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Brief Research Report

Study on the Availability and Rational Use of Veterinary Drugs in Veterinary Clinics of Haramaya and Dire Dawa Districts, Eastern Ethiopia

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ABSTRACT

Aim
The study was conducted between December 2021-June 2022 with an objective to assess the current status of veterinary drugs used in veterinary clinics of Dire Dawa and Haramaya districts using a questionnaire, personal interviews, and observations of public veterinary clinics.

Method
A total number of 40 public veterinary clinics were selected, purposively selected, and included in the study, and veterinary professionals working in each veterinary clinic were conveniently selected by using a non-probability method. The assessment methods such as descriptive drug use indicators, prescribing practices and other drug information sources and drugs of choice at health facilities were included.

Results
The results obtained were as; a majority of the clinicians (57.5%) were Bachelor of Veterinary Science (BVSc) and above. Nearly half (42.5%) of clinicians used only a verbal prescription for prescribing drugs. Oxytetracycline was available in all clinics and 32(80%) responded as it is their first drug of choice for treatment. Only 50% of the clinicians responded as they administer drugs and treat animals presented to their clinic for a definitive (laboratory investigation) diagnosis. The majority (80%) of respondents use antibacterials for prophylaxis. Major factors considered in drug selection by 92.5% of professionals amongst alternative drugs were its availability. About 98% of respondents use promotion materials or leaflets of different drugs as a source of information.

Conclusion
The study showed that the trend of using prescription papers for prescribing drugs was not enough and prescription papers did not include the relevant information that should be incorporated in drug ordering and dispensing drug prescriptions by and large based on tentative diagnosis and inappropriate drug selection were found to be bottlenecks for the successful drug treatment that leads to drug resistance. Therefore, awareness and training should be provided regularly for prescribers and end users about the proper way of drug use.

Keywords
Dire Dawa; Haramaya; Rational use; Veterinary clinics; Veterinary drugs.

INTRODUCTION

Animal healthcare necessitates the availability of safe, effective, and affordable drugs of the required quality in adequate amounts at all times. Access to affordable, quality-assured essential medicines is crucial to reducing the financial burden of care, preventing greater pain and suffering, including shortening the duration of illness, and averting needless disability and death worldwide.[1] Drug access combines three factors: availability, affordability, and rational use. In developing countries, drugs of standard quality are not available and the available drugs are not rationally used.[2]

Veterinary drugs can be used either rationally or irrationally as therapeutic, prophylactic, and growth promotion. Rational use of drugs is based on the use of the right drugs, at the right dos-

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age, right cost, and right time, which is well-reflected in the World Health Organization (WHO),[3] whereas irrational use of drugs is defined as "too many medicines are prescribed per patient, injections are used where oral formulations would be more appropriate, antimicrobials are prescribed in inadequate doses or duration, antibiotics prescribed for non-bacterial infections, prescriptions do not follow clinical guidelines and self-medicate inappropriately or do not adhere to prescribed treatment.[4]

The WHO estimates that more than half of all medicines are inappropriately prescribed, dispensed, or sold. Additionally, around 50% of patients fail to take their medicines correctly.[5] Problems like lack of information, poor communication between animal health professionals and animal owners, lack of diagnostic facilities, demand from the owners, and high burden of diseases with overlapping clinical symptoms (e.g., pain, fever, and depression are common symptoms for different conditions which require different drugs) lead to the irrational use of drugs.[6]

There are many factors that contribute to the irrational prescribing or use of medicines and can be broadly categorized into those emanating from patients, prescribers, workplaces (health systems), supply systems (including industry influence), regulation, drug information or miss information or a combination of these factors.[7,8]

Irrational prescription of drugs is a common occurrence in clinical practice.[9] Important reasons for irrational drug prescription are lack of knowledge about drugs, unethical drug promotions, and irrational prescribing habits of clinicians.[10] Drug prescription using merely empirical or tentative diagnoses is also one contribution to irrational drug use as the wrong drug can be administered while the diagnosis can be another disease. This is because several diseases can have similar clinical signs, especially infectious and febrile diseases.[11]

The irrational use of drugs is a major problem still in clinical practice as it could result in toxicity and treatment failure in patients and in the emergence of drug-resistant pathogens.[12] Resistance may escalate to the point at which the efficacy of drugs will no more be predictable and infections once treatable could become untreatable.[13]

