ASSESSMENT OF PRESCRIPTION PATTERNS OF VETERINARY DRUGS IN GONDAR, NORTH WEST ETHIOPIA

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✎Supporting Information

ABSTRACT: Veterinary drugs play an important role in the control and prevention of animal disease, but have the potential to cause harm if not used rationally. Irrational prescription of drugs is a common occurrence in veterinary clinical practice. To evaluate the prescription patterns of veterinarians and animal health workers in Gondar town of three veterinary clinics, Northwestern Ethiopia. A retrospective study was conducted using a systematic random sampling method of 1000 patient's encounters. Data were collected from prescription and case books retained in the clinic for the last two years. Average number of drugs per encounter in these health facilities was 1.291. Generic prescribing was low at 88.40% while encounters with antibiotic prescription were high at 44.4%. About 98.20% of prescribed drugs were listed in the national veterinary drug list while 64.4% of encounters had at least one injection prescribed. The most commonly prescribed drugs were Albendazole 330(25.6%), Oxyteteracycline 243(18.8%), Ivermectin 157(12.16%), Penicillin and Streptomycin fixed combination 133(10.3%), Acaricides 108(8.3%), vitamin supplements 77(6%), and other drugs including gastrointestinal stimulants, Anti-acids, anti-inflammatory drugs, lubricants and anti-foaming agents 243(18.8%). Among a total of 1000 animal patient encounters, only 158(15.8%) prescription contain name of the prescriber, while 128(12.8%) of prescriptions have signature of the prescriber and 109(10.9%) of prescriptions contained qualification of the prescriber. The prescribing practices for antibiotic, genetic drug and injection shows deviation from the standard recommended by WHO, so it should be improved. On the other hand, polypharmacy, generic prescribing and prescribing from Ethiopian veterinary drug list were not found to be a problem in this study. Further comprehensive studies on medication error are necessary to investigate the scale of problem and their economic impact.

Keywords: Assessment, irrational drug use, Prescription, Rational veterinary

INTRODUCTION

The rational use of drugs requires that "patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements for an adequate period of time, at the lowest cost to them and their community" (WHO, 1987). The irrational use of drugs is a problem, and to manage it the World Health Organization (WHO) convened an international conference in Nairobi, Kenya, in 1985 to develop useful guidelines (FMHACA, 2012).

Before activities are started to promote rational drug use, an effort should be made to describe and quantify the situation. Several well-established survey methods are available for this purpose. One assessment method is a prescribing and patient care survey using the WHO health facility drug use indicators. These quantitative indicators are now widely accepted as a global standard for problem identification and have been used in over 30 developing countries (Laing and Hogerzeil, 2001).

The irrational use of drugs is a major problem in present day clinical practices as it could result in toxicities and treatment failures in patients and in the emergence of drug resistant pathogens (Bisht et al., 2009). Whilst drug resistant bacteria were traditionally acquired in hospitals due to high antimicrobial use and disease transmission rate, community acquired drug resistant bacteria are becoming increasingly common (Nelson et al., 2009). Resistance may escalate to the point at which the efficacy of drugs will no more be predictable and infections once treatable could become untreatable (Morley et al., 2005).

Prescription writing is an art as it reflects the instructions given by the prescriber to the patient. Irrational prescription of drugs is a common occurrence in clinical practice. The cost of such irrational drug use is enormous in terms of both scarce resources and the adverse clinical consequences of therapies that may have real risks but no objective benefits (Ramsay, 1993). Improper prescribing habits lead to ineffective and unsafe treatment, exacerbation or prolongation of illness, distress and harm to the patient and higher costs. They also make prescriber vulnerable to influences which can cause irrational prescribing. Important reasons of irrational drug prescription are

lack of knowledge about drugs, unethical drug promotions and irrational prescribing habits of clinicians (de Vries et al., 1994).

Monitoring of prescriptions and drug utilization studies can identify the problems and provide feedback to prescribers so as to create awareness about irrational use of drugs. Variations in types of drugs used and in the way they are used is considerable even when comparing small adjacent areas and in comparing veterinarians working within same area. Drug utilization reviews (DURs) are useful for obtaining information about drug usage patterns and for identifying high cost drugs, which are of economic interest (Pradhan et al., 1988). Thus, appropriate drug utilization is essential in achieving quality of health and medical care for animal patients.

Worldwide, more than half of all medicines are prescribed, dispensed, or sold improperly, and 50% of patients fail to take them correctly. Moreover, about one third of the world's population lacks access to essential medicines (WHO, 2002).

