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Research Paper

Reaching for veterinary pharmacy services: an overlooked routine by community pharmacists?

Rita Dias[1], Ana Mafalda Lourenço[1], Berta São Braz[1] and Afonso Cavaco[2,*]

[1] Faculty of Veterinary Medicine, University of Lisbon, Lisboa, 1300-477, Portugal and [2] Faculty of Pharmacy, University of Lisbon, 1649-003, Portugal

*Correspondence: Afonso Cavaco, FFULisboa, Av. Prof. Gama Pinto 1649-003, Lisboa, Portugal. Tel: +351-217946456; Email: acavaco@ff.ulisboa.pt

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Abstract

Objectives Community pharmacists claim veterinary pharmacy as an integral part of their duties. There a paucity of studies investigating medication and health products' dispensation for veterinary purposes. This study aimed to probe the Portuguese community pharmacists' knowledge and behaviour towards veterinary pharmacy practice.

Methods A cross-sectional exploratory survey, using an online questionnaire, was sent to a sample of academic-related community pharmacists in greater Lisbon, Portugal (N = 349). The questionnaire addressed participants' specific education and training, counselling of products, and attitudes towards veterinary prescriptions. Logistic regression was used to estimated participants' propensity for changing veterinary prescriptions independently. Everyday case scenarios were used to ascertain veterinary pharmacotherapy knowledge.

Key Findings Participation reached 57.6% (N = 201), pointing to the theme's relevance, with 83.6% females and a mean age of 36 years (SD =10.1). A large proportion (71.6%) declared to have received veterinary pharmacy education, although virtually all pharmacists (99.0%) perceived a skills deficit. The overall level of correct decisions regarding case scenarios reached 54%, although most professionals counsel pets' treatments (85.6%). 18% of the sample declared to have changed a prescription without contacting the veterinarian. The propensity to independent medication changes was associated with being a male pharmacist, having one to two decades of professional experience, and working in community pharmacies with a permanent supply of prescribed veterinary pharmaceuticals.

Conclusions Although recognizing limitations in veterinary pharmacy competencies, not all community pharmacists decide to minimize potential hazards to animals' health as with human health. Present findings reinforce the urgency of further formal education and interprofessional collaboration.

Keywords: community pharmacy; pharmacy services; veterinary pharmaceuticals; pets; animal health

Introduction

It is estimated that 80 million European homes own at least one pet animal, of these 24% one dog and 25% one cat.[1] In Portugal, there were 6.7 million pets in 2015, distributed between 2 million (54%) households.[2, 3] Families consider pets as family members or friends, and are usually concerned about caring for their health and nutrition.[2, 3] Dogs' and cats' healthcare represented in 2016 25% and 11%, respectively, of the Portuguese family's budget.[2]

Veterinary pharmacy represents an exciting market segment for the Portuguese community pharmacies. In 2014, medicines and products for animal health corresponded to 20% of the drug sales, with 2 506 available references, and a turnover of around 20 million euros.[4, 5] Since 2009, many Portuguese community pharmacies have developed a dedicated area "Espaço Animal" (Animal Space), and expanded duties to comply with the Portuguese legislation (Decree-Law #307/2007, Article 33 and Decree-Law #288/2001, Article 77). Pharmacists are legally accountable for dispensing veterinary products, including prescribed medicines, and providing qualified advice as with any human medication (Decree-Law # 175/2005).