In addition, the most common problems for the increase of antibiotic resistance in the Ethiopian situatiare on, poor dispensing, drug quality concerns, especially in rural areas, unregistered drugs and drug sellers in rural areas, low patient knowledge about drugs dispensed to, them, and weak monitoring and lack of antibiotic policy and evaluations.[14]

When veterinary drugs are indicated rationally in the right dose and route of administration, the potential damages of their use are reduced and their efficacy increased.[15] The rational use of drugs in veterinary medicine has both public health[16] and economic significance.[17] To prevent the risk of drug resistance to infections, it is necessary to use drugs rationally, i.e., to use them only when they are really indicated, in the right way, at the right time, in the right dose, and respect withdrawal periods. Additionally, it should regularly control the sensitivity to antimicrobial agents and regulate the residue of antimicrobial agents commonly used in veterinary practice.[15,18]

A prescription written by a veterinarian or an authorized person reflects his attitude to the disease and the role of the drug in its treatment. It also provides insight into the nature of the healthcare delivery system.[19] Setting standards and assessing the quality of care through performance review should become part of everyday clinical practice.[20] Advice on nutritional support and nursing care is also essential to ensure rational therapeutics.[21]

In Ethiopia, a survey conducted on human subjects at referral hospitals located in different regions of the country revealed irrational drug use is commonly practiced.[22] However, in veterinary practice, a few published reports on the rational use of veterinary drugs in the country in general, although different studies were conducted by Beyene et al[11] revealed irrational use of drugs in veterinary clinics. No available literature about the availability and rational use of veterinary drugs in eastern Ethiopia. This study may help to promote the rational use of medicine by providing important, timely information for all interested parties involved in the promotion of rational use of medicine.

OBJECTIVES

General Objectives

• This study aimed to assess the availability and rational use of veterinary drugs in veterinary clinics of Dire Dawa and Haramaya districts of Eastern Ethiopia.

Specific Obective

• To assess the availability of veterinary drugs in veterinary clinics of the study areas,
• To assess the rational use of veterinary drugs in veterinary clinics of the study areas,
• To assess prescription methods, relevant guidelines, and other drug information sources in the delivery of animal healthcare services offered in veterinary clinics in the study areas.

LITERATURE REVIEW

Uses of Veterinary Drugs

Drugs in animals can be used as in therapeutic, prophylactic, and growth promotion. Therapeutic use refers to the treatment of established infections, whereas prophylaxis is the use of drugs in either individuals or groups to prevent the development of infections. Both therapeutic and prophylactic uses involve administration of drugs by different routes at therapeutic levels for a short period of time. The use of antimicrobials as feed supplements can promote the growth of food animals and enhance feed efficiency.[23,24]

Therapeutic and prophylactic: Most drugs, around 60%, are

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used for therapeutic purposes in humans, although an increasing amount is administered as prophylaxis to prevent infection, the farming industry is the second largest consumer of antimicrobials after the medical practitioners. Depending on the action, prophylactic and therapeutic drugs may be divided into different groups. The most widely distributed drugs are antimicrobials, antiparasitic and antimycotic preparations, and their use in the prevention and treatment of animal diseases.[17]

Veterinary drug products licensed for use throughout the world do not vary greatly from country to country, although the level of use, withdrawal times accepted safe levels in food to change from country to country in almost all cases. Depending on the requirements in different countries, feedstuffs containing veterinary drugs may be available only on the prescription of a veterinarian or they may be freely available. In most circumstances, if recommended withdrawal periods are observed, the presence of unacceptable residues is not expected.[25]

The choice of antimicrobial drugs to use for the treatment of animal diseases caused by an infectious agent should be in line with the guidelines as it aids in the decision-making process. The gold standard for this determination is the result of microbiological culture. However, strict application of this standard is unrealistic because the decision to use antimicrobial drugs is made several days before culture data are available. Therefore, as an aid in determining that a particular process has infectious components, certain clues are used. The Infectious Control Committee at Veterinary Medical Teaching Hospital, University of California, has drawn up guidelines for the rational use of antimicrobial drugs which are: demonstration of an infectious agent; clinical data (at least two of the following): fever; leukocytosis; localized inflammation and radiographic evidence. The whole purpose of the exercise is to know whether there is an infectious agent present or the best antimicrobial drugs to be used.[26]

