JHPHS
Journal of Hospital Pharmacy and Health Services

Original Paper

Open Access

Pharmacy practice in a veterinary hospital: development and application of a tool for inspection of medication labeling and packaging

Lorena Mendes SOARES[1], Alaine Lopes CATÃO[2], Angela Ferreira LOPES[3]

[1]Federal University of Goiás, Goiânia, Brazil; [2]Faculty of Sciences, San Sebastián University, Valdivia, Chile;
[3]Research Laboratory in Teaching and Health Services, Faculty of Pharmacy, Federal University of Goiás, Goiânia, Brazil.

Corresponding author: Lopes AF, angela_lopes@ufg.br

Submitted: 26-02-2025 Resubmitted: 13-11-2025 Accepted: 18-11-2025

Double blind peer review

Abstract

Objectives: This study aimed to develop and apply a tool to guide the inspection of technical parameters of medications used in veterinary health services, supporting practices that contribute to animal patient safety in accordance with current regulations. **Methods:** The Inspection Guide for Technical Aspects of Labeling of Medicines for Veterinary Use (RIATREvet) was designed from Brazilian regulations issued by Anvisa and MAPA, the agencies responsible for human and veterinary drug control, respectively. The tool was implemented at the veterinary hospital of the Federal University of Goiás, central-west region of Brazil, to assess compliance with medications used in animal care. **Results:** The RIATREvet covered three domains and 16 items. It was applied to 67 medications (58.2% human, 41.8% veterinary). Human drugs achieved near-total regulatory compliance (≥98%). Conversely, veterinary drugs exhibited significantly lower compliance, notably in primary packaging (Domain 1: 71.4%) and secondary packaging (Domains 1 and 2: ≤84%). The most frequent non-conformity was Item 3.3 ("Customer Service Phone Number"), with veterinary drugs showing a significantly higher failure rate (64.3%, $p<0.001$). High-risk APINCH medications (52.2% of the sample) showed high non-compliance, particularly for primary packaging (65.7%), increasing the risk of medication errors. **Conclusion:** The RIATREvet tool effectively guides veterinarians and pharmacists in evaluating medication labeling and packaging, thereby contributing to safer medication use in veterinary healthcare services.

Keywords: veterinary drugs, medication errors, patient safety, labeling, packaging.

Prática farmacêutica em hospital veterinário: desenvolvimento e aplicação de ferramenta para inspeção de rotulagem e embalagem de medicamentos

Resumo

Objetivos: Este estudo teve como objetivo desenvolver e aplicar uma ferramenta para orientar a inspeção de parâmetros técnicos de medicamentos utilizados em serviços de saúde veterinária, subsidiando práticas que contribuam para a segurança do paciente animal, em conformidade com as normas vigentes. **Métodos:** O Guia de Inspeção de Aspectos Técnicos da Rotulagem de Medicamentos de Uso Veterinário (RIATREvet) foi elaborado a partir das normas brasileiras emitidas pela Anvisa e pelo MAPA, órgãos responsáveis pelo controle de medicamentos para uso humano e veterinário. A ferramenta foi implementada no Hospital Veterinário da Universidade Federal de Goiás (HV/UFG) para avaliar a conformidade de medicamentos utilizados na assistência animal. **Resultados:** O RIATREvet abrangeu três domínios e 16 itens. A ferramenta foi aplicada em 67 medicamentos (58,2% humanos, 41,8% veterinários). Os medicamentos humanos alcançaram conformidade regulatória quase total (≥98%). Entretanto, os medicamentos veterinários exibiram conformidade significativamente menor, notavelmente na embalagem primária (Domínio 1: 71,4%) e na embalagem secundária (Domínios 1 e 2: ≤84%). A não conformidade mais frequente foi o Item 3.3 ("Telefone do Serviço de Atendimento ao Consumidor - SAC"), com medicamentos veterinários apresentando uma taxa de falha significativamente maior (64,3%, $p<0.001$). Os medicamentos APINCH de alto risco (52,2% da amostra) apresentaram alta não conformidade, particularmente na embalagem primária (65,7%), aumentando o risco de erros de medicação. **Conclusão:** A ferramenta RIATREvet orienta efetivamente veterinários e farmacêuticos na avaliação da rotulagem e embalagem de medicamentos, contribuindo para o uso mais seguro de medicamentos em serviços de saúde veterinária.

Palavras-chave: medicamentos veterinários, erros de medicação, segurança do paciente, rotulagem de medicamentos, embalagem de medicamentos.

JHPHS
Journal of Hospital Pharmacy and Health Services

Introduction

Medication labeling and packaging are critical components of patient safety, both in human and veterinary healthcare [1-3]. The primary function of a label is product identification, which is essential not only during the logistical stages of pharmaceutical assistance, such as acquisition, receipt, and storage, but also during its actual use. In this context, labeling errors or inadequate packaging can have harmful impacts on patient health, contributing to adverse events and compromising treatment safety [1-3].

