexamethasone Pharmacodynamics	Additive effect of risk for tendon rupture	Serious	59%	10	41%	7	4%	17
Ciprofloxacin Fentanyl Pharmacokinetics	Ciprofloxacin Fentanyl Pharmacokinetics	Ciprofloxacin Fentanyl Pharmacokinetics	Inhibition of CYP3A4-mediated metabolism	Serious	0%	0	100%	3	1%	3
Ciprofloxacin Hydrocortisone Pharmacodynamics	Ciprofloxacin Hydrocortisone Pharmacodynamics	Ciprofloxacin Hydrocortisone Pharmacodynamics	Increased risk of tendonitis and tendon rupture	Serious	67%	10	33%	5	4%	15
Ciprofloxacin H. Aluminum Pharmacokinetics	Ciprofloxacin H. Aluminum Pharmacokinetics	Ciprofloxacin H. Aluminum Pharmacokinetics	Decreased absorption of Ciprofloxacin due to chelation	Moderate	67%	10	33%	5	4%	15
Ciprofloxacin Insulin pharmacodynamics	Ciprofloxacin Insulin pharmacodynamics	Ciprofloxacin Insulin pharmacodynamics	Risk of severe, refractory hypoglycemia and hyperglycemic coma	Serious	40%	10	60%	15	6%	25
Ciprofloxacin Metformin Pharmacodynamics	Ciprofloxacin Metformin Pharmacodynamics	Ciprofloxacin Metformin Pharmacodynamics	Increased risk of hypoglycemia or hyperglycemia, Hypertension	Serious	38%	3	62%	5	2%	8
Ciprofloxacin Metronidazole Pharmacokinetics	Ciprofloxacin Metronidazole Pharmacokinetics	Ciprofloxacin Metronidazole Pharmacokinetics	Additive prolongation of the QT interval	Serious	58%	8	42%	6	4%	14
Ciprofloxacin Midazolam Pharmacokinetics	Ciprofloxacin Midazolam Pharmacokinetics	Ciprofloxacin Midazolam Pharmacokinetics	Inhibition of CYP3A4-mediated metabolism	Serious	0%	0	100%	2	0,6%	2
Ciprofloxacin Promethazine Pharmacodynamics	Ciprofloxacin Promethazine Pharmacodynamics	Ciprofloxacin Promethazine Pharmacodynamics	Increased risk of QT Interval	Serious	100%	4	0%	0	1%	4

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)