Published studies and grey literature have documented community pharmacy practice to handle issues when veterinary medications are involved.[6–10] For instance, in the UK, it was found that pharmacists may refuse to dispense veterinary prescriptions due to insufficient knowledge.[6, 7] Noncompliance with the veterinary prescriptions involving changing drugs, doses and(or) regimes have also been reported, sometimes with harmful repercussions to animals' health.[8–10] In Portugal, a study with veterinarians highlighted complications for animal health associated with medication for pets without veterinary medical advice.[11] Also, pet owners admitted to self-medicating their animals based on drugs effective in humans or recommended by the community pharmacy.[11]

Lack of pharmacists' veterinary-related knowledge is a significant limitation found by studies around the globe.[12–15] Educational weaknesses are described for different study cycles, particularly in pre-graduation, which is also the case for Portuguese higher education institutions. In Portugal, pharmaceutical study programs (accessible online) typically show veterinary pharmacotherapy as a subchapter of general pharmacology or pharmacotherapy; alternatively, veterinary pharmacy is an elective course. Gaps in pharmacists' knowledge are potentially dangerous to animals' health, from sub dosing or overdosing of drugs to the administration of active substances useful for humans but poisonous to animals, including compounding burdens.[16, 17] In this sense, the present study aimed to investigate veterinary pharmacy practice, including pharmacists' related knowledge, perceived skills, and professionals' behaviours towards veterinary medication dispensing.

Methods

The study followed an exploratory observational cross-sectional design. The online data collection occurred using the survey platform Google Forms.

Sample and sampling procedures

The questionnaire was distributed by email message to a sample of 349 community pharmacies between March 19th and May 20th, 2018. These professionals belong to the registry of pharmacies providing undergraduate internships from the Faculty of Pharmacy, University of Lisbon (FF-ULisboa). These community pharmacies are mainly located in the metropolitan Lisbon area and represent 40.5% of all pharmacies in the region. No sample power calculations were taken to represent the Portuguese community pharmacists nationally or locally; thus, one pharmacist from each community pharmacy was invited to respond to the survey.

Survey instrument

The survey instrument was comprised of questions related to workplace characteristics (location, co-workers), participant's demographics, education and training in veterinary pharmacy, handling of veterinary prescriptions and products, behaviours related to veterinary medications' dispensing, and the advice given on treatment options for pets. A dichotomous question, assessing pharmacists' behaviour towards changing veterinary prescriptions without contacting the prescriber, directed participants to questions focusing on the frequency, reasons, type of changes, and the known outcomes for the animal's health. As for veterinary-related advice-giving, equivalent to human counselling in self-medication, the aim was to identify whether the respondent had recently provided advice regarding pet health issues. If so, the participant was further referred to questions regarding the active substances involved and the known outcomes for the animal's health.

The survey finished with five clinical cases described in the literature, adjusted according to the authors' expertise, and deemed pet counselling scenarios in current pharmacy practice.[18] The cases were aimed to ascertain participants' degree of knowledge on the use of medication in dogs and cats.

The questionnaire was pre-tested by academic staff involved with pharmacy practice and piloted using six community pharmacists before being sent to the study sample. Minor changes were made based on the observations and suggestions provided.

Data analysis and ethical clearance

Statistical analyses were accomplished through the IBM SPSS program (v25), including non-parametric Mann-Whitney (U) and Kruskal-Wallis (KW) tests. A logistic regression analysis was performed to ascertain the propensity variables for modifying a veterinary prescription without contacting the prescriber.[19] No predictive estimation or prognostic purposes were intended, but only a descriptive model to identify significant variables to the outcome. Covariates were parsimoniously chosen, and the predictors entered the model estimation using a stepwise method (Forward Stepwise Likelihood Ratio). The significance level corresponding to $P < 0.05$ was used for all statistics.

The study was approved by the Institutional Review Board and Ethics Commission of the FMV-ULisboa and the National Data Protection Agency under reference #56.285.513. Best practice guidelines were followed in all research steps, with full anonymity afforded to participants.

Results

Participants features

Two hundred and one pharmacists responded to the survey, with an overall participation rate estimated at 57.6%. The sample consisted of 168 females (83.6%), and the mean age was 36 years (SD = 10.1). The average years of professional activity in community pharmacy was 11.7 (SD = 9.4), with 61.1% having ten or fewer years of practice, and equally distributed between genders (X^2 KW = 0.702, P = 0.402). A minority (16.9%) worked in a community pharmacy located in a semi-urban or rural environment. On average, there were 8 pharmacy professionals per community pharmacy, with 5 pharmacists, 2 pharmacy technicians, and 1 pharmacy assistants.

