RBFHSS
Revista Brasileira de Farmácia Hospitalar e Serviços de Saúde

Original Paper

Open Access

Analysis and spatial mapping of antimicrobial prescription completeness and legibility in a public community pharmacy

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Submitted: 21-08-2024 Resubmitted: 16-09-2024 Accepted: 01-10-2024

Double blind peer review

Abstract

Objective The phenomenon of resistance of antimicrobials is associated with inappropriately use. The analysis of antimicrobial prescriptions, evaluating their legibility and completeness, is interesting because it aims to identify possible errors that may compromise the proper use. This study aims to evaluate the completeness and legibility of antimicrobial prescriptions in a municipality in southeastern Brazil. **Methods** The antimicrobial prescriptions retained at the Community Pharmacy in the municipality of Alegre, from March 2018 to February 2019, underwent a simple random sampling process to obtain the sample for analysis. In addition, data on the origin of the prescription were georeferenced, generating a map correlating the evaluation of the legibility of the prescriptions with the health units of the municipality. This study approved by the Research Ethics Committee of the Administrative Coordination of Southern Espírito Santo (CASES) with the CAAE number: 13586319.6.0000.8151. **Results** The sample comprised 359 prescriptions containing 373 antimicrobials. The majority of prescriptions (97.2%) contained complete data from the prescribing professional, and 70.2% presented the patient's identification without abbreviations, although 44% showed legibility problems in this parameter. In 35.4% of the prescriptions, there were legibility problems and no data in the joint evaluation of the prescribed antimicrobial, concentration, quantity, pharmaceutical form, dose, frequency, and duration of treatment. In the evaluation of the posology (dose and frequency) and duration of treatment, complete data were found in 82.3% and 71.8%, respectively. Most of the antimicrobials prescribed, 95.4% and 93% respectively, were listed in the National List of Essential Medicines (Rename) and were in the Brazilian Common Denomination (DCB) format. The most prescribed antimicrobial was Cephalexin 500mg. **Conclusion** The study indicated the presence of antimicrobial prescriptions that do not comply with legislation and may compromise patient safety. These findings highlight the need for targeted interventions to improve prescription legibility and adherence to the regulatory standards in public health settings.

Keywords: Public pharmacy, prescription, antimicrobial, completeness, legibility

Análise e mapeamento espacial da completude e legibilidade das prescrições de antimicrobianos em uma farmácia comunitária pública

Resumo

Objetivo O fenômeno da resistência dos antimicrobianos está associado ao uso inadequado. A análise de prescrições de antimicrobianos, avaliando sua legibilidade e completude, é interessante porque visa identificar possíveis erros que podem comprometer o uso adequado. Este estudo tem como objetivo avaliar a completude e legibilidade das prescrições de antimicrobianos em um município do sudeste do Brasil. **Métodos:** As prescrições de antimicrobianos retidas na Farmácia Comunitária do município de Alegre, no período de março de 2018 a fevereiro de 2019, passaram por um processo de amostragem aleatória simples para obtenção da amostra para análise. Além disso, os dados sobre a origem da prescrição foram georreferenciados, gerando um mapa correlacionando a avaliação da completude e legibilidade das prescrições com as unidades de saúde do município. Este estudo foi aprovado pelo Comitê de Ética em Pesquisa da Coordenação Administrativa do Sul do Espírito Santo (CASES) com o número do CAAE: 13586319.6.0000.8151. **Resultados:** A amostra foi composta por 359 prescrições contendo 373 antimicrobianos. A maioria das prescrições (97,2%) continha dados completos do profissional prescritor, e 70,2% apresentavam a identificação do paciente sem abreviações, embora 44% apresentassem problemas de legibilidade neste parâmetro. Em 35,4% das prescrições, houve problemas de legibilidade e ausência de dados na avaliação conjunta do antimicrobiano prescrito, concentração, quantidade, forma farmacêutica, dose, frequência e duração do tratamento. Na avaliação da posologia (dose e frequência) e duração do tratamento, foram encontrados dados completos em 82,3% e 71,8%, respectivamente. A maioria dos antimicrobianos prescritos, 95,4% e 93% respectivamente, estava listada na Relação Nacional de Medicamentos Essenciais (Rename) e estava no formato da Denominação Comum Brasileira (DCB). O antimicrobiano mais prescrito foi a Cefalexina 500mg. **Conclusão:** O estudo indicou a presença de prescrições de antimicrobianos que não atendem à legislação e podem comprometer a segurança do paciente. Essas descobertas destacam a necessidade de intervenções direcionadas para melhorar a legibilidade das prescrições e a adesão aos padrões regulatórios em ambientes de saúde pública.

Palavras-chave: Serviços Comunitários de Farmácia, prescrição, antimicrobiano, integralidade, legibilidade

Introduction

Medicines are an important therapeutic option to be used from the prevention of diseases to the complete recovery of health[1], and their rational use is decisive to ensure the the provision of care to patients[2].