© the Authors

Ciprofloxacin Tramadol Pharmacodynamics	Ciprofloxacin Tramadol Pharmacodynamics	Ciprofloxacin Tramadol Pharmacodynamics	Risk of CNS depression and respiratory depression	Serious	58%	30	42%	22	13%	52	
Ceftazidime Chloramphenicol Pharmacodynamics	Ceftazidime Chloramphenicol Pharmacodynamics	Ceftazidime Chloramphenicol Pharmacodynamics	Antagonism decreased effectiveness of Ceftazidime	light	50%	2	50%	2	1%	4	
Clarithromycin Aminophylline Pharmacodynamics	Clarithromycin Aminophylline Pharmacodynamics	Clarithromycin Aminophylline Pharmacodynamics	Theophylline toxicity, nausea, vomiting, palpitations	light	25%	1	75%	3	1%	4	
Clarithromycin Dexamethasone Pharmacokinetics	Clarithromycin Dexamethasone Pharmacokinetics	Clarithromycin Dexamethasone Pharmacokinetics	CYP3A4-mediated substrate metabolism induction	Serious	100%	1	0%	0	0,2%	1	
Clarithromycin Losartan Pharmacokinetics	Clarithromycin Losartan Pharmacokinetics	Clarithromycin Losartan Pharmacokinetics	Inhibition of CYP3A4-mediated metabolism	Serious	100%	1	0%	0	0,2%	1	
Clarithromycin Morphine Pharmacodynamics	Clarithromycin Morphine Pharmacodynamics	Clarithromycin Morphine Pharmacodynamics	Increases risk of respiratory and CNS depression	Serious	100%	1	0%	0	0,2%	1	
Clarithromycin Nifedipine Pharmacodynamics	Clarithromycin Nifedipine Pharmacodynamics	Clarithromycin Nifedipine Pharmacodynamics	Risk of hypotension, bradycardia or acute kidney injury	Serious	50%	1	50%	1	0,6%	2	
Clarithromycin Promethazine Pharmacodynamics	Clarithromycin Promethazine Pharmacodynamics	Clarithromycin Promethazine Pharmacodynamics	Increased risk of QT interval prolongation.	Serious	0%	0	100%	2	0,6%	2	
Clarithromycin Tramadol Pharmacokinetics	Clarithromycin Tramadol Pharmacokinetics	Clarithromycin Tramadol Pharmacokinetics	Inhibition of CYP3A4-mediated metabolism of Tramadol	Serious	67%	2	33%	1	0,8%	3	
Chloramphenicol Iron III Pharmacokinetics	Chloramphenicol Iron III Pharmacokinetics	Chloramphenicol Iron III Pharmacokinetics	May result in decreased effectiveness of Iron	light	100%	3	0%	0	0,8%	3	
Gentamicin Furosemide Pharmacodynamics	Gentamicin Furosemide Pharmacodynamics	Gentamicin Furosemide Pharmacodynamics	Increased nephrotoxicity and ototoxicity	Serious	32%	10	68%	21	8%	31	
Gentamicin Digoxin Pharmacokinetics	Gentamicin Digoxin Pharmacokinetics	Gentamicin Digoxin Pharmacokinetics	Increased concentrations of Digoxin	light	0%	0	100%	2	0,6%	2	
Gentamicin Oxacillin Pharmacodynamics	Gentamicin Oxacillin Pharmacodynamics	Gentamicin Oxacillin Pharmacodynamics	Loss of aminoglycoside efficacy	light	60%	15	40%	10	6%	25	
Gentamicin Penicillin Pharmacodynamics	Gentamicin Penicillin Pharmacodynamics	Gentamicin Penicillin Pharmacodynamics	Loss of aminoglycoside efficacy	light	33%	1	67%	2	0,8%	3	
Imipenem Aminophylline Pharmacodynamics	Imipenem Aminophylline Pharmacodynamics	Imipenem Aminophylline Pharmacodynamics	May result in theophylline toxicity	Serious	0%	0	100%	1	0,2%	1	
Metronidazole Promethazine Pharmacodynamics	Metronidazole Promethazine Pharmacodynamics	Metronidazole Promethazine Pharmacodynamics	Risk of QT interval prolongation and arrhythmias.	Serious	40%	2	60%	3	1%	5	
Metronidazole Cimetidine Pharmacokinetics	Metronidazole Cimetidine Pharmacokinetics	Metronidazole Cimetidine Pharmacokinetics	Inhibition of CYP450 metabolism of MTZ by Cimetidine	Moderate	68%	70	32%	40	28%	110	
				Total		211		184		395	

Fonte: Autores, 2021

CC BY NC ND

© the Authors

The DI between metronidazole and cimetidine is classified as moderate and was represented by 28% (n=110) of the total DI, occurring with higher prevalence in patients aged 18 to 59 years.

Among the most predominant adverse effects that can be caused by interactions classified and identified as serious, are: Ciprofloxacin x Metronidazole with potential increase in the risk of QT interval prolongation and in 17% (n=36), with prevalence among adult patients; Ciprofloxacin x Tramadol which can potentially result in risk of CNS depression and respiratory depression 27% (n=56), with a prevalence of 57% (n=32) in adult patients; And the interaction between ciprofloxacin x insulin that can increase the risk of hypoglycemia or hyperglycemia, 16% (n=33), with a frequency of 61% (n=20) in elderly patients.

The 395 DIs found were related to the group of patients using polypharmacy. According to the statistical analysis, there was a positive correlation ($p < 0.0001$) between the number of prescribed drugs and the probability of MI occurring.

DISCUSSION

In the present study, a predominance of hospitalization of male patients was observed, 54% (n 416), corroborating the research by Murtaza10, where 55% of the patients were male and 45% female, with a mean age of 62 years. As well as the study by Mousavi & Ghanbari11 which showed a prevalence of 59% of male hospitalizations and a mean age of 61 years. Other studies carried out in Brazil also highlighted the prevalence of hospitalized men with frequencies above 55%, this factor can be justified due to social and cultural barriers, in which men only seek the health service when the condition becomes critical.[12,13,14] The cited studies present differences in relation to the age group and the diagnoses found, with a prevalence of elderly people, while this research shows a higher percentage of hospitalized adult population (54% n=409). The most frequent diagnoses presented in studies with the profile of adult and elderly patients are diseases of the cardiorespiratory and circulatory system, which differs from this research in which there was a prevalence of diagnoses related to infectious and parasitic diseases (20% n=156). The divergence between the results can be justified due to regional variations, socioeconomic profile of the population, climate and organization of health care networks, as observed in other studies.[10,12,13,15,16,17,18,19, 20.21]