Globally, medication errors related to poor labeling or similar packaging account for a considerable proportion of adverse events in both human and animal health[4-5]. The One Health concept reinforces that drug safety in veterinary medicine directly affects not only animal welfare but also public and environmental health. As with human medicines, when veterinary drugs are not used according to good practices, they may fail to achieve their intended therapeutic effect and may also pose significant risks to the patient [4-5].

In Brazil, the National Health Surveillance Agency (Anvisa) regulates labeling for human drugs, while the Ministry of Agriculture and Livestock (MAPA) oversees veterinary drugs. However, there is a significant gap in MAPA's regulatory and inspection activities, particularly regarding the updating of legislation, market supervision, and conformity assessment of products available for sale. This regulatory deficiency compromises the traceability, efficacy, and safety of pharmacological therapies intended for animals[6].

At the national level, there has been a marked increase in the number of veterinary hospitals, clinics, and related services, reflecting the expansion of the pet market and the growing demand for specialized animal healthcare (Panorama PetVet, 2025; ABHV, 2025). Despite this progress, there is still limited institutionalization of internal quality assurance systems within veterinary hospital pharmacies and clinical services, particularly concerning the inspection of medication labeling and packaging. The international literature on this subject remains scarce, and in Latin America, no validated instruments exist that integrate these aspects into veterinary pharmaceutical practice.

A recent study conducted in Brazil identified significant inconsistencies and omissions in the technical information provided in veterinary medicine package inserts, revealing deficiencies in standardization and legibility that may compromise therapeutic safety[7]. These issues occur within a broader context in which medication errors continue to be reported across various veterinary clinical settings[8-9]. The absence of systematic inspection and validated tools for labeling assessment reinforces the need for strategies that ensure traceability and accuracy of information in veterinary pharmaceutical products marketed in Brazil.

Patient safety in veterinary healthcare, therefore, is not only a matter of clinical responsibility but also of regulatory and operational quality assurance (FDA, 2025). This concept encompasses the prevention of errors related to healthcare processes, including those associated with medication labels and packaging, which often lack standardization and completeness of information[1]. One of the main challenges identified in hospital environments is the absence of mechanisms that prevent or intercept errors before they reach the patient. In study conducted in Nigeria highlighted that prescribers primarily rely on the information contained in drug labels and package inserts when writing prescriptions, emphasizing the importance of accuracy and completeness of labeling information[10].

Internationally, there are reference instruments for human drugs, such as the *Good Label and Package Practices Guide for Prescription Drugs* (ISMP Canada, 2019), which provide evidence-based guidelines to minimize labeling-related errors and enhance medication safety. However, no standardized or validated tools currently exist to evaluate labeling and packaging practices for veterinary drugs, which reinforces the need for structured methodologies capable of assessing regulatory compliance and promoting the safer use of medications in animals. Therefore, the present study aims to develop and apply an inspection tool focused on the technical aspects of identification, labeling, and packaging of medications used in veterinary healthcare services in Brazil. By addressing a regulatory and operational gap, this investigation offers an original contribution to veterinary pharmacy, providing a structured methodology that can support the establishment of good labeling practices, improve traceability, and reduce risks to animal patients.

Methods

This action research study[11] aimed to develop and apply an inspection tool for the technical aspects of identification, labeling, and packaging of medications routinely used in animal health. The study was conducted in two distinct phases: tool development and its application in the practical context.

The study took place at the Pharmacy Service of the Veterinary Hospital (HV) of the Federal University of Goiás (UFG), located in central Brazil. Founded in 1966, the HV/UFG offers a variety of clinical and surgical services to the external community and serves as a teaching, research, and extension center for the academic and productive sectors of the School of Veterinary Medicine and Animal Science (EVZ), in collaboration with the Laboratory of Research in Teaching and Health Services (LaPESS) of the Pharmacy College of UFG.

To develop the tool, a review of the current national legal framework was conducted, focusing on the regulations provided by the agencies responsible for regulating medications in human health (RDC no 768/2022 from Anvisa) and veterinary use (Decree MAPA No 5053/2004). After reviewing the relevant legislation, the "Inspection Guide for Technical Aspects of Labeling of Medicines for Veterinary Use (RIATREvet)" was developed, reviewed, and approved by two experts in the field of veterinary pharmacy.

The tool was applied from April to June 2023. A visual inspection of the labeling and packaging was conducted to assess compliance with the requirements defined by the RIATREvet tool, comparing different drug categories, those for veterinary use and human use, both categories adopted into the study setting. To minimize bias from visual inspection, two professionals were involved in applying the tool to assess the available information on the medication.