Growth Promoters: "Growth promoters (GPs)" are any antimicrobial agents administered at a low or sub-therapeutic dose and destroy or inhibit the growth of microbes as infectious agents reduce the yields of food animals.[27] Antibiotic GPs are used to help grow animals by increasing the rate of weight gain to improve feed conversion efficiency and get the maximum benefit from it and allow them to develop into a strong and healthy individual.[23,28]

Although the mechanism underlining their action is unclear, it is believed that the antibiotics suppress sensitive populations of bacteria in the intestines. It has been estimated that as much as 6% of the net energy in the pig diet could be lost due to microbial fermentation in the intestine. If the microbial population could be controlled, it is possible that the lost energy could be diverted to growth.[28]

It is also hypothesized that cytokines released during the immune response as a result of bacterial infection may stimulate the response of catabolic hormones, which could reduce muscle mass. Therefore, a reduction in gastrointestinal tract (GIT) infection would result in a subsequent increase in muscle weight. Whatever the mechanism of action, the results of the use of GPs are resulting in the meat of better quality, with less fat and increased protein content.[27]

Method of Veterinary Drug Use

Rational drug use: Rational use of drugs is based on the use of the right drug at the right dosage, right cost, and right time which is well-reflected in the WHO. The promotion of rational drug use involves a wide range of activities such as adaptation of the essential drug concept, continuous training of health professional, and the development of evidence-based clinical guidelines. Unbiased and independent drug information, consumer education, and regulatory strategies are also vital to promote rational drug use.[29]

Irrational drug use: Irrational use of a drug means misuse of drugs by the patient (i.e., patients receive medications inappropriate to their clinical needs, under or over dosing that meet their own individual requirements, and for an inadequate period).[30] Irrational drug use causes particular concern for the development of resistance. The antimicrobial drug is now becoming a major problem both in veterinary and human medicine as a consequence of the intensive use and misuse of antimicrobial drugs.[31] There is a despread misuse of permitted drugs which results in unwanted residues in foods of animal origin. Moreover, there has been a widespread failure to observe the recommended withdrawal and withholding period for antimicrobial agents.[32]

Irrational prescribing can arise as a result of several internal or external factors. For instance, a prescriber-related factor is one of the major reasons for the irrational use of drugs. The prescriber may lack adequate training, or there may be no adequate continuing education, resulting in the reliance on outdated prescribing practices which may have been learned while under training. The lack of opportunities for on-job continuing education is a challenge faced by many health professionals in resource-poor countries.[8,33] Besides, not explaining to patients how to take their medicines, economic incentives where prescribers gain income from dispensing or selling the medicines they prescribe.[34]

Reason for irrational use of drugs: Problems like lack of information, poor communication between health professionals and animal owners, lack of diagnostic facilities, demand from the owners, and high burden of diseases with overlapping clinical symptoms (e.g., pain, fever, and depression are common symptoms for different conditions which require different drugs) lead to the irrational use of drugs.[6] Important reasons for an irrational drug prescription are lack of knowledge about drugs, unethical drug promotions, and irrational prescribing habits of clinicians.[10]

Impacts of irrational use of drugs: The impact of irrational drug use can be enormously harmful in different aspects. First, it can affect the quality of treatment and care in various ways. For example, when an oral rehydration solution is underused for pediatric acute diarrhea, then dehydration may not be corrected and thus the mortality rate may increase. Another example is if an antibiotic is not given before surgery, which indicates preoperational infection prophylaxis, then the risk of postsurgical infection may rise. On the other hand, irrational prescription of antimicrobials can

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be a risk for treatment failure due to the emergence of resistance. This may also lead to another result of irrational drug use, that is, adverse drug reactions like renal impairment or exacerbating the patient's condition, or causing iatrogenic disease. Consequently, this will prolong hospitalization or lead to mortality. Together with these consequences, antimicrobial resistance will limit the choice of treatment and increase the pressure on expensive antimicrobials resulting in resources and money wastage.[35]

Irrational use of drugs can have a negative impact on public health, some of them are as follows: it could result in toxicity and treatment failure in patients and in the emergence of drug-resistant pathogens.[12] Resistance may escalate to the point at which the efficacy of drugs will no more be predictable and infections once treatable could become untreatable.[13]