Medication errors (ME) are defined as any avoidable event that causes the inappropriate use of medicines or harm to the patient[3]. These events can be related to any stage of the medication use process, such as prescribing, transcribing, dispensing, administering, or monitoring the effect[4]. The topic gained prominence in 1999, when an important report by the Institute of Medicine of the United States of America was published in the book "To err is human", indicating the main components of the North American health system capable of leading to adverse events, some of which are frequent and potentially fatal[2].

The issuance of a prescription is the starting point in the process of medicine use, and errors at this stage are potential sources of their irrational use, which can lead to ineffective treatment, patient suffering, and an increase in the duration and cost of the treatment[5]. A study conducted by Lopes et al. (2021)[6] indicated that the majority of medication errors were prescription-related. It should be noted, however, that the errors related to this stage are considered avoidable medication errors and are an important target for improvement in health[7]. Thus, strategies have been implemented in order to identify, resolve, and prevent prescription errors.

Worldwide, the WHO has developed prescription indicators to describe and evaluate aspects that affect pharmaceutical practice in large and small health centers (WHO, 1993). In Brazil, the Brazilian government has implemented legal strategies to help reduce prescription errors, such as the Collegiate Board Resolution (RDC) No. 20/2011[8] which regulates the prescription of antimicrobial medicines. This class can cause significant harm to the patients' health when associated with prescribing errors, such as bacterial resistance[8].

In Brazil, within the scope of primary care, antimicrobial prescribing gains prominence since it represents a class of medicines that generates a considerable number of prescriptions, also standing out due to the large volume of non-compliant and often abusive prescriptions[9]. Its inappropriate use in primary care and at the hospital level has been shown to be an important factor in the spread of antimicrobial resistance[10,11].

The United States Centers for Disease Control and Prevention (CDC-US) estimates that more than 20,000 deaths annually in the United States are due to infections caused by bacteria resistant to antimicrobials[12]. In Brazil, antimicrobial resistance has also had a major impact on public health, with the Brazilian Ministry of Health estimating that the global infection rate is 14%, and of these, 9% result in death[12].

By analyzing the completeness, legibility, and presence of legal requirements in prescriptions, it is possible to identify the main errors that can compromise the safety and effectiveness of the treatment[14]. Thus, this study aimed to evaluate the completeness and legibility of antimicrobial prescription in a municipality located in the southeast of Brazil, in the south of the state of Espírito Santo (ES), justified as the first study conducted on the analysis of antimicrobial prescriptions in the municipality of Alegre/ES, contributing to data collection on this subject at local, state, and national levels.

Methods

Study design

A cross-sectional, quantitative, and retrospective study was conducted to analyze the completeness and legibility of antimicrobial prescriptions in a municipal community pharmacy from March 2018 to February 2019.

Study location

The study was carried out in the municipal community pharmacy of Alegre, in the south of the state of Espírito Santo, southeastern Brazil.

The public health network of the municipality of Alegre holds ten Family Health Strategies (ESF), by which the Brazilian health system offers Primary Health Care, corresponding to the first contact with health services, involving prevention, promotion, and rehabilitation actions using interdisciplinary health actions aimed at the population. In addition to the ESFs, the municipality holds an Emergency Care unit, a hospital unit (Casa de Caridade São José), and a Medical Center for medical specialties.

The medicines prescribed at all these health units are dispensed at the municipal community pharmacy, located in the center of the city. The community pharmacy is involved in the pharmaceutical assistance actions of the municipality and is responsible for supplying the entire demand of the municipal public health network.

Sample

The sample consisted of antimicrobial prescriptions retained during patient care at the municipal community pharmacy, from March 2018 to February 2019, it corresponds to the period during which this study and others were conducted to investigate the feasibility of implementing pharmaceutical services in community pharmacies. One copy of the prescription containing antimicrobials is retained for regulatory purposes required by the National Health Surveillance Agency (Anvisa) for subsequent archiving for a period of two years, and to comply with possible sanitary inspections.

All the prescriptions were enumerated totaling 5415, and the study sample (*n*) was defined using simple random sampling, using a 95% confidence level and a 5% margin of error, totaling 359 prescriptions considered representative.

Methodological approach

Construction of the data collection form

A data collection form was prepared using a Microsoft Office Excel spreadsheet, covering the main parameters required by current legislation for prescribing antimicrobials[13].

Staff training

The training focused on prescription errors and current legislation[13], aiming to align the evaluators' knowledge. The trainings aimed to standardize the conduct of evaluators during data collection. The training concluded with the approval of the final data collection spreadsheet, following testing.

Data collection

The completeness and legibility of the prescriptions were evaluated by 10 evaluators divided into pairs, and the analysis was carried out individually. If there was a discrepancy between the evaluation of each pair, a third external evaluator and pharmacist provided their opinion, ending the evaluation of that prescription.

Variables

To assess completeness (compliance of the prescription with current Brazilian legislation)[13], the following parameters were evaluated: identification of the prescriber, date of prescription, identification of the patient, antimicrobial prescribed, concentration, quantity prescribed, pharmaceutical form, dose, frequency, and duration of treatment. For the parameter related to the identification of the prescriber, the classification by Rosa et al., was used, evaluated as complete, incomplete, and absent[14].