A survey conducted in southern Ethiopia that investigated the prescription patterns of drugs concluded that irrational prescribing, as evidenced by high average number of drugs prescribed per encounter, high percentage of injections, and high percentage of antibiotic use, was prevalent in the studied region (Debalto et al., 1991). However, another study found good signs of rational drug prescribing at Jimma Hospital, south west Ethiopia (Abdulahi and Shiferaw, 1997). A prescription written by a veterinarian or an authorized person is a reflection of his attitude to the disease and the role of drug in its treatment. It also provides an insight into the nature of the health care delivery system (Ravi et al., 2002). Setting standards and assessing the quality of care through performance review should become part of everyday clinical practice (Sharif et al., 2008). Hence, this study was aimed to assess the prescriptions in the context of their adherence to prescription format and rationality of prescription

Most studies on prescription practice focus on medical health institutions. Studies on the evaluation of prescription pattern among clinicians in veterinary medicine in the country, particularly in northern part of Ethiopia is lacking to our knowledge. In this part of the country, data about drug usage patterns is not satisfactory especially in veterinary drug prescription pattern. It is essential to define prescribing pattern and to identify the irrational prescription habits to recommend a science based remedial message to the prescribers. So, the present study was planned to assess the prescription pattern in veterinary clinics of Gondar, northwest Ethiopia.

MATERIAL AND METHODS

Study setting

The study was conducted in three veterinary clinics which are found in Gondar. Gondar is one of the most historical places which found 727 km far from the capital city of Ethiopia. The study was conducted from March first to May 30, 2016. The town consisted of three public veterinary clinics.

Study population

All prescription papers which were filled for the past two years in three public veterinary clinics the prescription papers were systematically selected from drug prescriptions retained at the dispensary of each veterinary clinic.

Study design and methods

A retrospective and cross-sectional study was carried out in 3 veterinary clinics namely Azezo town veterinary clinic, Gondar town veterinary clinic and University of Gondar veterinary clinics a minimum of 250 prescriptions per facility were obtained from subsequent animal patient encounters in these selected veterinary clinics. The data were collected by principal investigator after obtaining necessary orientation and guidance from the advisor how to collect data on prescribing indicators retrospectively by using prescriptions and prescription registration books. The samples were selected using a systematic random sampling method.

One thousand prescriptions that contain the animal's characteristics (age, sex, breed, body condition, clinical signs and symptoms observed), disease diagnosis treatment (name, empiric or physical clinical examination and confirmatory laboratory tests used), prescribed drugs (type, dose, strength, frequency, route of administration, dosage form, duration of treatment, drug withholding period, naming (generic or brand), number of drugs prescribed, prescriber's signature, level of education and name of prescriber were collected retrospectively from more than 12,000 prescriptions written for the last 2 years (from February 01, 2014 to January 01, 2015). The availability of both veterinary standard treatment guidelines (STG) and Ethiopian veterinary drug list (EVDL) in the clinic was also observed.

The specific types of data necessary to measure the prescribing indicators were recorded for each patient encounter and entered directly into an ordinary prescribing indicator form then transferred to excel 2007 version. A prepared format (Annex II) was used to check whether the following information's were written or not in the prescription.

❖ Information about animal patient

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- ❖ Information about drug
- ❖ Information about prescriber
- ❖ Information about animal owner

Data management

There was no available guideline for prescribing indicators used in veterinary medicine as a result. The WHO prescribing indicators was used to analyze the date which are listed below:

1. The average number of drugs prescribed per encounter was calculated to measure the degree of poly-pharmacy by dividing the total number of different drug products prescribed by the number of encounters surveyed.

2. Percentage of drugs prescribed by generic name was calculated to measure the tendency of prescribing by generic name by dividing the number of drugs prescribed by generic name by total number of drugs prescribed, multiplied by 100.

3. Percentage of encounters with an injection prescribed was calculated to measure the overall level use of commonly overused and costly forms of drug therapy by dividing the number of patient encounters in which an injection was prescribed by the total number of encounters surveyed, multiplied by 100.

4. Percentage of drugs prescribed from an essential veterinary drug list (EVDL) was calculate to measure the degree to which practices conform to a national drug policy as indicated in the national veterinary drug list of Ethiopia. Percentage was calculated by dividing number of products prescribed which are in essential drug list by the total number of drugs prescribed, multiplied by 100.