The study sample consisted of standardized medications registered in the HV/UFG pharmacy service inventory, accessed through the ProntusVet software (Version 5.1). This ensured that the sample represented a broad range of medications used. Diluents, vaccines, and fluid therapies were excluded from the study. Medications were categorized by therapeutic classes using the Anatomical Therapeutic Chemical Classification System for Veterinary Medicine (ATCvet), 2022, 24th edition by the WHO, and were also stratified into two main categories: veterinary drugs and human drugs, according to registry data.

JHPHS
Journal of Hospital Pharmacy and Health Services

Medications were also screened for high-risk status using the Institute for Safe Medication Practices (ISMP)[9] APINCH acronym, which includes antimicrobials, potassium and other electrolytes, insulin, narcotics and sedatives, chemotherapeutics, heparin, and other anticoagulants, due to their potential to cause severe harm in the event of medication errors.

A descriptive frequency analysis was conducted to achieve the compliance rate of label and packaging information disponible at human and veterinary medication in comparison to the RIATREvet tool requirements. An overall percentual of compliance rate was calculated, as well as the confidence interval of 95% (95% CI). Differences in frequencies were assessed using the Chi-square test. A two-sided p-value of less than 0.05 was considered statistically significant.

Data analysis was conducted using SigmaPlot 11.0 (Systat Software, San Jose, CA), Microsoft Excel (Microsoft Corporation, Redmond, WA), and OpenEpi 3.01 (Open Source Epidemiologic Statistics for Public Health). The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

Results

The RIATREvet tool comprises 16 items, divided into three domains: general aspects (Domain 1), technical issues (Domain 2), and regulation (Domain 3). A total of 20 regulations, published between 1969 and 2022, in the study thematic area, were applied in tool development, mainly (60%; n=12) originating from Anvisa, and 40% (n=8) from MAPA (Table 1). The RIATREvet tool and animal safety implications are presented in Figure 1.

The RIATREvet tool was applied for the inspection of 67 medications, including human (n=39; 58.2%) or veterinary drugs (n=28; 41.8%) available for animal health assistance in a veterinary hospital. A total of 20 distinct therapeutic classes were identified, with the highest frequency of antimicrobials (16.4%), followed by anesthetics (14.9%). Opioids analgesics, and anti-inflammatories/analgesics represented approximately 21% of the total medication (Figure 2).

Table 1. Summary of Brazilian regulatory acts related to labeling and packaging of human and veterinary medicines (1969–2022).

Year	Type of Act	Act Number	Origin	Description/ Summary
1969	Decree-Law	467	MAPA	Provides for the inspection of veterinary products, the establishments that manufacture them, and other related provisions.
1998	Ordinance	344	Anvisa	Approves the Technical Regulation on substances and medicines subject to special control.
1999	Ordinance	6	Anvisa	Applies Ordinance 344/1998 regarding packaging and labeling.
2010	Official Letter	1,282	MAPA	Concerns labeling of products intended for production animals.
2012	RDC	61	Anvisa	Establishes procedures within Anvisa for labeling changes of medicines and other related provisions.
2012	RDC	21	Anvisa	Visual identity manual for medicines of the Ministry of Health.
2012	Law	12,689	MAPA	Amends Decree-Law No. 467 of February 13, 1969, to establish generic veterinary medicines.
2015	Decree	8,448	MAPA	Amends the Regulation on the inspection of veterinary products and establishments that manufacture or market them, approved by Decree No. 5,053 of April 22, 2004.
2016	Decree	8,840	MAPA	Amends the Annex to Decree No. 5,053 of April 22, 2004, which approves the Regulation on the inspection of veterinary products and establishments that manufacture or market them.
2017	IN	35	MAPA	Establishes procedures for the commercialization of substances subject to special control when intended for veterinary use and veterinary products containing them.
2018	RDC	242	Anvisa	Procedures within Anvisa for labeling changes of medicines.
2020	IN	71	Anvisa	Establishes the inclusion of a statement about a new formula on the labeling of low-risk notified medicines, traditional herbal products, and cannabis products when their composition is altered.
2020	RDC	421	Anvisa	Establishes the inclusion of a statement about a new formula on the labeling of products subject to sanitary surveillance when their composition is altered.
2021	RDC	471	Anvisa	Establishes criteria for the prescription, dispensing, control, packaging, and labeling of prescription-only antimicrobial medicines, isolated or in combination, listed in a specific Normative Instruction.
2021	Law	14,187	MAPA	Authorizes industrial structures intended for the manufacture of veterinary vaccines to be used in the production of active pharmaceutical ingredients (APIs) and vaccines against CoVID-19 in Brazil.
2022	Law	14,338	MAPA	Establishes the digital leaflet (electronic package insert) for medicines.
2022	IN	131	Anvisa	Establishes complementary Good Manufacturing Practices for sampling activities of raw materials and packaging materials used in the manufacture of medicines.
2022	RDC	683	Anvisa	Defines extraordinary and temporary criteria and procedures for applying exceptions to specific labeling and package insert requirements due to the international public health emergency caused by the Coronavirus.
2022	RDC	770	Anvisa	Warning phrases for substances, therapeutic classes, and controlled lists in medicine leaflets and packaging.
2022	RDC	768	Anvisa	Rules for medicine labeling.