To evaluate legibility (ability to read and understand the writing without problems)[14], the criteria proposed by Rosa et al. were also used, with adaptations, in addition to evaluating the presence of acronyms and/or abbreviations and of amendments and/or erasures in the parameters: identification of the patient, prescribed antimicrobial, concentration, pharmaceutical form, dose, frequency, and duration of treatment[14].

Besides the legibility and completeness, the prescriptions were also evaluated regarding the origin of the prescription and the use of the DCB for the identification of antimicrobials. A survey of the frequency of antimicrobial prescriptions according to pharmaceutical forms was also carried out, evaluating whether they were listed in the Rename. Additionally, the classification was made according to the Anatomical Therapeutic Chemical (ATC).

In prescriptions containing more than one antimicrobial, the parameters of prescriber identification, date, legibility of date, erasure/amendment of date, patient identification, legibility of patient identification, erasure/amendment of patient identification were mandatorily evaluated in the same way for the different antimicrobials, since they are common parameters in a prescription regardless of the number of medicines prescribed. In the other parameters, the evaluations were able to differentiate among the antimicrobials found in the same prescription.

The possible classifications for each parameter evaluated are described in Table 1.

Geoprocessing

For the prescription origin parameter, a code was assigned to each prescriber, safeguarding their anonymity. During the period of interest in this study, there was no significant turnover of professionals in the public health units. Thus, it was possible to identify these health units based on the identification of the prescriber.

The data generated by this parameter were georeferenced, generating a thematic map of the health units in the municipality

Table 1. Spreadsheet for data collection in 2019, with parameters analyzed and possible classifications.

Parameter Evaluated	NUMBER	ORIGIN	ID PRESC	DATE PRESC	LEG DATE	ERA AM (DATE)	PAT	LEG PAT	ERA AM (PAT)	ACR ABB (PAT)
Classification	Prescription number drawn	Health unit	Complete Incomplete Absent	Yes No	Good legibility Barely legible or doubtful Illegible Not evaluated due to lack of data	Yes No Unidentified	Yes No	Good legibility Barely legible or doubtful Illegible Not evaluated due to lack of data	Yes No Unidentified	Yes No Unidentified

Parameter Evaluated	LEG MED	ERA AM (MED)	ACR ABB (MED)	RENAME	DCB	CONC	LEG CONC	ERA AM (CONC)	ACR ABB (CONC)	QTT
Classification	Good legibility Barely legible or doubtful Illegible Not evaluated due to lack of data	Yes No Unidentified	Yes No Unidentified	Yes No Unidentified	Yes No Unidentified	Complete Incomplete Absent Unidentified	Good legibility Barely legible or doubtful Illegible Not evaluated due to lack of data	Yes No Unidentified	Yes No Unidentified	Complete Incomplete Absent Unidentified

ID PRESC: Identification of the prescriber; DATE PRESC: Date of prescription; LEG DATE: Legibility of the date; ERA AM: Erasure/amendment; PAT: Patient; LEG PAT: Legibility of the patient; ERA AM(PAT): Erasure/amendment of patient; ACR ABB(PAT): Acronym/abbreviation of patient; LEG MED: Legibility of the medication; ERA AM (MED): Erasure/amendment in medication; ACR ABB (MED): Acronym/abbreviation on medication; RENAME: National List of Essential Medicines; DCB: Brazilian Common Denomination; CONC: Concentration; LEG CONC: Legibility of the concentration; ERA AM (CONC): Erasure/amendment in concentration; ACR ABB (CONC): Acronym/abbreviation in concentration; QTT: Quantity

of Alegre/ES, correlating the prescriber and the health unit to which they belonged at the time the prescription was issued. This made it possible to correlate the health units with the legibility of the antimicrobials prescribed by them, in terms of the name of the medicine, concentration, quantity, pharmaceutical form, dose, frequency, and duration of treatment. Legibility was selected as a parameter for easy tracking and with the potential for targeted interventions directed at antimicrobial prescribers. The prescriptions found of private origin, from public health units not belonging to the municipality, and those in which the origin was not identified due to lack of identification of the prescriber were not georeferenced, since they were not part of the scope of this study.

The health units referenced are the ESFs, the Casa de Caridade São José (hospital unit), the Medical Center, and the Emergency Care unit. Due to the high turnover of prescribers in the Emergency Care unit, the data from the unit were presented in a grouped manner with the Medical Center. Thus, the origin of the prescriptions was classified into 12 locations, namely: 1. ESF Anutiba; 2. ESF Araraí; 3. ESF Celina; 4. ESF Guararema; 5. ESF Misael Barcelos; 6. ESF Pedro Martins; 7. ESF Rive; 8. ESF Vila Alta; 9. ESF Vila do Café; 10. ESF Vila do Sul; 11. Casa de Caridade São José; 12. Medical Center and Emergency Care unit.