Examples of Irrational Drug Use

Polypharmacy: Polypharmacy occurs in any of the two scenarios. First, by prescribing more than one medication to treat one condition. Second, by prescribing more than one medication of the same chemical class or with a similar mechanism of action to treat different conditions. In addition to these scenarios, a patient may contribute to polypharmacy by self-medication, visiting different clinics, or byusing over-the-counter (OTC) alternative medicines that in many cases the physician is unaware of.[36]

No utilization of therapeutic guideline: When no therapeutic guideline is implanted in an institution or there is unjustifiable deviation and non-adherence to the institutional guideline, then the drug may be used irrationally. A simple example is when a guideline recommends the use of an oral rehydration solution for acute diarrhea in children and the physician prescribes an antibacterial instead. In this instance, the prescriber underused the effective drugs and abused each other when it is not needed. Moreover, the use of metronidazole in combination with *carbapenems* or *pipiperacillin-tazobactamo* empirically cover anaerobic bacteria in aspiration pneumonia is an example of guideline non-adherence and a reason for polypharmacy that creates irrational drug use. Moreover, using prolonged or shorter duration of antimicrobial guideline recommendations may be considered irrational drug use. Lastly, the use of ineffective or no recommended drugs such as multivitamins can be an example of guideline deviation and irrational drug use.[37]

Excessive use of injections: Exaggerated use of injections may be because the prescriber or patients usually think they are more potent than oral forms. However, many medications are with oral bioavailability similar to their injectable form and have proven to be effective and safe. This irrational drug use may be a source of resource wastage. Moreover, excessive injection use may be a risk for infection.[37]

Significance of Rational Veterinary Drug Use

The rational use of drugs in veterinary medicine has public health and economic significance.

Public health significance: No significant reported episodes of adverse human health effects occurred in food when veterinary drugs were used at the correct dosages and at the levels permitted.[16]

Improve food safety concerns: When drugs are indicated rationally for food animals, the potential adverse effects of their use as a result of consumption of animal products. However, when irrational use of drugs used on food producing animals, there is the possibility that minimal quantities of drug residues which remain in animal products and induce certain harmful effects in people as potential consumers of such food.[15]

Reduce the development drug resistance: Human health can be affected by a widespread range of antibiotic resistance to pathogens, as it is occurring due to extensive overuse of antibiotics, as well as their use in under therapeutic dosages.[38] Resistant microorganisms can get access to human, either through direct contact or indirectly *via* meat, milk, and egg. As bacteria, the endogenous flora of a food animal, contaminated food of animal origin, might either colonize human or transfer the resistant genes to humans endogenous flora or super impose an additional load to the reservoir of resistant genes already present in man.[39] Rational use of drugs can also significantly minimize the risk of microorganisms resistance development (in case of antimicrobials). Hence, no significant reported episodes of adverse human health effects occurred in food when the veterinary drugs were used at the correct dosages and at the same levels.[16]

Reduce the development of drug residues: The residue of veterinary drugs is one of the major problems of food contamination. Human health can be affected by residues of drugs in food of animal origin, which may cause direct side effects. In general, the effect of antibiotic residues in food of animal origin is significant when compared with the antibiotic misuse or selection and amplification of antibiotic-resistant strains of bacteria.[27] Food of animal origin, such as meat, milk, and eggs intended for human consumption, may have some residual amount of veterinary drugs which remain in edible tissues after harvest.[40] Generally, there is no significant reported episode of adverse human health effects that occurred in food when the veterinary drugs were used at the correct dosages and at the levels permitted.[16]

Economic Significance

The widespread availability and use of antimicrobials have several negative implications on global healthcare: among these developments, drug resistance is one. The primary economic implications of resistance on the diminishing efficacy of antibiotic treatment include the need to rely on more expensive drugs that may be practically unaffordable for most primary healthcare programs.[17] Antimicrobial residue remains very significant in the perspective of international trade and consumer confidence because it results in an international trade barrier. As tariffs are removed and goods flow freely between countries, importing countries must be confident that goods available for purchase are safe, and in addition to this, from time to time, there is pressure to use antimicrobial residues on nontariff barriers to importation. Major economic losses and animal welfare problems could arise in veterinary medicine because antimicrobial resistance has been found to cause therapy failure

and higher mortality and morbidity rates.[24]