Legend: MAPA – Ministry of Agriculture, Livestock and Supply; Anvisa – Brazilian Health Regulatory Agency; RDC – Collegiate Board Resolution; IN – Normative Instruction; PRT – Ordinance.

Figure 1. Inspection Protocol for Technical Aspects of Labeling of Veterinary Medicines (RIATREvet) and its implications for the animal patient safety, 2023.

DOMAINS		Implications for the care and safety of the animal patient
1) GENERAL INFORMATION		
1.1	Name of medicine: commercial or generic (for generic medicines, the name of the active ingredient is used).	Identification Concentration Pharmaceutical form of the medication
1.2	Generic name of each active ingredient, in capital letters, on the main face of the packaging, just below the commercial name.	
1.3	Route of administration.	
1.4	Concentration of active ingredients.	
1.5	Expression "Shake before using" for medicines in the form of powder or granules for suspension or solution.[a]	
2) TECHNICAL INFORMATION		
2.1	The expression "Veterinary use" is highlighted on the main side.	Conservation and Storage Indication for use
2.2	Lot number (for human use) or batch number (for veterinary use), manufacturing date (month/year), and expiration date (month/year).	
2.3	Storage precautions: temperature range and storage conditions.[a]	
2.4	Withdrawal period (mandatory for medications intended for production animals).	
2.5	Expression "All medicines must be kept out of the reach of children and pets".[a]	
2.6	Expression "Use restricted to hospitals" for medicines whose administration is permitted only in a hospital environment".[a]	
2.7	Expression "See package insert" for information intended for healthcare professionals, indications, contraindications, and precautions.[a]	
3) REGULATION		
3.1	Name of the technical responsible person from the company holding the registration.[a]	Pharmacovigilance Traceability
3.2	Name of the company holding the registration, or its logo, provided it contains the company name, business name, or trade name, and CNPJ (National Register of Legal Entities).[a]	
3.3	Consumer Service (SAC) phone number.	
3.4	Medicine registration number.[a]	

(a) Not applicable for primary packaging with reduced size.

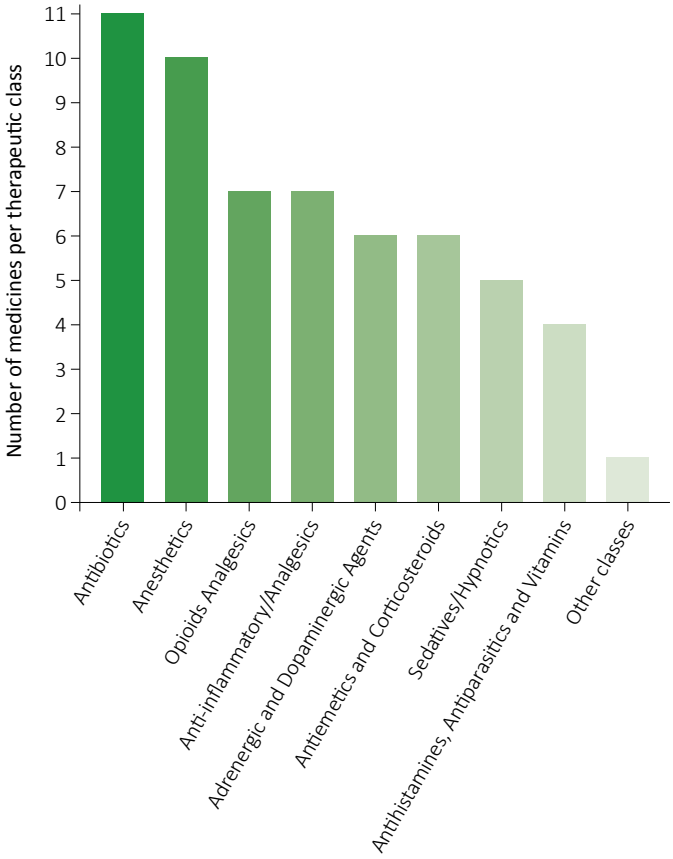
For primary packaging, human drugs achieved a 100% compliance rate for general aspects (Domain 1) and technical issues (Domain 2). In contrast, the veterinary drugs varied from 71.4% (n= 20/28; 95% CI 52-85) in Domain 1 to 98% (n= 27/28; 95% CI 83-99.9) in Domain 2. It is noteworthy that, for primary packaging, Domain 3 (Regulation) was deemed not applicable, regardless of the type of medication. This methodological decision was based on current sanitary legislation, which, due to the space limitations of small-volume primary packaging, waives the requirement for certain regulatory information (e.g., Customer Service Phone Number), these being mandatory only on the secondary packaging.