Five ESF units are located in district regions, outside the municipality's headquarters; they are: ESF Anutiba, ESF Araraí, ESF Celina, ESF Rive, and ESFVila do Café. The other ESFs (ESF Guararema, ESF Misael Barcelos, ESF Pedro Martins, ESF Vila Alta, and ESF Vila do Sul), as well as the other health units, are located in the municipality's headquarters.

For geoprocessing, the Geographic Information System (GIS) was used, which allows capturing, storing, manipulating, and analyzing geographically referenced data. The GIS platform used to generate the map with the location of the municipality's health units was ArcGIS®.

Data analysis

The data obtained from each pair of evaluators were unified in a Microsoft Office Excel® spreadsheet and submitted to descriptive statistics to define the means and frequencies of prescription errors.

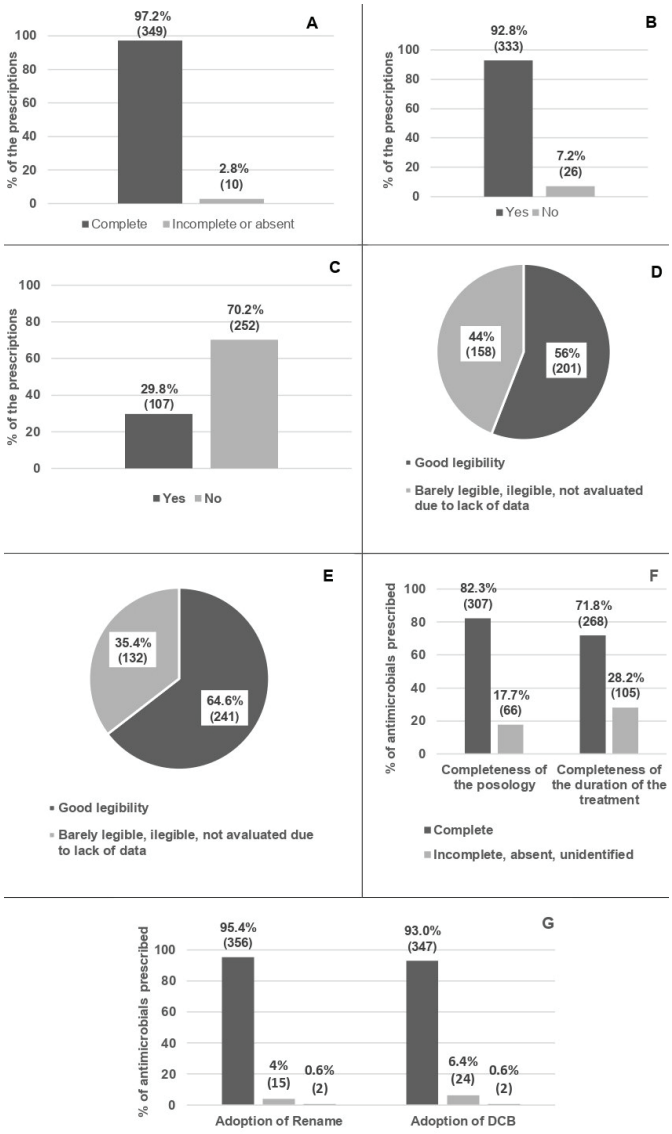
Ethical aspects

The analysis of the prescriptions represented the situational diagnosis in which their completeness and legibility were evaluated and is part of the research project entitled "*Implementação e integração de serviços clínicos farmacêuticos em sistemas de saúde*" [Implementation and integration of pharmaceutical clinical services in health systems], approved by the Research Ethics Committee of the Administrative Coordination of Southern Espírito Santo (CASES) - Federal University of Espírito Santo (UFES) on July 1, 2019 with the CAAE number: 13586319.6.0000.8151.

Results

The process of enumerating the prescriptions containing antimicrobials resulted in 5,415 prescriptions. After drawing the sample, a total of 359 prescriptions were analyzed, with 373 antimicrobials prescribed, indicating the occurrence of prescriptions containing more than one antimicrobial. The results of the analysis of the parameters evaluated in the prescriptions are shown in Figure 1.

Figure 1. Analysis of the parameters evaluated in the prescriptions from in 2019.



DCB = Brazilian Common Denomination
A. Evaluation of the presence of prescriber data; B. Percentage of prescriptions with the date of prescription; C. Presence of acronyms/abbreviations in the identification of the patient; D. Legibility of prescriptions in patient identification; E. Joint evaluation of legibility in the name of the medication, concentration, quantity, pharmaceutical form, dose, frequency, and duration of treatment; F. Evaluation of the completeness of the posology (dose and frequency) and the duration of treatment; G. Evaluation of the adoption of Rename and DCB.

The results found in the evaluation of the completeness of the prescriber's identification and the presence of the date on the prescription (1A and 1B) indicate that the vast majority of prescriptions correctly presented the data of the issuer of the prescription, as well as the date on which it was issued. Regarding the presence of acronyms/abbreviations in the identification of the patient (1C), the results showed that although most of the

prescriptions (70.2%) presented the complete identification of the patient, it was identified that in 29.8% of the prescriptions analyzed, the patient's name held some kind of acronym/abbreviation. Still in the identification of the patient (1D), the written evaluation indicated that almost half of the prescriptions (44%) presented problems in the legibility of this parameter.