RESULTS

A total of 1000 prescriptions and cases from case books obtained from animal patient encounters in the 3 veterinary clinics Azezo town veterinary clinic (250) Gondar town veterinary clinic (250) and University of Gondar veterinary clinic (500) were evaluated. All the encounters had one or more drugs prescribed. A total of 1291 drugs were prescribed in the 1000 animal patient encounters evaluated with an average of 1.291 with a maximum of five drugs. The total number of drugs prescribed by generic name was 1146 which is (88.8%) of the total number. The total number of antibiotic drugs prescribed was 444 of the total animal patient encounters (44.4%) and an injection was prescribed in 644 animal patients (64.4%). Moreover this study found that out of the total patient encounters, 1267 drugs (98.14%) prescriptions were belonging to Ethiopian veterinary drug list (EVDL).

Analysis of the 1000 prescriptions revealed that demographic profile or animal and owner information of the patients was recorded in 100% prescriptions. Tentative diagnosis of the disease was mentioned in 100 % of prescriptions. While assessing the components of the prescription, the superscription (symbol Rx) was present in 100% prescriptions.

The dose of the drug was recorded in 94.6% of the prescriptions. The route of drug administration was mentioned only in 21% of the prescriptions and the frequency of drug administration was also mentioned in only 4.7 % prescriptions. The dosage form of the drug was mentioned only in 16.4% of the total prescriptions. In addition to the above prescription components, the duration of treatment was specified in 70.4% prescriptions. None of the prescriptions above was writing drug withholding period. All animal patients admitted to Gondar town Veterinary clinic, Azezo town veterinary clinic and university of Gondar veterinary clinic were treated empirically without definitive diagnosis or laboratory examination. Among a total of 1000 animal patient encounters, only 158 (15.8%) prescription contain name of the prescriber, while 128 (12.8%) of prescriptions have signature of the prescriber and 109 (10.9%) of prescriptions contained qualification and name of the prescriber (Figure 1).

Out of the total 1291 drugs prescribed, the most commonly prescribed drugs were; 243 (18.8%) was oxyteteracycline, 133 (10.3%) was penicillin and streptomycin fixed combination, 157(12.16%) was ivermectins, 330 (25.6%) was albendazole, 108 (8.3%) was acaricides, 77 (6%) vitamin supplements, and 243(18.8%) other drugs including gastrointestinal stimulants, antiacids, anti-inflammatory drugs, lubricants and anti-foaming agents (Table 2). In all of three veterinary clinics none of them had the Ethiopian veterinary drug list and drug formulary

Table 1 - Summary of prescribing indicators in three veterinary clinics of Gondar from 2014 to 2015.

Prescribing indicators assessed	Total number of drugs	Average/percent
Average number of drugs encountered	1291	1.291
Percentage of encounters with antibiotics	444	44.4%
Percentage of encounters with injections	644	64.4%
Percentage of drugs prescribed by generic name	1146	88.8%
Percentage of drugs from Ethiopian veterinary drug list	1267	98.14%

S. No.	Prescription components	Total encounters	Percentage
Table 2 - Percentage of prescriptions with prescription components (n=1000)			
1.	Prescriptions with demographic parameters of animal patients and owners information	1000	100%
2.	Prescriptions with Rx or treatment mentioned	1000	100%
3.	Prescriptions with diagnosis mentioned	1000	100%
4.	Prescriptions with route of drug administration mentioned	210	21%
5.	Prescriptions with dose of drug mentioned	946	94.6%
6.	Prescriptions with frequency of drug administration mentioned	47	4.7%
7.	Prescriptions with dosage form mentioned	164	16.4%
8.	Prescriptions with duration of treatment mentioned	704	70.4%
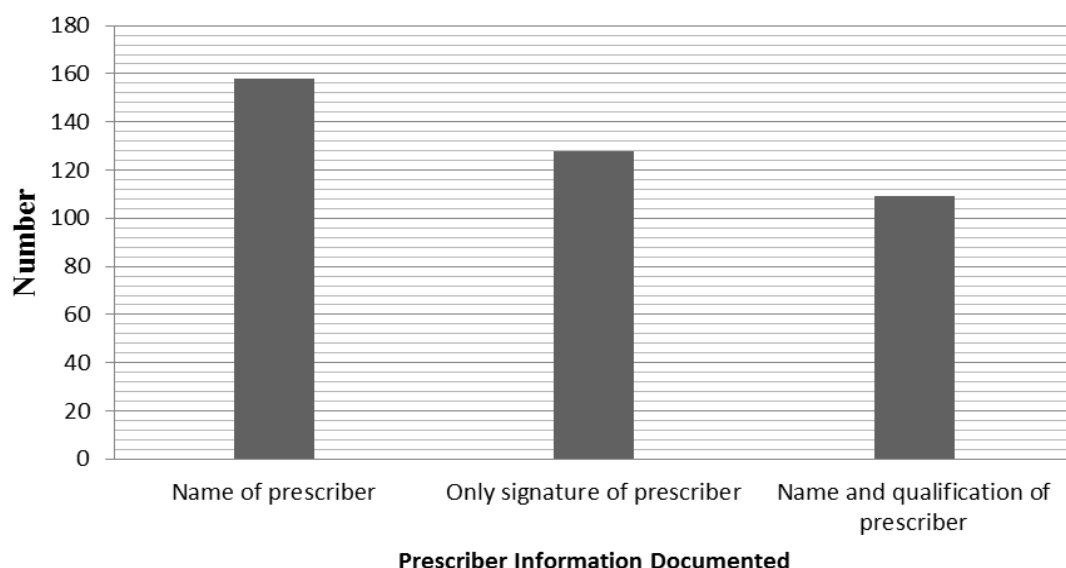
Figure 1 - Results of prescriber information in three veterinary clinics of Gondar from 2014 to 2015 (n=1000)