Measures to Promote the Rational Veterinary Drug Use

Regulation of veterinary drugs: Government regulatory agencies have the crucial responsibility of ensuring that only safe, effective, high-quality, well-manufactured and properly labeled veterinary drugs are available in the marketplace for use, and that unsafe and ineffective products, such as counterfeit and illegally compounded medicines, are not available.[41] Adequate drug legislations and regulatory tools, such as policies, proclamations, standards and guidelines, appropriate organizational structure, good cooperation between different regulatory bodies and other law-enforcing bodies (e.g., trade, customs, and police) sufficient qualified and experienced human resources, adequate and sustainable financial resources, and transparency and accountability combined with good management are essential for effective drug regulation.[42,43]

Adhering to the withdrawal period: The withdrawal time (also known as the depletion or clearance period) is the time for the residue of toxicological concern to reach a safe concentration as defined by the tolerance. Depending on the drug product, dosage form, and route of administration, the withdrawal time may vary from a few hours to several days or weeks. It is the interval necessary between the last administration to the animals of the drug under normal conditions of use and the time when the treated animals can be slaughtered or the production of safe foodstuffs.[24]

To ensure that drug residues have declined to a safe concentration following the use of drugs in animals, a specified period of drug withdrawal must be observed prior to providing any products for human consumption. Drug withdrawal time is the time required for drug residues to reach a safe concentration for human or animal consumption and is defined as the maximum residual limit (MRL). Failure to follow the recommended withdrawal time is often implicated in residual problems.[44] It is advisable to follow the recommended withdrawal time to avoid residual effects of drugs in the food of animal origin; that is, we have to check and observe the withdrawal period laid down for the particular medicine and food animals should not be sold for slaughter or slaughtered before the end of the withdrawal period.[45]

Minimizing misuse of antimicrobials: This is achieved by different strategies. These are: education of prescribers and dispensers (including drug sellers); education of farmers to create awareness; limiting the availability of antimicrobials by prescription; ensuring that only antimicrobials meeting international standards of quality, safety, and efficiency are granted marketing authorization; establishing and maintaining updated national standard treatment guidelines; developing guidelines for veterinarians to reduce overuse and misuse of antimicrobial in food animals and enhancing immunization coverage and other preventive measures, thereby reducing the need for antimicrobial.[45] WHO came out with twelve core interventions to promote more rational use of medicine. Some of them are: public education about medicine; clinical guidelines; appropriate and enforced regulations; supervision, audit, and feedback; independent information on medicine, and problem-based pharmacotherapy training in the undergraduate curriculum.[5]

Alternatives for antimicrobial growth promoters: Essentially, there are many ways by which we can reduce our dependence on antibiotic use in animals. Developing an alternative to antibiotics that work *via* similar mechanisms, promoting growth While enhancing feed conversion efficiency, is the best option. A more difficult route would be to improve animal health. Growth promoters have been shown to perform best when the condition is worst, that is, when the animal is in poor health and the living conditions are unhygienic; if their local environment is improved with overcrowded reduced and injection control technic is introduced, then the actual need for growth promoters may be removed.[46]

MATERIALS AND METHODS

Description of the Study Area

The study was conducted at Dire Dawa and Haramaya district. Dire Dawa is located approximately between latitude 9°27' and 9°49' North and longitude 41°38' and 42°19' East. It shares boundaries to the south, southeast and southwest with Eastern Haraghe zone of the Oromia regional state and to the north, northeastern and west with Shinile zone of Somalia regional state. There are two farming systems, namely, mixed and agro-pastoral are noted in the rural area. Majority of agro-pastoral (a production system in which there they practice growing crops and raising animals) and pastoral areas (relying only raising animals) located in the northeastern lowlands with rainfall that does not favor crop production. There are 16 peasant associations under this category. The mixed farming areas dominate the southeastern part of the region and are better in crop farming. The rest 22 Keble (peasant associations) are found in this agro ecological zone. In 2003, the livestock population of Dire Dawa Administration was estimated to have 37,126 cattle, 64,370 sheep, 112,065 goats, 7,513 camels, 10,779 equines, 1,225 Beehives and 25,301 chickens a total number of clinics found with in Dire Dawa district are found to be 27 at the time of performing this study.[47]