At the institution under study, the choice of antimicrobial drug was based on the patient's clinical condition and on laboratory tests that indicated signs of infection, but not the specific identification of the microorganism. This means that the initiation of antibiotic treatment was empirical. However, it is advisable that the choice of antibiotic drug be based on microbiological effectiveness tests for the microorganisms found in the patient, in order to avoid the risk of bacterial resistance.[22] In the hospital unit under study, ceftriaxone was identified as the most prescribed antibiotic, which is in line with a study carried out in Ethiopia, where the prevalence of ceftriaxone prescriptions was 58%.[23] In another study carried out in three hospitals located in northeastern Tanzania, ceftriaxone and metronidazole were the most frequently prescribed antibiotics.[24] The prevalence of ceftriaxone use can be explained by the fact that it is a broad-spectrum drug used to treat a variety of infections, being the first choice in cases such as acute bacterial meningitis, community-acquired pneumonia, complicated intra-abdominal infections, pneumonia acquired hospital, pyelonephritis, among others.[25]

The frequency of severe DI in this study corresponded to 52%, similar to two studies carried out in the Asian continent.[26,27] In Brazil, a study by Alvim and collaborators[2] in a hospital in the state of Minas Gerais, found a frequency above 50% in DIs considered serious. Considering the negative results and the risk of death from DI, the presence of a clinical pharmacist in hospitals becomes an effective alternative in reducing risks and preventing serious adverse events, ensuring safe and effective treatment for hospitalized patients.[28]

Metronidazole and ciprofloxacin had the highest number of interactions with other drugs and are highlighted as drugs with the highest frequency of interactions. Sanchez-Lopez[29] observed the same prevalence of interactions related to the use of these two drugs and the class of fluoroquinolones in general, in a study carried out in Mexico. These drugs can cause QT interval prolongation and their simultaneous use increases the risk of this side effect, and therefore attention should be paid to this interaction.[30] Fluoroquinolones are antibiotics widely used in clinical practice due to their broad spectrum, and they are among the antibacterials most associated with QT interval prolongation.[31,32]

The average prescription of nine medications per patient can be considered high and is configured as polypharmacy, corroborating the research carried out in Italy in which patients were on therapy with an average of eight medications.[33] A retrospective study with hospital prescriptions showed results similar to those of this study, potential DIs were described in prescriptions with five or more drugs, suggesting an association between polypharmacy and the occurrence of DI.[34,35] Polypharmacy is one of the main problems in patient safety, as it increases the chances of adverse events due to medication errors and IM.[36]

CONCLUSION

The identification and analysis of DI with antimicrobials in this study revealed a significant number of interactions, with a predominance of severe interactions. These results underscore the importance of the pharmacist in the multidisciplinary team, as he is crucial in the prevention, detection and resolution of DI, in addition to playing a key role in guiding health professionals and patients. The presence of this professional in the hospital environment allows for a more comprehensive approach to drug therapy, including reviewing prescriptions, identifying potential interactions and suggesting appropriate adjustments in the therapeutic scheme, as well as strengthening actions aimed at pharmacovigilance.

Therefore, the presence of clinical drugs in the multidisciplinary

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)
© the Authors

hospital team is essential to ensure the effectiveness, safety and quality of drug therapy, especially with regard to the use of antimicrobials. Its collaborative and interdisciplinary work allows the promotion of integrated pharmaceutical care, directly benefiting the health and well-being of hospitalized patients.

CONFLICTS OF INTEREST: There are no conflicts of interest.

FINANCIAL SUPPORT AND SPONSORSHIP: Nil.

ACKNOWLEDGEMENTS: The authors would like to thank Propesp/UFPA.