Veterinary pharmacy education

Most participants (71.6%) declared to have received training in veterinary pharmacy. 30.3% received academic-based education, with 8.5% attending a compulsory course and 21.9% attending an

elective one. Only four participants took an academic postgraduate course, while about half of the sample (53.2%) attended other training types after graduation, e.g. continuing education seminars or workshops provided by professional organizations or veterinary companies.

When asked to self-assess their degree of preparation in veterinary pharmacy, 21.9% of respondents considered themselves well or very well prepared, with 38.3% assuming a poor preparation. Almost all participants (99%) considered it necessary for pharmacists to receive more training in veterinary pharmacy. One hundred and forty-two participants justified the need for further veterinary pharmacy training due to the relevance and expansion of the veterinary practice in pharmacies (24.4%), the lack of previous education in veterinary pharmacology (22.9%), and to be able to improve the quality of advice-giving by pharmacists to animal owners, for animals under their care (20.9%). This training could be delivered through continuous education programs (89.6%) and(or) compulsory academic education (54.7%).

Pharmacists' practice and animal health

Eighty-six per cent of the participants mentioned participating in veterinary pharmacy practice, comprising of dispensing medication and other products, providing information, and counselling.

Advice-giving on animal health issues and pharmaceutical products recommendation, based on a customer's request, was reported by most participants (85.6%). Of these pharmaceutical products, a wide variety of active substances was included (Table 1), with the most recommended medications being worming formulations for external and internal administration. Shampoos with antibacterial or antifungal action (66.9%), medications for topical application to the ocular mucosa (47.1%) were also recommended; these products were not always non-prescription veterinary (NPVMs) or OTC human medications. Oral administration, thus with systemic distribution, was reported for several substances, notability non-steroidal anti-inflammatory drugs (NSAIDs) (21.5%), and other substances with known pharmacological effects in humans. Regarding recommendation outcomes, from 125 replies, more than half of the respondents mentioned treatment with the recommended products proved beneficial to the pet (68%), with one participant (0.8%) reporting the recommend product was ineffective.

Participants reported one or more veterinary medical prescriptions per week (58.1%) or once a month (21.9%). These included prescription-only veterinary medicines (POVMs), NPVMs, and human medications (MHUs) intended for animal administration. Thus, participants confirmed a permanent stock of POVMs, e.g. anticonceptional medication (60.2%) and NPVMs, e.g. antiparasitic lotions (98.6%), as well as other veterinary products (VPs), e.g. pet shampoos (89.6%). Some pharmacies also had pet food (25.4%) and accessories such as toys (21.9%).

One reported POVMs dispensing issue is the potential change of the veterinarian's prescription.[8, 9] After contacting the veterinarian, changing the prescription was confirmed by 48.8% of participants. One-fifth of the participants (N = 36) were assumed to have done so without contacting the prescriber. This is not legal under the Portuguese law, except in duly justified cases such as strength or a dosage form. The frequency of change was approximately 1 in 30 veterinary prescriptions for 44.4%, although it only happened once for 38.9% of the participants.

Table 2 shows the active substances and respective pharmacotherapeutic groups mentioned by the 36 participants in the situation they could recall best. In this study, the type of active substances involved were registered, but the actual change for each substance was not detailed. Antibiotics were the pharmacotherapeutic group targeted for most changes (38.9%), noting that most modifications occurred with MHUs (58.3%).

The modifications were mainly described as changing to another brand while keeping the prescribed active substance (33.3%), to another dosage form keeping the active substance (25%), or the prescribed drug itself (19.4%) (Table 3). Table 4 shows the reasons that have led to a change in the prescription. The most frequent reasons were drug absence due to temporary shortage at the wholesaler or manufacturer (69.4 %), a pharmacy stocking disruption (63.9%), or non-stocking, e.g. withdrawal from the market (47.2%).