Haramaya is located 14 km west of Harare and 508 km east of Addis Ababa. The estimated animal population in the area is about 63,723 cattle, 13,612 sheep, 20,350 goats, 15,978 donkeys, 530 camels, and 42,035 chickens. The production system of the district is mixed. Topographically, it is situated at an altitude of 1600 to 2100 m above sea level with the mean annual temperature and relative humidity of 18 °C and 65%, respectively. There are four seasons; a short rain season (from March to mid-May), a short dry season (from the end of May to the end of June), a long wet season (early July to mid-October) and a long dry season (end of October to the end of February). The Haramaya area receives an average annual rainfall of approximately 900 mm, with a bimodal distribution pattern, picking in mid-April and mid-August. The vegetation that constitutes the available pasture land in this area is predominantly native grasses and legumes inter-dispersed with open acacia shrub land a total number of clinics found in Haramaya district found to be 13 at the time of performing this study.[48]

Study Participants

The present study was conducted by incorporating veterinary pro-

fessionals working in public veterinary clinics in the Dire Dawa and Haramaya districts. A total number of 40 public veterinary clinics selected purposively and included in the study were included and a single veterinary professional working in each veterinary clinic was conveniently selected by using a non-probability method.

Data Collection Method

Data were collected through a questionnaire survey, personal interview, and inspection or observation of public veterinary clinics. The questionnaire, inspection, and interviewing schedule were focusing on the availability of veterinary drugs, prescription methods as well as quality, safety, efficacy, and other additional concerns in the delivery, provision, and administration of drugs for the healthcare services of animals offered in and around Haramaya and Dire Dawa districts.

Data Management and Analysis

Data were entered into Microsoft Excel sheets for further analysis and statistical (STATA) software version 12 was used to analyze the data. Differences in proportions for each variable were determined using descriptive statistics. Then the results were described mainly by frequency (n) and percentage or proportions (%) and then were summarized and represented in table form to describe the variable characteristics.

RESULTS

General Characteristics of Respondents

The qualification of the veterinary clinicians those involved in the study as a participant working in Haramaya and Dire Dawa district is given in Table 1. Thus, 57.5% of the clinicians hold a degree in veterinary science and above, whereas 42.5% of the participants possess a diploma in veterinary science. Regarding the work experience of the participants, 50% of them had more than 5-years of experience, whereas the remaining had experience ranging from 4 to 22-years in addition some of the clinicians responded as their drugs of choice like penstrip for paratuberclosis disease, Ivermectin for external parasites and Albendazole for internal parasites are not responding after being used as a first choice for treatment.

Table 1. *Qualification Profiles of Clinicians Working in Veterinary Clinics*

Qualification	Frequency	Percentage (%)
BVSc and above	23	57.5
Diploma	17	42.5
Total	40	100

Availability of Drugs

Of the antibacterials, oxytetracycline (10% and 20%) and pen strep were available in all clinics, 40(100%) followed by sulfadimidine 33(82.5%) and gentamycine 6(15.0%) and procain penicillin G 1(2.5%) are the only drugs available. Amprolium, diaminazine aceturate, bromide aceturate, and isometamedium were reported to be available in 92.5%, 32.5%, 10%, and 20% of the clinics. Ketoconazole and amphotericin B were the only antifungals available only (2.5%) in the clinic. Albendazole was available in all veterinary clinics (100%) followed by ivermectin (95%), tetraclozan (92.5%), and fenbendazole (2.5%). The availability and most frequently prescribed veterinary drugs in the clinics are given in Tables 2, 3, 4 and 5.

Table 2. *Experience as a Clinician*

Frequency	Percentage (%)	
≤5-years	20	50
≥5≤10-years	10	25
≥10-years	8	20
None/unknown	2	5
Total	40	100

Table 3. *Availability and Rank of the most Frequently Prescribed Antibacterials*

Antibacterials	Availability (%)	Rank (%)		
		1st	2nd	3rd
Oxytetracycline	40(100%)	32(80%)	8(20%)	0(0.0%)
Penstrep	40(100%)	8(20%)	32(80%)	0(0.0%)
Sulfadimidine	33(82.5%)	0(0.0%)	0(0.0%)	33(82.5%)
Gentamycine	6(15.0%)	0(0.0%)	0(0.0%)	6(15%)
Procain penicillin	1(2.5%)	0(0.0%)	18(72%)	1(2.5%)

Table 4. *Availability and Ranks of Most Frequently Prescribed Antiprotozoals and Anti-Fungals*