In the joint evaluation of the parameters (1E), related to the antimicrobial prescribed, concentration, quantity, pharmaceutical form, dose, frequency, and duration of treatment, 35.4% of the prescriptions evaluated presented problems ranging from poor legibility to complete absence of data. In Figure 1F, the evaluation of the completeness of the data prescribed in the posology (dose and frequency) and duration of treatment showed that 82.3% and 71.8% of the prescriptions, respectively, presented complete data, indicating a higher percentage of incomplete or even absent data (28.2%) in the duration of treatment with the antimicrobial. Regarding the evaluation of whether the antimicrobials prescribed were included in the Rename and in the DCB form (1G), the results indicated that, respectively, 95.4% and 93% of the prescriptions analyzed included antimicrobials listed in the Rename and prescribed in the DCB format.

Table 2 shows the absolute and relative frequencies of the prescribed antimicrobials found in the data collection. Their respective ATC codes and whether the antimicrobial is listed in Rename are also indicated.

Geoprocessing

Table 3 shows the number of prescriptions found and antimicrobials prescribed in each public health unit in the municipality of Alegre/ES, in addition to those found of private origin, from public health units not belonging to the municipality, and those in which the origin was not identified due to lack of identification of the prescriber.

Figure 2 shows the location of these units, using geoprocessing, and the number of antimicrobials prescribed that showed good joint legibility, in the name of the medicine, concentration, quantity, pharmaceutical form, dose, frequency, and duration of treatment.

Table 2. Antimicrobials prescribed in the study in Alegre/ES in 2019, by pharmaceutical form, frequencies, and presence in Rename 2018.

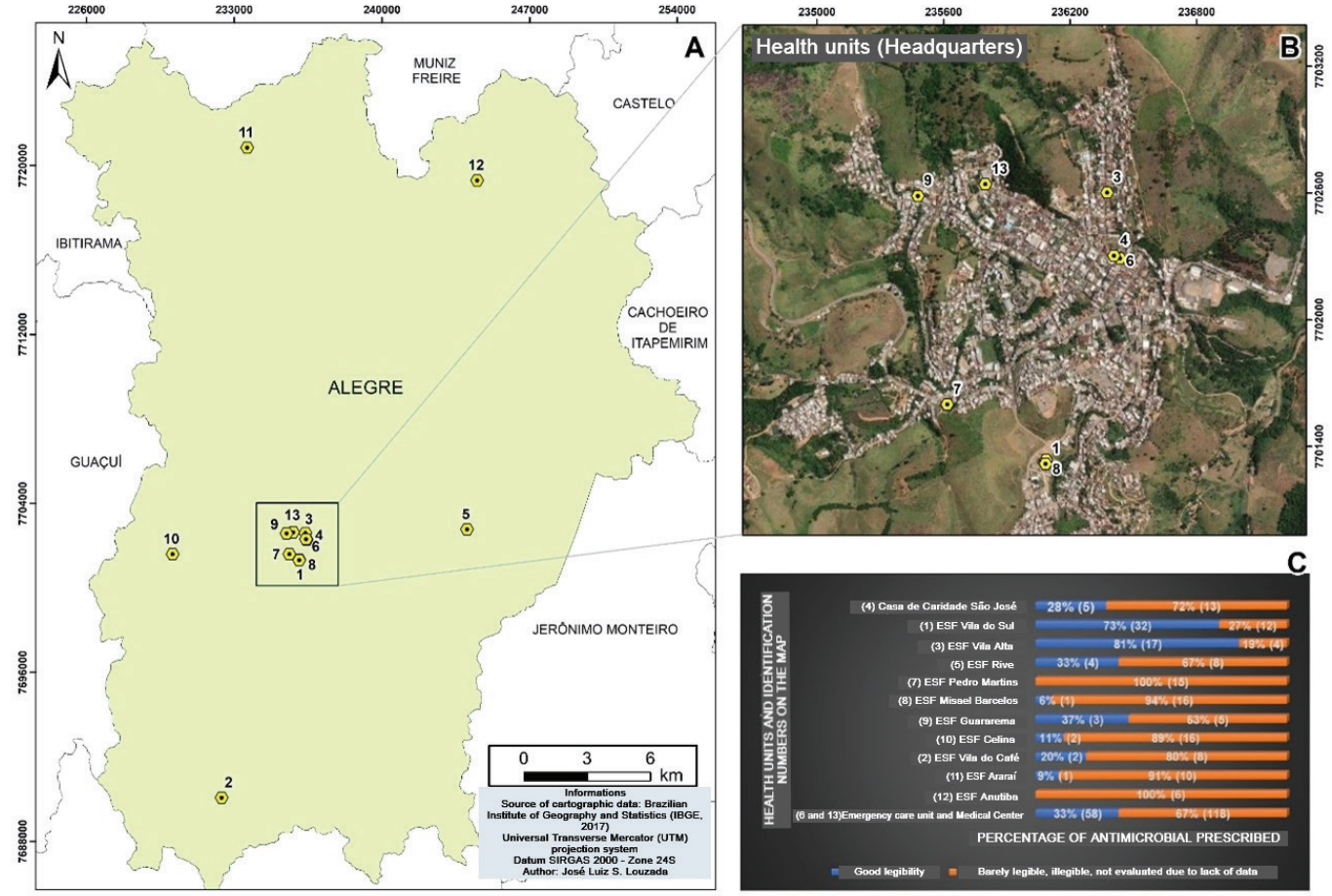
Antimicrobial	ATC Code	Frequency		Rename 2018
		Absolute (n)	Relative (%)	
Cephalexin 500mg tablet	J01DB01	85	22.8	Yes
Amoxicillin 500mg capsule	J01CA04	53	14.2	Yes
Ciprofloxacin 500mg tablet	J01MA02	51	13.7	Yes
Azithromycin 500mg tablet	J01FA10	44	11.8	Yes
Amoxicillin 250mg/5mL oral suspension	J01CA04	41	11.0	Yes
Metronidazole 250mg tablet	J01XD01	26	7.0	Yes
Cephalexin 250mg/5mL oral suspension	J01DB01	17	4.5	Yes
Azithromycin 40mg/mL oral suspension	J01FA10	15	4.0	Yes
Levofloxacin 500mg tablet	J01MA12	15	4.0	No
Amoxicillin+Clavulanate 500mg+125mg tablet	J01CR02	13	3.5	Yes
Metronidazole 100mg/g jelly tube	G01AF01	9	2.4	Yes
Silver Sulfadiazine 1% cream	D06BA01	1	0.3	Yes
Sulfamethoxazole+trimethoprim 400mg+80mg tablet	J01EE01	1	0.3	Yes
Unidentified	-	2	0.5	-