Factors influencing veterinary prescription change

A logistic regression model was calculated to find which variables could explain pharmacists' likelihood to change the medical prescription without contacting the veterinarian. The predictors were selected amongst the variables statistically associated ($P < 0.05$) with the binary outcome:

Table 1 Pharmacotherapeutic groups and active substances recommended and dispensed without a medical prescription (N = 172)

Primary routes of administration	Pharmacotherapeutic groups	Frequency (%)
Topical administration	Deworming ectoparasites, including heartworm[1]	164 (95.3%)
	Antibacterial/antifungal preparations	115 (66.9%)
	Ocular mucosa	81 (47.1%)
	Otologic	15 (8.7%)
Topical or oral administration (Endectocides)	Deworming ecto- and endo-parasites	80 (46.5%)
Oral administration	Deworming against ectoparasites	124 (72.1%)
	Non-steroidal anti-inflammatory drugs	37 (21.5%)
	Immunostimulant medication	18 (10.5%)
	Sex hormones (contraceptives)	13 (7.6%)
	Antibiotics	9 (5.2%)
	G.I. (anti-diarrheal, antacid/gastric protector, antiemetic, laxative) drugs	7 (4.1%)
	Steroidal anti-inflammatory drugs	5 (2.9%)
	Vitamins & probiotics	3 (1.7%)
	Antihypertensive (ACE inhibitors, vasodilators) drugs	2 (1.2%)
	Antihistaminic drugs	1 (0.6%)
	Anticonvulsant drugs	1 (0.6%)

[1]Only to be administered after testing negative for the disease.

Table 2 Pharmacotherapeutic groups and active substances dispensed without contacting the veterinarian (*N* = 36)

Pharmacotherapeutic groups	Frequency (%)	Active substances	Frequency (%)
Antibiotics	14 (38.9%)	Amoxicillin + clavulanic acid	9 (25%)
		Amoxicillin	1 (2.8%)
		Chloramphenicol	1 (2.8%)
		Metronidazole	1 (2.8%)
		Not specified	2 (5.5%)
Non-steroid anti-inflammatory	4 (11.1%)	Caprophene	2 (5.5%)
		Meloxicam	2 (5.5%)
Analgesic	3 (8.3%)	Tramadol	2 (5.5%)
		Not specified	1 (2.8%)
H2 antagonists	3 (8.3%)	Famotidine	3 (8.3%)
Blood changing agents	1 (2.8%)	Aminocaproic acid	1 (2.8%)
Anti-inflammatory drugs	1 (2.8%)	Not specified	1 (2.8%)
Antiparasitic drugs	1 (2.8%)	Praziquantel + pyrantel + febantel	1 (2.8%)
Proton pump inhibitor	1 (2.8%)	Omeprazole	1 (2.8%)
Diuretics	1 (2.8%)	Furosemide	1 (2.8%)
Vitamins	1 (2.8%)	B12 vitamin	1 (2.8%)

6 (16.7%) participants could not recall details of the situation.

Table 3 Characterisation of the change made to the veterinary prescription without contacting the veterinarian (*N* = 36)

Actions taken	Frequency (%)
Prescribed active substance from another manufacturer	12 (33%)
Prescribed active substance in a different dosage/concentration	9 (25%)
Prescribed medication in a different dosage/concentration	7 (19.4%)
Prescribed medication but with changes in posology (dose and/or frequency)	5 (13.9%)
Prescribed medication in a different pharmaceutical form	4 (11.1%)
Prescribed active substance in a different pharmaceutical form	3 (8.2%)
Active substance from the same therapeutic group	2 (5.6%)
Active substance from a different therapeutic group	2 (5.6%)

Table 4 Reasons for changing veterinary prescriptions (*N* = 36)