References

1. Santos JS, Giordani F, Rosa MLG. Potential drug interactions in adults and older adults in primary care. Ciência & Saúde Coletiva. 2019;24(11):4335-44. https://doi.org/10.1590/1413-812320182411.04692018
2. Alvim MM, Silva LA, Leite ICG, Silvério MS. Adverse events due to potential drug interactions in the intensive care unit of a teaching hospital. Brazilian Journal of Intensive Therapy. 2015;27(4):353-9. https://doi.org/10.5935/0103-507x.20150060
3. Celdran LMM, Ferrando JG, Royo LM. Do we know all pharmacological interactions?: the OATP1B1 transporter. Community Pharmacists. 2018;10(4):29-32.
4. Neves C, Colet C. Profile of antimicrobial use and their drug interactions in an adult ICU in Rio Grande do Sul. Journal of Epidemiology and Infection Control.2015;5(2):65-71.
5. Cortes ALB, Silvino ZR, Santos FBM, Pereira JAC, Tavares GS. Prevalence of drug interactions involving high-alert drugs: cross-sectional study. Revista Mineira de Enfermagem. 2019;23:1226.
6. Brazil. Ministry of Health. Health and Foreign Policy: 20 years of the International Health Affairs Office (1998-2018). 1st ed. Brasília: Ministry of Health. 2018:364.
7. Piedade DV, Silva LAF, Lemos GS, Valasque JRGL, Lemos LB. Potential drug interactions in prescriptions containing restricted use antimicrobials for patients admitted to a hospital in the interior of Bahia. Medicine (Ribeirão Preto). 2015;48(3):295-307.
8. Brazil. Federal Council of Pharmacy. Resolution No. 585 of August 29, 2013. Regulates the clinical attributions of the pharmacist and makes other provisions. Official Gazette of the Union, Brasilia; 2013 th
9. Rodrigues AP, Dambrós BP, Santin NC, Frighetto M. Analysis of antibiotic prescriptions dispensed to children in a pharmacy in a municipality in Santa Catarina. Revista Interdisciplinar. 2017;10(4):69-76.
10. Murtaza G, Khan MY, Azhar S, Khan SA, Khan TM. (). Assessment of potential drug-drug interactions and its associated factors in the hospitalized cardiac patients. Saudi Pharmaceutical Journal. 2016;24(2):220-25.
11. Mousavi S, Ghanbari G. Potential drug-drug interactions among hospitalized patients in a developing country. Caspian Journal of Internal Medicine. 2017;8(4):282-8. https://doi.org/10.22088/cjim.8.4.282
12. Cedraz KN, Santos MC. Identification and characterization of drug interactions in medical prescriptions of the intensive care unit of a public hospital in the city of Feira de Santana, BA. Revista Sociedade Brasileira de Clínica Médica. 2014;12(2):1-7.
13. Nascimento MSM, Nunes EM, Medeiros RC, Souza WIM, Filho LFS, Alves ESRC. Epidemiological profile of patients in an adult intensive care unit of a regional hospital in Paraíba. Topics in Health. 2018;18(1):247-265.
14. Reis LCC, Gabarra LM, Moré CLOO. The repercussions of the hospitalization process in an adult ICU from the perspective of family members. Topics in Psychology. 2016;24(3):815-28.
15. Oak AMR. Analysis of the prescription of patients using an enteral tube in a university hospital in Ceará. Rev Bras Farm Hosp Serv Saúde. 2010;1(1):17-22.
16. Guia CM, Biondi RS, Sotero S, Lima AA, Almeida KJQ, Amorim FF. Epidemiological profile and predictors of mortality in a general intensive care unit of a public hospital in the Federal District. Journal of Communication in Health Sciences. 2015;26(1/2):9-19.
17. Perão O, Bub M, Zandonadi G, Martins M. Sociodemographic and epidemiological characteristics of patients admitted to an adult intensive care unit. UERJ Nursing Journal. 2017;25:7736.
18. Rodriguez AH, Bub MB, Perão OF, Zandonadi G, Rodriguez M de J. Epidemiological characteristics and causes of deaths in hospitalized patients under intensive care. Brazilian Journal of Nursing. 2016;69(2):229-34. https://doi.org/10.1590/0034-7167.2016690204i
19. Araújo LU, Santos DF, Bodevan EC, Cruz HL, Souza J, Silva-Barcellos NM. Patient safety in primary health care and polypharmacy: cross-sectional survey among patients with chronic diseases. Latin American Journal of Nursing. 2019;27:e3217. https://doi.org/10.1590/1518-8345.3123.3217
20. Ueno E, Koffke M, Voigt VR. Profile of hospitalized patients under enteral therapy. Braspen Journal. 2018;33(2):194-8.
21. Leal LF, Cousin E, Bidinotto AB, Sganzerla D, Borges RB, Malta DC, et al. Epidemiology and burden of chronic respiratory diseases in Brazil from 1990 to 2017: analysis for the Global Burden of Disease 2017 Study. Brazilian Journal of Epidemiology. 2020;23(1):e200031. https://doi.org/10.1590/1980-549720200031
22. Vieira PN, Vieira SLV. Irrational use and antimicrobial resistance in hospitals. UNIPAR Health Science Archives. 2017;21(3):209-213.
23. Muhammed OS, Nasir BB. Drug Use Evaluation of Ceftriaxone in Ras-Desta Memorial General Hospital, Ethiopia. Drug, Healthcare and Patient Safety. 2020;12:161-8. https://doi.org/10.2147/dhps.s260364

© the Authors