Therapeutic agent class	Frequency	Percentage of total
Table 3 - The most commonly prescribed antimicrobials and antihelmintics at three veterinary clinics of Gondar from 2014 to 2015 (n=1291).		
Antimicrobials		
Oxytetracycline	243	18.8%
Penicillin-streptomycin combination	133	10.3%
Sulphamethoxazole trimethoprim Combination	37	2.8%
Procaine penicillin	19	1.47%
Mammary infusion	12	0.93%
Antihelmintics		
Albendazole	330	25.56%
Ivermectin	157	12.16%
Diazinon	108	8.3%
Triclabendazole	31	2.4%
Fenbendazole powder	18	1.4%
Others		
Amprolium hydrochloride	26	2%
Vitamin supplement	77	5.96%
Diminazene aceturate	25	1.93%
Dexamethasone	21	1.6%
Digestion powder	16	1.24%
Liquid paraffin	15	1.12%
Vegetable oil	9	0.7%
Ecthammol	9	0.7%
Sodium bicarbonate	5	0.4%
Total	1291	100%

DISCUSSION

A prescription written by a veterinarian or an authorized person is a reflection of his attitude to the disease and the role of drug in its treatment. It also provides an insight into the nature of the health care delivery system (Ravi et al., 2002). Setting standards and assessing the quality of care through performance review should become part of everyday clinical practice (Sharif et al., 2008). In this study, majority of the prescriptions adhere to the ideal pattern of prescription writing with regards to important demographic parameters of animal identification and owner's information. The name, age, sex and address of the patient were written in 100% of the prescriptions in the present study indicating that the clinicians adhere to the pattern of prescription writing. This is in line with a study done in central part of Ethiopia which also indicated that most of the prescriptions were having demographic parameters (Beyene et al., 2015).

These parameters are important as they help to establish the animal patient's identity and also help in tracing the patient during the follow up visits. A brief note about the diagnosis of the disease is also helpful to the pharmacist to ensure that the drugs prescribed are appropriate for the patient's condition. In the present study, diagnosis was mentioned by the clinicians in 100% of the prescriptions although most were based on empirical or tentative diagnoses. The prescription of drugs using merely empirical or tentative diagnoses is one contribution to an irrational drug use as the wrong drug can be administered while the diagnoses can be another disease. This is because several diseases can have similar clinical signs, especially those infectious and febrile diseases (Beyene et al., 2015).

In this study the percentage of dosage form, frequency, duration of drug therapy and its route of administration were 16.4%, 4.7%, 70.4%, 21% respectively out of the total prescriptions. The dose of the drug that has to be administered was specified in 94.6% of the prescriptions. This figure is quite higher as compared to other studies where dose was mentioned in only 80% of the prescriptions in a study conducted in Jammu (Sharif et al., 2008). With respect to route of administration, the route of drug administration was mentioned in 21% of the total prescriptions in this study. Our finding is in contrast to a result from a study conducted in central Ethiopia where it was found that route of drug administration were not mentioned in 98.9% prescriptions (Beyene et al., 2015). The duration of treatment was specified in 70.4% of the total prescriptions in the current study. On the other hand our result was higher than the result of a study carried out in adama veterinary clinic where duration of treatment was mentioned only in 6.5% of the total cases (Beyene et al., 2016). This study revealed that directions regarding the duration of drug therapy were verbal. Such practices should be corrected.