Reasons disclosed for prescription modifications	Frequency (%)
Temporary lack of the prescribed medication at the wholesale or manufacturer	25 (69.4%)
Temporary lack of the prescribed medication at the pharmacy	23 (63.9%)
Permanent lack of medication (e.g. market withdraw)	17 (47.2%)
Error detected after contacting the prescribing veterinarian for clarification	7 (19.4%)
Difficulties in interpreting prescription handwriting	6 (16.7%)
Error detected according to animal health knowledge	5 (13.9%)
Impossibility to contact the veterinarian	5 (13.9%)
Error detected according to the general pharmacotherapy knowledge	3 (8.3%)

* Community pharmacy experience (year groups) – categorical (X^2 KW = 11.020, P = 0.026).
* Academic education from compulsory courses – dichotomous (U = 1258.0, P = 0.030).
* Continuous education initiatives – dichotomous (U = 4442.5, P = 0.024).
* Self-perception of veterinary pharmacy preparation – categorical (X^2 KW = 11.846, P = 0.019).
* POVMs stock at the pharmacy – dichotomous (U = 4304.5, P = 0.033).

Other variables entered the model estimation as potential predictors: gender (dichotomous), the total number of pharmacy staff (continuous), and the frequency of veterinary prescriptions (continuous). The theoretical underpinning was, respectively, the high proportion of female professionals, the possibility of specialized staff members, and opportunities to interact with veterinary patients and veterinarians. The estimated model parameters endorsed the pharmacist's gender, years of work experience, and POVMs availability in the pharmacy as the covariables significantly influencing the propensity of changing a prescription without consulting the veterinarian (Table 5).

When the professional is a female, there is a 91% reduction in the propensity to change the prescription without consulting the veterinarian. Moving from a pharmacist with less than five years of experience to one between 11 and 20 years of experience increases the propensity to change the prescription by 4.15 times. All other pharmacists do not present statistical differences in the propensity of changing the prescription compared to the youngest colleagues. Pharmacies with POVMs in stock seem to have 4.01 more propensity to change the prescription without contacting the prescriber.

Table 5 Answers to veterinary knowledge assessment questions (*N* = 138)

Case clinical scenarios						
Replies	Paracetamol	Permethrin	Cetirizine	Levothyroxine	Anticonception pill	Totals
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	
Do not know	9 (4.5%)	9 (4.4%)	136 (67.6%)	18 0 (89.5%)	9 (4.5%)	
Incorrect option	12 (6.0%)[1]	19 (9.5%)	58 (28.9%)	19 (9.5%)	101 (50.2%)	
Correct option	180[1] (89.5%)[1]	173 (86.1%)	7 (3.5%)	2 (1.0%)	91 (45.3%)	

[1]Value corrected based on a wrong justification for the chosen option.

Veterinary pharmacotherapeutic proficiency

The overall participants' performance in the five clinical situations is shown in Table 5.

The first case was about a customer asking for Ben-u-Ron 500 mg tablets (paracetamol) to give to a cat with a fever. The most common justifications for the correct option were the toxicity of the drug (52.7%), detailed as low paracetamol metabolism by this species (29.7%), which may have been lethal to the cat in the opinion of the pharmacists (14.5%). The second case involved buying a box of Advantix (permethrin) to be applied for deworming a dog and a cat. Most participants (86.1%) chose the correct option, indicating the drug could only be administered to the dog. The third case was related to a dog owner who asked for the appropriate dose of the antihistamine medication Zyrtec 10 mg (cetirizine tablets) to be administered to his 30 kg pet, who had pruritus secondary to allergy. Only 3.5% indicated the correct answer of 3 tablets once a day, while 67.6% reported not knowing the correct answer. The fourth case corresponded to doubts concerning the minimum therapeutic dose of Letter 0.1 mg (sodium levothyroxine tablets) to be administered to a 20 kg hypothyroid dog. Only 1% of the participants opted for the correct answer of 4 tablets once a day, while 89.5% did not know the correct answer. Finally, the fifth case comprised of a pet owner asking for a treatment to prevent for the first time his female dog from having offspring: 45.3% chose the correct option of not dispensing a contraceptive pill and to advise for a consultation with the veterinarian.