Analysis of secondary packaging showed a compliance rate above 98% for human drugs, considering all domains. On the other hand, for veterinary drugs, the compliance rates achieved 82% in Domain 1 (n=23/28; 95% CI 63-92.1), 84% in Domain 2 (n=24/28; 95% CI 65.4-93.6), and 93% in Domain 3 (n=26/28; 95% CI 77.3-98) (Figure 3).

Regarding non-conformities, considering all 67 medications evaluated in this study and their primary and secondary packaging, approximately 40% of the sample did not comply with item 3.3 in the regulation domain, "Customer Service Phone Number." Among these, 20.5% (n=8/39; 95% CI 10.8-35.5) were human drugs, and 64.3% (n=18/28; 95% CI 45.8-79.3) were veterinary drugs, showing a statistically significant difference ($p<0.001$; Table 2).

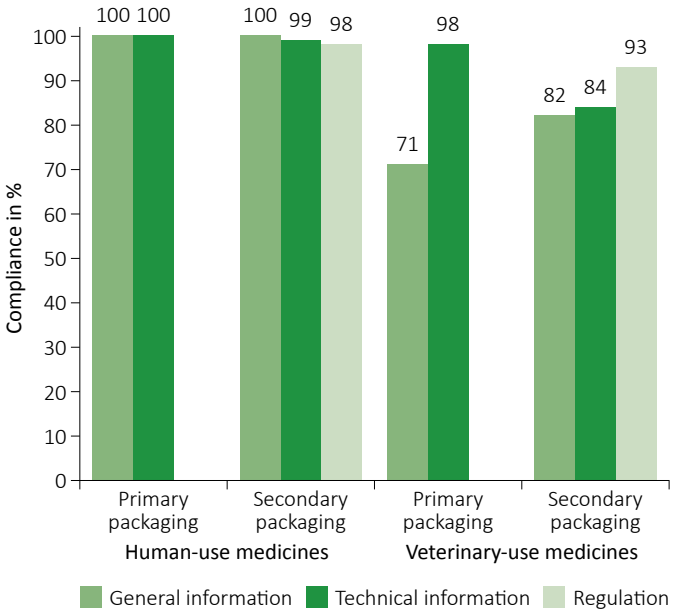
An analysis approach of the APINCH group showed that approximately half (52.2%; n=35/67) of the sample study were high-risk medications. Among these, a non-compliance rate was 65.7% (n=23/35) for primary packaging and 45.7% (n=16/35) for secondary packaging, adding risk of severe advent effects in case of medication errors occurring with this group of medication.

Figure 2. Characterization of veterinary hospital medicines according to ATCvet classification.



Legend: other classes: antiarrhythmics (n=1), anticoagulants (n=1), anticholinergic (n=1), antihypertensive (n=1), antipsychotic (n=1), diuretic (n=1), expectorant /mucolytic (n=1), hemostatic (n=1), and hormones (n=1).

Figure 3. Comparison of the compliance rate of three domains in primary and secondary packaging of human and veterinary medications applied in a veterinary hospital setting.



Note: Domain 3 (Regulation) was not applicable for primary packaging with reduced size.

Discussion

The scope of this study was to develop and implement a tool to assess the technical information present in the primary and secondary packaging of drugs enrolled into a veterinary assistance. In this context confers an importance due to the impact that this information has on human, animal, and environmental health, i.e., the concept of One Health, providing to professionals a tool for evaluation and promotion of actions related to the safety of animal patients.

The legislation that supported the development of this tool revealed that the regulatory agency for human use products, Anvisa, has updated regulations on the study's theme. In contrast, regulations published by the MAPA show little variety in regulating the labeling of medications, with few changes made to their regulatory framework in recent decades. These findings align with the recent publication[10], stating that in Brazil, the first regulatory framework in the field of veterinary products was published at the end of the 1960s and updated after 35 years. Another highlight is the report on the scarcity of regulatory documents[12] and recommendations for the safe use of medications in animal patients, as well as information related to the occurrence of medication errors and pharmacovigilance, which are still incipient in animal health care according to the policy directive: safe management and use of high-risk medicines of the Clinical Excellence Commission (2020).

After reviewing the legislation governing the study's theme, the tool developed in this research encompasses, in its three domains and respective items, general, technical, and regulatory information, which we consider crucial to be available on the primary and/or secondary packaging of animal use medications, given their direct impact on the quality and safety of animal health.

Regarding the sample characterization, this study highlights a predominance of human-use medications, which is a frequent, permitted, and opportune practice, mainly due to the lack of commercial alternatives in the veterinary pharmaceutical industry and the greater accessibility of human medications. It is emphasized that this practice is accompanied by the same challenges present in the use of human medications, such as rational use and toxicity[13].

A total of 20 therapeutic classes were identified in use at the veterinary hospital of UFG, demonstrating a wide range of medications administered to patients across different areas. The diversity of essential medication classes is crucial to encompassing the main therapeutic spheres[14-16].