The WHO prescribing indicators have provided a reproducible and objective measure of characterizing prescriptions by clinicians. This study reveals areas of irrational prescribing that needs to be corrected with intervention programs or by work trainings. Whilst the WHO guidelines on rational use of drugs had reference values of (1.6 - 1.8) drugs per encounter, the average of 1.291 drugs prescribed per patient encounter as seen in this study is comparatively low this may be occur due to absence of some drugs in the veterinary clinics or may be due to rational prescribing of the veterinarians.

However, this low average number is similar to those of public health institutions in the same setting, suggesting the therapeutic tradition in the regions. Sharif et al. (2008) reported a 2.2% average drug prescription in Ghana while in central Ethiopia a research which have been done on "evaluation of rational use of veterinary drugs especially antimicrobials and anthelmintics" the average number of drugs per prescription at CVMAVTH and Ada district veterinary clinic was 1.23, (Beyene et al., 2015) which indicates the absence of poly-pharmacy. Their result is almost the same as the result of the present study (1.21). Poly-pharmacy provides a fertile ground for drug-drug interactions, toxic effects and incurs high cost treatment and should be discouraged in clinics where it is apparent.

Although there is no other study on veterinary drug prescription pattern, when we see reports of studies performed on human subjects in contrast to our study, the study done in southwest Ethiopia, Jimma Hospital, has shown that the average number of drugs per encounter was 1.59 (Abdulahi et al., 1997). Additionally, in other study conducted in three hospitals in north Ethiopia, the average number of drugs per patient was 0.98 at Gondar Hospital, 1.8 in Bahir Dar Hospital, and 2.2 in Debre Tabor Hospital. A high average number of drugs on humans might be due to financial incentives to prescribers to prescribe more, lack of therapeutic training of prescribers, or shortage of therapeutically correct drugs. The low values might mean there is constraint in the availability of drugs, or prescribers have appropriate training in therapeutics (Anteneh, 2013).

Low generic prescribing is seen in this study as compared with WHO standard as it should be 100%, as the result of our study is 88.76% only had drugs prescribed by their generic name. In a study conducted in Nigeria, almost 100% of the prescriptions in the name of generic drug were reported; although only 50% of the prescriptions were correct according to the standard treatment guidelines (Mallet et al., 2001). Another study carried out at a non-governmental organization in India reported that 46.2% of the drugs were prescribed by generic name, but 45.6% of the prescribed drugs were irrational drug combinations, while similar studies conducted in central Ethiopia Bishoftu reported that the percentage of veterinary drugs prescribed by generic name was 90.1% which is less than the standard derived to serve as ideal (100%) (Beyene et al., 2015). In contrast to our finding in the study conducted in

12 developing countries (human subject), the percentage of generic drugs prescribed was low in Nigeria (58%) and Sudan (63 %) but encouraging in Tanzania (82 %) and Zimbabwe (94 %) (Bimo, 1997).

Antibiotic resistance among pathogenic microorganisms is a matter of worldwide concern. Antibiotics are among the most commonly prescribed drugs in veterinary clinics and hospitals and in developed countries around 30% of the hospitalized patients are treated with these drugs (Van der and, Gyssens, 2001). In the present study, antibiotics were prescribed in 44.4% of the total prescriptions in contrast to a WHO standard for human medicine 20% to 26.8%, but it was almost similar to a research done by Beyene et al. (2016) who reported that number of antibiotics were 46.4%. In contrast, a study conducted in Nigeria reported that the majority of prescriptions (83.5%) contained antibiotics. Similarly, in a study conducted in Jordan, the percentage of prescriptions involving antibiotics averaged 60.9% which is high when compared to our study. In a related study in a private hospital in Dubai, the findings of 21.4% antibiotics prescription was much lower than that of this study (Sharif et al., 2008).

In related study conducted in central Ethiopia the percentage of encounters in which antibiotics and anthelmintics were prescribed at CVMA-VTH and Ada district veterinary clinics were 54.4 and 38.9 %, respectively, which were nearly similar to our study (Beyene et al., 2015). The high percentage of antibiotics prescribed in this study setting may be due to inadequate diagnosis and recognition of the disease, unavailability of diagnostic aids for confirmatory tests, absence of alternative drug, prescriber's belief of the therapeutic efficacy of the antibiotics is low and inadequate prescribers knowledge.