Discussion

This study aimed to delve into a relevant area of practice, that of veterinary pharmacy. It is recognized worldwide that pharmacists' professionalism should address all patients, including animals, and all medications, including veterinary pharmaceuticals, as stated in the recently published FIP Development Goals.[20] This topicality was also present in this study: there was an unusually high response rate amongst busy professionals.[21]

No statistical representation was aimed; nevertheless, the sample's basic demographics, such as the gender distribution, were near the overall registered Portuguese pharmacists (79% females, Pharmaceutical Society 2017 data). The average sample number of co-workers was above the national mean of 3.3 staff per pharmacy,[22] which was expected as internship sites. As urban practitioners, participants mainly were addressing pets' health needs instead of other veterinary populations that require specialized veterinary pharmacists, as happens in other countries.[23]

Since the mid-1970s' there have been concerns that pharmacists' do not possess the necessary expertise to dispense veterinary medicines to their animal patients correctly.[7, 24–26] These gaps in veterinary pharmacy readiness were also found in this study. Around one-third of the participants have mentioned not having attended any veterinary pharmacy training adding to a reported self-perception of under-preparation. Facing the high availability of veterinary medications at community pharmacies, this contrasts with the expected high level of preparation for human medications, e.g. antibiotics stewardship.[27, 28] The knowledge gap was confirmed through clinical case scenarios: although not completely underprepared, participants were not fully equipped for everyday situations.[18] The sample was comprised of internship tutors and interested professionals, most with further undergraduate educational responsibilities and opinion leaders; thus, the present findings suggest overall a discouraging outlook. Moreover, there were changes in veterinary prescriptions comprising POMVs dispensing. Changes to prescriptions without veterinarian consultation can raise concerns to animals' health and wellbeing, knowing animals are also subject to drug adverse events,[29] thus bringing potential unwanted outcomes, including legal liability. As with human medication, changes are only duly justified in special situations such as with strength and/or dosage forms replacements to cover market shortages in emergency situations. Additionally, prescription changes might have an impact on the inter-professional working between veterinarians and pharmacists, a subject that requires further research.

One main reason for lower readiness in veterinary pharmacy is the lack of training during undergraduate education, also found in other countries such as the UK and the USA.[2, 14] The lack of veterinary undergraduate education can be confirmed when browsing the syllabus of pharmaceutical degrees in Portugal. O'Driscoll et al. found that most pharmacists considered university education as the best way to acquire the necessary training, which could later be augmented by experience gained through inter-professional working and other means.[7] The present findings point to a preference in receiving training in animal health and veterinary medication after graduation through continuous education. According to a previous study, implementing an educational program can increase pharmacists' knowledge to care for animals safely.[15] Previous experiences with online courses on veterinary therapeutics for undergraduate training, has proven to be an effective education method.[30]

As well as with human medications, POMVs dispensing in pharmacies should be subject to best practices.[31] The most common rule is to comply with the prescribed information. If changes are needed, the pharmacist needs to ensure all active substances, dosage, route of administration, frequency, and treatment duration are retained unchanged. Few changes for active substances were admitted by participants, which underpins caution for potential hazards to animals' health based on the pharmacists' paucity of information and training. However, brand changes happen, even if there is not a generic market for veterinary pharmacy. These changes are regarded as a straightforward way to help the animal owner overcome medication shortages or price differences. Good practice recommends changes

to be confirmed first with the prescribing veterinarian, as with physicians for human prescriptions, and subject to legal liability if not duly justified. However, tracking these events is not practical due to the use of non-normalised or validated veterinary prescriptions for pets.