Concerning medications belonging to the APINCH group, it is essential to highlight their significance among the analyzed drugs. Errors, whether common or not, with these medications have the potential to cause more severe harm due to their narrow therapeutic range. Given their low compliance with information on packaging, it is believed that they are even more exposed to medication errors.

JHPHS
Journal of Hospital Pharmacy and Health Services

Table 2. Non-conformities related to the inspection of technical aspects of labeling of primary and secondary packaging of standardized medicines in a veterinary hospital.

Technical medication labeling items	Primary Packaging						Secondary Packaging					
	Humane Use		Veterinary Use		Total		Humane Use		Veterinary Use		Total	
	N=39	(%)	N=28	(%)	N=67	(%)	N=39	(%)	N=28	(%)	N=67	(%)
(1) General information												
(1.2) Generic name of each active ingredient, in capital letters, on the main face of the packaging, just below the commercial name	0	(0)	10	(35.7)	10	(14.9)	0	(0)	9	(32.1)	9	(13.4)
(1.3) Route of administration	0	(0)	2	(7.1)	2	(3)	0	(0)	2	(7.1)	2	(3)
(1.5) Expression “Shake before using” for medicines in the form of powder or granules for suspension or solution	0	(0)	1[a]	(100)	1	(100)	0	(0)	1[a]	(100)	1	(100)
(2) Technical information												
(2.3) Storage precautions: temperature range and storage conditions	0	(0)	0	(0)	0	(0)	1	(2.5)	2	(7.1)	3	(4.4)
(2.4) Withdrawal period (mandatory for medications intended for production animals)	0	(0)	1[b]	(5)	1	(5)	0	(0)	0	(0)	0	(0)
(2.5) Expression “All medicines must be kept out of the reach of children and pets”	0	(0)	0	(0)	0	(0)	1	(2.5)	1	(2.5)	2	(3)
(2.7) Expression "See package insert" for information intended for healthcare professionals, indications, contraindications, and precautions	0	(0)	0	(0)	0	(0)	0	(0)	1	(3.5)	1	(1.4)
(3) Regulation												
(3.1) Name of the technical responsible person from the company holding the registration	0	(0)	0	(0)	0	(0)	2	(5.1)	0	(0)	2	(3)
(3.3) Consumer Service (SAC) phone number	0	(0)	0	(0)	0	(0)	1	(2.5)	8	(28.6)	9	(13.4)

a= Only one medicine. Amoxicillin suspension injectable. b= 19 evaluated medicines.

It is noteworthy to mention the scarcity of information on specific high-alert medications within veterinary medicine. However, a recent study has addressed this issue and promoted prominence of the theme[17], which emphasized the importance of reporting errors and their impact on the patient safety culture in the veterinary field.

Regarding the items in each domain of the developed tool, it is essential to highlight that, according to article 15 of Anvisa’s RDC No. 768/2022, primary packaging with reduced size may, with justification and approval by the agency, omit some of the mandatory information listed in this guideline. Still, under certain conditions (legibility), all information must be included. Therefore, medications with reduced primary packaging size, analyzed in this study, were categorized as “not applicable” in domain 3 (regulation) of the tool, where this information was omitted.

Items in domain 1 (general information) have a direct implication on medication identification, considering label characteristics and nomenclatures. These items are frequently involved in medication errors exposed in scientific literature[18-19]. The lack of this information, small font sizes, or insufficiently contrasting backgrounds, and packaging with common designs and many similarities produced by the same manufacturer can confuse, especially during emergency situations[2,19]. An example in human health is the case reported by Institute for Safe Medication Practices (ISMP) Brazil safety alert[20], where a baby died due to suspected ingestion of “brimonidine” eye drops instead of “bromopride” oral solution. The alert provides recommendations to minimize similar situations.

An important observation regarding the packaging of veterinary medications is the information on the route of administration. Compliance was given based on the presence of the phrase “injectable use.” However, this nonspecific form of the administration route, as injectable medications can have various routes such as subcutaneous, intravenous, intramuscular, intrathecal, among others, leads to one of the main administration errors reported in the literature[21-22].

An important case in human health literature, contained in a bulletin published in 2014 by ISMP, that underscores the relevance of detailed information is the mistaken administration of “vincristine” intrathecally instead of intravenously, an error usually fatal, reported since 1968 in the United States, and numerous similar cases thereafter. The bulletin highlights some recommendations to avoid these errors, such as labeling alerts and double-checking.

Another observation about the analyzed packaging of veterinary medications is the presentation of active ingredients only as a formula on the side of the secondary packaging, making it difficult to identify the active ingredient. For example, Ivomec®, where the active ingredient is ivermectin. Furthermore, formulation components such as additives, preservatives, and stabilizers, among other products commonly present in medications, are not described and can cause harm to animal patients. For instance, xylitol, mentioned in the Anfarmag magazine[23], is an additive that can increase blood glucose levels in dogs and cause ataxia, or benzyl benzoate, which can cause vomiting, diarrhea, and seizures in felines.