Unsafe use and overuse of injection play an important role in transmission of very serious blood-borne infections. In the present study, injections were prescribed in 64.4% of the total prescriptions which is higher than the standard (13.4%-24.1%) derived to serve as ideal (Hazra et al., 2000). Possible reasons for the high use of injections could be beliefs and attitudes of animal owners and health professionals about the efficacy of injection versus oral medication. A national baseline study on drug use indicators in Ethiopia in September 2002 found the percentage of encounters with an injection to be 23%, which is lower than our finding (64.4%). In a prescription pattern study in 12 developing countries, the percentage of encounters in which an injection was prescribed was high in Uganda (48%) and Sudan (36%) but very low in Zimbabwe (11%), and in the acceptable range in Indonesia (17%), Ecuador (17%), and Mali (19%) (Bimo, 1997). Injections are very expensive compared to other dosage forms and require trained personnel for administration. The percentage of drugs prescribed from the essential veterinary drug list was 98.14%, which is almost identical with the standard (100%) derived to serve as ideal (Isah et al., 2004). A study of the patterns of rational use of veterinary drugs in central Ethiopia revealed that number of drugs prescribed from essential veterinary drug list was 99.7% which is almost similar with our study. A study on evaluation of drug use in Jordan using WHO prescribing indicators concluded that the percentage of prescriptions involving drugs from the essential drugs list averaged 93% (Otoom et al., 2002).

CONCLUSION AND RECOMMENDATIONS

On the basis of the findings of the this study on veterinary drugs prescribing practices have showed that antibiotics are prescribed on clinical judgment of animal patient rather than taking the specimen of blood or urine for culture. Absence of standard case paper which has to contain all necessary animal related, drug and owners information of routine clinical examination and treatments, and the non-availability of both standard veterinary treatment guideline and drug formulary in the study area, could lead to irrational drug use. On the other hand, average number of drug which indicates the degree of poly pharmacy and prescribing from EVDL were not found to be a problem. The name, qualification and signature of prescribers were available in minimal number of prescriptions, so it should be improved because it leads to absence of accountability. This study reveals areas of irrational prescribing that needs to be corrected with intervention programs or by work trainings.

The result of the present study can be used by researchers and policymakers to improve drug prescribing practice in veterinary medicine. Hence, integrated cooperation between different stake- holders should be maintained to support a rational use of antimicrobials in food animals, which would ensure the effectiveness of these drugs and the safety of foods of animal origin. Based on the above findings and conclusions the following recommendations are forwarded:

❖ Veterinary medicine education in clinical pharmacology should be based on the practical needs of future prescribers, should include the principles of rational therapeutics and problem solving, and should immunize the students against the influences they are likely to encounter in their professional life.

❖ Further comprehensive studies on medication error are necessary to investigate the scale of problem and their economic impact.

❖ Sustainable interventional strategies and periodic audit at all levels of health care to avoid the negative consequences of inappropriate prescriptions should be established.

❖ Training and refresher courses should be given to prescribers on the basic principles of prescription order writing.

DECLARATIONS

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Consent to publish
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Authors' contributions
BB conceived the study, coordinated the overall activity, and carried out the statistical analysis, drafted the manuscript. EK conceived the study, coordinated the overall activity, and reviewed the manuscript. MB conceived the study, coordinated the overall activity, and reviewed the manuscript. AM participated in drafting and reviewing the manuscript. All authors read and approved the final manuscript.

Availability of data and materials
Data will be made available up on request of the primary author

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ANNEXES

Annex 1a

S no	Animal patient and owners information																						
	name		address		Spp		age		breed		sex		DX		tent DX		Conf DX		Drug with holding period				
	Yes	no	Yes	no	yes	No	yes	no	yes	o	yes	no	yes	no	yes	no	yes	no	yes	no			
1																							
2																							

Annex 1b

S. no	Drug related information																	
	Dose		Strength		Frequency		Route of administration		Dosage form		Duration of treatment		No of drugs prescribe	NO of antibiotics per encounter	No of injection per encounter	No of generic drugs	Remark	
	yes	No	yes	No	Yes	no	yes	no	yes	No	yes	no						

Annex 2

S No	PRESCRIBERS INFORMATION					
	Name of prescriber		Qualification		Signature	
	yes	no	yes	No	yes	no