Table 3. Number of prescriptions and antimicrobials prescribed in public health units in Alegre/ES in 2019.

Health Unit Origin	No. of prescriptions	%	No. of antimicrobials prescribed	%
ESF Anutiba	6	1.7	6	1.6
ESF Araraí	9	2.5	11	2.9
ESF Celina	15	4.2	18	4.8
ESF Guararema	8	2.2	8	2.2
ESF Misael Barcelos	13	3.6	17	4.6
ESF Pedro Martins	14	3.9	15	4.0
ESF Rive	11	3.1	12	3.2
ESF Vila Alta	21	5.9	21	5.6
ESF Vila do Café	10	2.8	10	2.7
ESF Vila do Sul	42	11.7	44	1.8
Casa de Caridade São José	18	5.0	18	4.8
Medical Center and Emergency Care unit	175	48.7	176	47.2
Private	2	0.6	2	0.5
Unified Health System (SUS) External	7	1.9	7	1.9
Unidentified origin	8	2.2	8	2.2
TOTAL	**359**	**100**	**373**	**100**

Legend – ESF: Family Health Strategy

Figure 2. Public health units in Alegre/ES and the legibility of prescribed antimicrobials in 2019.



A- Geographic location of the public health Units in the municipality of Alegre/ES.
B- Geographic location of the public health Units at the headquarters of the municipality of Alegre/ES.
C - Public health Units in Alegre/ES, absolute values, and percentages of antimicrobials prescribed with good legibility in the parameters: medication name, concentration, quantity, pharmaceutical form, dose, frequency, and duration of treatment.

Discussion

The Brazilian legislation that specifically deals with the prescription of antimicrobials and used as a reference is the text of the RDC No. 20 of May 5, 2011, revoked by RDC No. 471 of February 23, 2021. There were no changes to the requirements for the parameters evaluated in this study, and they are covered at national level for all private pharmacies and drugstores, as well as public dispensing units at municipal (location of this study), state, and federal level. RDC No. 471/2021, in its article 6, indicates mandatory data related to the identification of the patient and the prescriber, name of the medicine in the DCB form, dose or concentration, pharmaceutical form, posology, quantity, and date of prescription, in addition to vetoing erasures and valuing the legibility of the data[15].

The evaluation of the parameters related to the completeness of the prescriber's data showed results very close to those found in the study carried out in the municipality of Santo Ângelo, state of Rio Grande do Sul, Brazil, indicating that 90.22% of the prescriptions *(n*=511*)* presented the prescriber's data filled in correctly[16]. A lower result was found in a study conducted in Asmara, capital of Eritrea, South Africa, in which 75.3% and 81.8% of the prescriptions *(n=385)*, respectively, included the prescriber's name and signature[4].

In the broad context of medicine prescriptions, indicating the date of issue ensures the validity of the document, which, according to RDC No. 471/2021[15], is 10 days, and the pharmacist is prohibited from accepting prescriptions after the expiration date. The results are close to those found in a study conducted in the municipality of Teresina, in the state of Piauí, Brazil, where in 98.3% of the prescriptions (*n=2,195*) the date of antimicrobial prescription was informed[17].