In the second domain (technical information), the items are related to indications for use, conservation, and storage, ensuring the physical-chemical characteristics until the moment of use, ensuring their effectiveness, and preventing and warning about the risks of indiscriminate medication use. The presence of this information certifies that errors, such as those exposed by Heinemann[24], regarding alterations caused by storing insulin at inappropriate temperatures, reach the patient, causing sensitivity, requiring a dose adjustment, or causing hyperglycemia.

The third domain refers to the regulatory aspects of the marketed medication, providing information regarding traceability and reporting possible adverse events to the responsibility of a professional who responds to the legal entities involved, ensuring compliance with legislation. As evidenced in the study by Fonseca et al[25], highlighting the implications related to deficiencies in the regulation and post-marketing surveillance of veterinary medications in Brazil, as well as the absence of an adverse drug event (ADE) notification system. For this point, the researchers propose adopting the use of trackers in medical records to detect ADEs and improve safety in caring for animal patients.

Regarding the species for which the medication is intended, this information is usually found only in the package insert and can be a source of confusion due to images or elements with potential ambiguity. Some industries use images that do not refer to the species for which the medication is intended. Among the analyzed cases is Acepran®, which features images of the animals it is intended for. However, the laboratory's logo includes two horses images that are not applicable and can mix with other images, diverting attention and causing errors.

A 2006 report from the Institute of Medicine (IOM) mentioned labeling of human medication packaging as the cause of 33% of all medication errors and 30% of deaths due to medication error[26]. Some identified labeling and packaging problems included unclear volume concentrations or definitions, complex labels, small fonts, insufficient background contrast, and excessive emphasis on company logos[27].

The information on the lot for human medications or the batch for veterinary medications was the item on the guideline with the highest compliance. Regarding these terms, according to Article 2 of Normative Instruction (IN) No. 23/2016, a lot or batch is the quantity of a veterinary product produced in a manufacturing cycle, and its essential characteristic is homogeneity (MAPA, 2016). This information is crucial for traceability because these numbers or letters identify and allow locating the medication in case of inspection of its manufacturing stages.

One of the medication errors frequently reported to the USP Medication Error Reporting Program (USP-MERP) is related to the labeling and packaging of medications. Product labeling is among the most important tools to assist pharmacists. A label should be designed and checked by healthcare professionals involved in the technical and managerial actions of pharmaceutical care, covering standardization, selection, receipt, storage, and distribution of these medications, to promote safety in animal healthcare and prevent unintentional exchanges by the professionals involved[2].

Conclusion

This study presented a tool (RIATREvet) developed to guide medication inspection to assist pharmacists and veterinarians in identifying the necessary minimum information on the packaging and labeling of medications applied in veterinary assistance. The aim is to promote greater patient safety at different stages of healthcare, including product receipt, storage, dispensing, and administration.

This tool can also guide or assist in the qualification of products and their respective manufacturers. This process can help prioritize the acquisition of products that provide complete information, impacting patient safety and contributing to the improvement of the quality of care provided in veterinary hospitals.

In terms of applying the RIATREvet tool to medications already in stock in veterinary healthcare services such as clinics and hospitals, the pharmaceutical service can segregate these products and implement norms and measures to prevent medication errors from occurring. This emphasizes the importance of comprehensive information on medication labels in ensuring patient safety and enhancing the overall quality of veterinary healthcare services.

Sources of Funding

The research presented did not receive any type of funding or financial support.

Declaration of conflict of interest

The authors declare no conflict of interest in relation to this article.

Acknowledgements

The authors would like to thank the staff of Veterinary Hospital (HV) of the Federal University of Goiás (UFG) for providing data for this work.

References

1. Lopes DM, Néri ED, Madeira LS, et al. Análise da rotulagem de medicamentos semelhantes: potenciais erros de medicação. *Rev Assoc Med Bras* (1992). 2012;58(1):95-103.
2. Moura CM, Carvalho, ACB, Falcão, DP. Rotulagem de medicamentos fitoterápicos industrializados: está adequada às diretrizes legais? *Vigil Sanit Debate*. 2014;2(2):60-66. doi:10.3395/vd.v2n2.140
3. Caon S. Pictogramas em embalagens de medicamentos - estratégia para a segurança do paciente [tese de doutorado]. Porto alegre: Universidade Federal do Rio Grande do Sul; 2019.
4. Novaes MFB. Avaliação das Normas Regulatórias sobre rotulagem e embalagem de produtos farmacêuticos. *Rev Cient Multidiscip Núcleo Conhecimento*. 2020;6(1):44-64.

5. Lombardo M. Rotulagem de medicamentos industrializados: uma análise das diretrizes legais brasileiras e contribuições para a qualidade de produtos. *Rev Adm Saúde*. 2020;20(81):1. doi:10.23973/ras.81.225

6. Rath S, Mejia, MJM, Schroder CHK. Guia de validação e controle de qualidade analítica: fármacos em produtos para alimentação animal e medicamentos veterinários. *Quim Nova*. 2015;38(5):697-708.