The propensity to independent prescription changes was studied in this sample. Findings showed a stronger likelihood for changes made by male professionals having two decades of professional experience and working in pharmacies with constant POVMs availability. Gender and years of practice are non-modifiable factors, whereas the stock of POVMs in the pharmacy is. However, limiting the stock of POVMs does not seem a feasible approach, particularly when compared to education initiatives and a better role definition.[15, 23, 32] An additional explanation for independently modifying prescriptions relates to the regular use of human medication in animals, often through cheaper generic drug substitution. However, these changes are not exempt from the risk of negative outcomes.[29] Pharmacists' awareness of such risks may increase if there is further education with direct animal contact, proving to improve pharmacists' caring abilities.[33, 34] This training would probably require veterinary schools' participation, which can also improve professionals' cooperation and interprofessional education.[12, 35]

Attending pharmacy-based training or continuing education programs were not significant predictors of reducing veterinary prescription changes. Nevertheless, a significant association was found between professionals' non-academic preparation and independent dispensing decisions. Again, this may be related to a professional routine where medicine dispensing is the most common task.[36] Additionally, veterinary sales representatives usually o visit prescribers in their practice sites and not necessarily dispensing pharmacists,[37] who might miss the update of veterinary drugs information.

Finally, there is an underlying tension between pharmacy and veterinary professions related to veterinarians' medication dispensing in their clinics: veterinarians are the unique health practitioners allowed to dispense veterinary medication, competing with community pharmacies, while pharmacists' want to exert control over all marketed medications.[38] Moreover, veterinarians perceive the roles of pharmacists in veterinary health as being medication compounding specialists rather than having a counselling role to pet owners.[39] Thus, pharmacy professional organizations and educational institutions should first implement robust practice procedures and comprehensive education in veterinary pharmacy before claiming additional animal healthcare roles. Additionally, mechanisms for inter-professional working between veterinarians and community pharmacists should be approached and implemented.

Study limitations

The results from this cross-sectional survey do not represent the Portuguese community pharmacists' population. Differences in veterinary pharmacotherapy competencies are expected between a sample of mostly urban pharmacists with internship tutoring responsibilities and other practitioners, e.g. in rural areas.

As with any self-administered questionnaire, items replies were subject to participants' motivation and accuracy. Although participants could be more engaged in FFULisboa initiatives, response bias is expected from our participants, spanning from less honest replies to memory limitations. Retrospective questions often give rise to recall errors. Therefore, they can lead to underreporting and over-reporting, which can be aggravated by the length between the events occurrence and reporting (retention interval) and the period to which the question refers (reference period). Also, PMOVs recommendations may have been underestimated based on disclosing less commitment to practice's legal aspects. Nevertheless, to all participants, full anonymity was guaranteed.

Conclusions

Pets have a substantial presence within most households around the world. Pharmacy professionals, working at the community level, often face requests from animal owners. This study found gaps in general veterinary pharmacotherapy knowledge in a sample of practising pharmacists, also involved in students' tutoring, suggesting veterinary pharmacy to be an overlooked practice. Though propensity to take risks with animals' wellbeing varies with practitioners' experience, including direct counselling and prescription changes, the knowledge gaps were extensively recognized by the participants, thus suggesting business pressures in current practice.

Measures to overcome less prepared pharmacy work routines include developing communication channels with the veterinary prescribers and the improvement of competencies by formal education means. Faculties of Pharmacy and Veterinary sciences and professional organizations in both professions should cooperate to offer competitive courses while avoiding anecdotal learning and unsafe practices.

Author contributions

RD collected the data, performed data analysis and drafted the paper. AML conceived and designed the study, contributed to data analysis and reviewed the paper. BSB revised the paper critically for important intellectual content. AC contributed to conceived and designed the study, data analysis, paper writing and paper revision for accuracy and completeness. All authors contributed to the work integrity and approved the version to be published.

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Conflict of Interest

The Author(s) declare(s) that they have no conflicts of interest to disclose.

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