Complete and legible identification of the patient is one of several mandatory and indispensable elements in a prescription, as stipulated in RDC No. 471/2021[15]. A study carried out in the city of Niquelândia, in the state of Goiás, showed, in two different months (June and July 2015), that the patient's name was written in full in 93.33% (*n=120*) and 94.78% (*n=115*) of the prescriptions[18] a result higher than that found in this study. A lower result was found when evaluating the legibility of the patient's name in a study carried out in the municipality of Juazeiro do Norte, state of Ceará, which identified good legibility in 24% of the prescriptions analyzed (*n=150*)[19].

The specific evaluation of legibility in prescriptions containing medicines is of great relevance because it is in the public interest, since problems related to poor legibility or prescriptions that are totally illegible can lead to problems of intoxication, acquisition, and ingestion of the wrong[20]. The joint result of the analysis of legibility of the medicine name, concentration, quantity, pharmaceutical form, dose, frequency, and duration of treatment in this study indicates legibility problems, classified as poorly legible, illegible, or not evaluated due to the absence of some data. The study carried out in Asmara, Eritrea, showed an even lower result in terms of legibility, when it indicated that only 2.1% of the prescriptions (*n=385*) were completely legible[4]. This result differs from the study carried out in the municipality of Ipatinga, state of Minas Gerais, Brazil, which indicated legibility in 56% of the prescriptions analyzed (*n=150*)[21].

The analysis of the results regarding the completeness of the posology (dose and frequency) and duration of treatment showed a lack of total or partial information on both parameters evaluated. Notably, the duration of treatment was the most neglected parameter, which can cause interruptions in treatment earlier than desired or misuse over the prescribed time. Similar results were evidenced in a study carried out in community pharmacies in the city of Milhã, in the state of Ceará, identifying the presence of the posology in 82.21% of the prescriptions analyzed (*n=253*)[22]. On the other hand, a study carried out in the city of Ribeirão Preto, state of São Paulo, showed superior results when it was found that 92.6% of the prescriptions (*n=112*) included the duration of treatment[23].

The purpose of the Rename is to list the medicines considered essential at a national level, also serving as a guiding instrument for the municipality to elaborate and organize its own list of essential medicines, called the Municipal List of Essential Medicines (Remume), always considering the incidence and prevalence of diseases, in addition to the organization of health services at a municipal[24]. The result of this study was higher than that found in Bahawalpur, Pakistan, which indicated that 54.4% of the prescribed drugs (*n=1345*) were on the list of essential[25] while studies carried out in the cities of Asmara, Eritrea, and Belo Horizonte, state of Minas Gerais, Brazil, showed results close to those of this study, indicating that, respectively, 98.39% (*n=1055*) and 91.4% (*n=1383*) were on the list of essential[10,26]

With regard to the adoption of the DCB or use of the generic name, Law No. 9787 of February 10, 1999 requires, within the scope of the Brazilian health system, its use in the acquisition of medicines in any type of purchase, and when prescribing them[27], with antimicrobials being specifically regulated by RDC No. 471/2021[15] which, in its article 6, also makes it compulsory. The use of the generic name becomes important because it reduces the influence of the pharmaceutical industry's marketing on prescribers[28], allows pharmacies to replace brands that are out of stock with generic therapeutic equivalents that are cheaper[10], in addition to avoiding errors in dispensing, since the use of the trade name can increase the risk of switching medicines[26].

In a study carried out in the municipality of Angicos, in the central region of the state of Rio Grande do Norte, Brazil, a lower result was observed, in which 18.02% (*n=3,275)* of the prescriptions contained the medicines prescribed with the nomenclature represented by the DCB[29]. A lower result was also demonstrated in a study conducted in a community pharmacy in the southeast of the state of Bahia, Brazil, indicating that 45.2% (*n=755*) of the prescribed medicines were in the DCB[30]. A superior result was found in a study conducted in the municipality of Muriaé, state of Minas Gerais, Brazil, which found that 97.2% of the medicines prescribed (*n=147*) were in the DCB format[31].

The most prescribed antimicrobial in this study was Cephalexin 500mg tablet, a result different from that found in the study conducted in the city of Teresina, state of Piauí, which identified Metronizadole 250mg (28%; *n=2232*) among the 13 antimicrobials described in the prescriptions evaluated[17]. In another study conducted in the municipality of Muriaé, state of Minas Gerais, Amoxicillin was the most prescribed antimicrobial (57.8%; *n=172*)[31]. Regarding the evaluation of prescribed antimicrobials and their presence in Rename, the only prescribed antimicrobial that is not listed in the official national list, although standardized in Remume, is Levofloxacin, which is the ninth most prescribed.

Geoprocessing

Geoprocessing is a valuable tool in tracking events such as antibiotic prescription errors, enabling the development of specific and targeted actions and policies that promote health in communities according to their real needs[31].

The results showed a discrepant profile among the health units in terms of the quantity of antimicrobials prescribed. The five health units in the districts and the seven units in the headquarters presented, respectively, 16.0% (n=57) and 84.0% (n=299) of the total number of antimicrobials prescribed. The lower number observed in the units of the districts can be explained by the smaller number of users and the physical structure related to a lower service capacity.