7. Thomazini VC, Lima RA, Vilela LC, et al. Inconsistencies in the quality of the information on package inserts for veterinary medicines in Brazil. *Braz J Pharm Sci.* 2024;60:e22180. doi:10.1590/s2175-97902024000222180

8. Pinho RH, Magalhães E, Zambelli AB, et al. Medication errors in veterinary anesthesia: a literature review. *Vet Anaesth Analg.* 2024;51(2):123-133. doi:10.1016/j.vaa.2024.01.003

9. Barazowski JA, Pinard CL, Hess RS. Assessment and categorization of medication errors in a veterinary teaching hospital. *J Vet Intern Med.* 2024;38(4):1393-1402. doi:10.1111/jvim.17896

10. Sanches NHC. Cuidado farmacêutico no uso de medicamentos em animais domésticos [trabalho de conclusão de curso]. São Paulo: Universidade São Judas Tadeu; 2023.

11. Grundy SJ, Kemmis, S. Educational action research in Australia: the state of the art. Geelong. New York: Routledge;1997.

12. Bezerra TM, Filho, NAM. Soler O. Regulatory frameworks and the role of the pharmacist in the veterinary drug market for companion animals: integrative review. Rev Biotecnol Cienc. 2022;11(4):e2760. doi:10.33448/rsd-v11i4.27604

13. Martins MR. Thomaz DV, Silvério RM. Avaliação das prescrições medicamentosas de um hospital veterinário: uma contribuição dos serviços clínicos farmacêuticos. Rev Biotecnol Cienc. 2017:6(2):38-45.

14. Lima TM, Magalhães VS, Dewulf NLS, et al. Perspectivas da atuação do farmacêutico hospitalar no âmbito veterinário. *Braz J Health Pharm*. 2021;3(4):10-17.

15. Castro PIM. Estudo sobre medicamentos humanos utilizados em prescrição veterinária [trabalho de conclusão de curso]. Natal: Universidade do Rio Grande do Norte; 2019.

16. Ferreira JPA, Santos AS, Fonseca BCO. Guia farmacoterapêutico HV/UFG. Goiânia: Brazil Publishing; 2020. doi:10.31012/978-65-86854-11-4

17. Low R, Wu AW. Veterinary healthcare needs to talk more about error: for the wellbeing of our patients and medical teams. *J Vet Intern Med.* 2022;36(6):2199-2202. doi:10.1111/jvim.16554

18. Karapinar-Çarkit F, van den Bemt PMLA, Sadik M. Opportunities for changes in the drug product design to enhance medication safety in older people: evaluation of a national public portal for medication incidents. *Br J Clin Pharmacol.* 2020;86(10):1946-1957. doi:10.1111/bcp.14392

19. Pons EDS, Moraes CG, Falavigna M, et al. Users' preferences and perceptions of the comprehensibility and readability of medication labels. *PLoS One.* 2019;14(2):e0212173. doi:10.1371/journal.pone.0212173

20. Anacleto TA, Perini E, Rosa MB, et al. Medication errors and drug-dispensing systems in a hospital pharmacy. Clinics (Sao Paulo). 2005;60(4):325-332. doi:10.1590/s1807-59322005000400011

21. Carvalho VT, Cassiani SHDB, Chiericato C, et al. Erros mais comuns e fatores de risco na administração de medicamentos em unidades básicas de saúde. *Rev Latino-Am Enfermagem.* 1999;7(5):67-76. doi:10.1590/S0104-11691999000500009

22. Gimenes FRE, Marques TC, Teixeira TCA, et al. Medication wrong-route administrations in relation to medical prescriptions. *Rev Latino-Am Enfermagem.* 2011;19(1):11-17. doi:10.1590/S0104-11692011000100003

23. Associação Nacional de Farmacêuticos Magistrais. Dicas Farmacotécnicas: Manipulação Veterinária. *Assoc Nac Farm Magistrais.* 2019;(116):1-9.

24. Heinemann L, Braune K, Carter A, et al. Insulin Storage: A Critical Reappraisal. *J Diabetes Sci Technol.* 2021;15(1):147-159. doi:10.1177/1932296819900258

25. Oliveira Fonseca BC, Forgerini M, Dias Zorzin LC, et al. Uso de ferramenta de gatilho para identificação de eventos adversos a medicamentos em cães. *Rev Bras Med Vet.* 2020;42(1):e109720. doi:10.29374/2527-2179.bjvm109720

26. Aspden P, Wolcott J, Bootman JL, et al. Preventing medication errors. Washington, DC: National Academies Press; 2006.

27. Institute for Safe Medication Practices Canada. Good Label and Package Practices Guide for Prescription Drugs. Ottawa: ISMP Canada; 2019.