In the evaluation of legibility, it was identified that, in total, 64.9% (n=231) of the antimicrobials prescribed were evaluated as poorly legible, illegible, or not evaluated due to lack of data. In the districts, 84.2% (n=48) of the antimicrobials were prescribed in a poorly legible, illegible, or were not evaluated due to lack of data, whereas 61.2% (n=183) received the same evaluation in the prescriptions of the health units located at the municipality's headquarters. Finally, analyzing all the units, 10 of the 12 health units obtained a percentage higher than 62.5% of prescribed antimicrobials classified as poorly legible, illegible, or not evaluated due to lack of data.

The results show the existence of legibility problems in the antimicrobials prescribed, especially in the districts, but also highlight this problem in all public health units in the municipality, regardless of their location and quantity prescribed. There are systemic or organizational factors that may contribute to poor prescription quality, such as healthcare professional training, workload, or infrastructure limitations in this area. It should be noted that in one unit of the headquarters, ESF Pedro Martins, and in the unit located in the district of Anutiba, there was no evidence of antimicrobials prescribed with good joint legibility in the parameters evaluated.

It is noteworthy the presentation of legibility data by the spatialization of the municipality's health units. Based on the premise that financial resources are finite, it is up to public management to make choices to ensure the principle of equity and thus better direct its actions for the benefit of the population[31]. Public health interventions could remedy these issues[17]. An important contribution to reducing the problem related to the legibility of prescriptions must be related to a prescription qualification program, which can be favored by a georeferenced diagnosis, thus being a fundamental tool for defining priorities. By

favoring the knowledge of the realities of different micro-areas, there is effective planning and management of the health services offered to the population[31].

Legibility problems, as already discussed, generate communication problems among the prescriber and other professionals at any level of health care. From the researcher's observation, the issuance of prescriptions with legibility problems in the ESFs in the city of Alegre/ES, especially in those located farther from the city center, made it more difficult for the patient to access pharmacotherapy, since the municipal basic pharmacy is located in the central area of the city.

The strengths of the study are related to the novelty of the data collection in the municipality of Alegre/ES, Brazil, mainly because it adds to other studies on primary health care in Brazilian municipalities, and because it generates an important return of academic activities from public higher education institutions to municipal public management. It is worth mentioning that the stratification of the items evaluated resulted in a more accurate picture of each parameter that legally composes the prescription of antimicrobials.

The weaknesses of this study are related to the subjectivity inherent in evaluating the legibility of the prescriptions, since it is directly related to the personal observation of each evaluator, although this was minimized with the analysis by a third evaluator in cases of divergence between the pairs. Information related to the prescriber's decision-making was not evaluated, only the wording of the prescriptions, since there was no access to the patients' medical records, contact with prescribers, or evaluation of clinical protocols and therapeutic guidelines for the use of medications in the various situations. Another limitation is that the possible causes of the errors identified were not surveyed. The causes associated with the prescribers' work overload, lack of knowledge of the current legislation, and working conditions require further targeted qualitative studies. Finally, the consequences of the errors identified for patients and their respective treatments were also not addressed.

Conclusion

This study showed that the prescriptions evaluated in the municipality of Alegre/ES indicated problems ranging from non-compliance with current legislation to those related to risks to patient safety. The lack of complete data on posology, duration of treatment, and legibility problems, combined with the identification of the patient with the presence of acronyms/abbreviations, indicate a need to study their possible causes so that specific interventions can be carried out by the municipal public administration. In addition, healthcare professionals could benefit from policies that provide guidance and direction for appropriate prescribing, such as the implementation of electronic prescribing systems and stricter local guidelines on prescription formatting. It should also be emphasized that although most prescriptions meet the legal requirements in terms of identifying the prescriber, the presence of the prescription date, and the use of the DCB, the problems described above lead to possible problems in the dispensing of these medicines.

Funding

The authors declare no financial support for the development of this research.

Author's contribution

All authors contributed substantially to the completion of this work. FB was responsible for executing and writing the work. AMS and CHRO also assisted with writing. FBO and GASJ were responsible for designing and reviewing the manuscript. SHS performed the data analysis. LCR took care of the review for final formatting. All authors participated in the reading and final review.

Acknowledgements

This research was conducted as part of the professional master's program in Public Management at the Federal University of Espírito Santo. The authors extend their gratitude to the Municipal Government of Alegre for enabling researchers to access the archives of retained prescriptions for antimicrobials. Special thanks are also extended to the members of the Research Group on Implementation and Integration of Pharmaceutical Care in the Unified Health System (SUS) for their valuable assistance in data collection.

Conflict of interests

The authors declare that there are no conflicts of interest regarding this article

Ethics approval and consent to participate

This study was approved by Comitê de Ética em Pesquisa da Coordenação Administrativa do Sul do Espírito Santo – CASES - UFES (Universidade Federal do Espírito Santo) em 01 de julho de 2019 com o número CAAE: 13586319.6.0000.8151.

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