Antiprotozoal/ Antifungal	Availability (%)	Rank (%)		
		1st	2nd	3rd
Amprolium	37(92.5%)	29(72.5%)	3(7.5%)	6(15%)
Diaminazine aceturate	13(32.5%)	8(20%)	5(12.5%)	0(0.0%)
Isometamedium	8(20%)	1(2.5%)	5(12.5%)	2(5%)
Bromide aceturate	4(10%)	0(0.0%)	0(0.0%)	4(10%)
Ketoconazole	1(2.5%)	1(2.5%)	0(0.0%)	0(0.0%)
Amphotracin B	1(2.5%)	0(0.0%)	1(2.5%)	0(0.0%)

Table 5. *Availability and Rank of the Most Frequently Prescribed Anihelmintics*

Antihelementics/ ectopaciticides	Availability (%)	Rank (%)		
		1st	2nd	3rd
Albendazole	40(100%)	26(65%)	14(35%)	0(0.0%)
Ivermectin	38(95%)	14(35%)	20(50%)	9(22.5%)
Tetraclozan	37(92.5%)	0(0.0%)	6(15%)	30(75%)
Fenbendazole	1(2.5%)	0(0.0%)	0(0.0%)	1(2.5%)

Prescription Patterns of Drugs

Method of drug prescription: Following the assessment of prescription methods, 42.5% veterinary clinicians were found using verbal prescriptions. However, 68% of the clinicians did not explain the name of the drug, the strength of the drug, dosage, and route of administration to their clients prescribing drugs verbally. Frequency of administration and duration of administration were

expressed inclients by (8%) of the clinicians. Of the clinicians that had a diploma in animal health, 70% used verbal prescriptions only, while 30% used written prescriptions but none used both verbal and written prescriptions. Of the veterinary practitioners qualified as BVSc and above, 66.6% used verbal prescription only, 6.6% used prescription paper only, and 26.6% used both verbal and prescription papers. The methods of drug prescription by the veterinary clinicians in the clinics of the study are given in Table 6.

Table 6. *Availability and Rank of the Most Frequently Prescribed Ancillary Agents*

Ancillary Drug	Availability (%)	Rank (%)		
		1st	2nd	3rd
Multi vitamins	35(87.5%)	30(75%)	5(12.5%)	2(5%)
Indigestion powder	28(70%)	7(17.5%)	15(37.5%)	6(15%)
Egg stimulant	1(2.5%)	1(2.5%)	1(2.5%)	0(0.0%)

Factors considered in drug selection: The frequently employed methods used in establishing a diagnosis were clinical signs (97.5%), history of the client (100%), and epidemiology (55%). Isolation of infectious agents by employing laboratory methods and establishing the confirmed diagnosis (50%). In addition, other factors considered in drug selection amongst alternative drugs were availability of drug (92.5%), efficacy (82.5%), cost (40%),drug interaction (40%) and safety (40%) of the drug. Ease of administration is not considered in drug selection amongst alternatives. In consideration of precautionary measures of safety during drug prescription, the majority (96%) of clinicians considered safety margin, pregnancy status, and drug withdrawal period. Factors considered in drug selection are shown in Tables 7, 8, 9, 10 and 11.

Table 7. *Methods of Drug Prescription by Clinicians*

Prescription Method	Frequency	Percentage (%)
Verbal prescription	17	42.5
Prescription paper	20	50
None	3	7.5
Total	40	100

Table 8. *Critical Factors Considered by Clinician in Drug Selection amongst Alternative Drugs by Factors*

Factors	Rank (%)		
	1st	2nd	3rd
Efficacy	16(40%)	12(30%)	6(15%)
Safety	2(5%)	4(10%)	10(25%)
Cost	5(12.5%)	7(17.5%)	6(15%)
Availability	17(42.5%)	14(35%)	8(20%)
Ease of administration	0(0.0%)	0(0.0%)	0(0.0%)
Drug interaction	2(5%)	2(5%)	12(30%)

Table 9. *Most Frequently Employed Methods Used in Establishing a Diagnosis as Responded by Clinician*

	Respondents (%)	
	Yes	No
Clinical signs	39 (97.5%)	1(2.5%)
Laboratory	20(50%)	20(50%)
History	40(100%)	0(0.0%)
Epidemiology	22 (55%)	18(45%)

Table 10. *Availability of Sources of Information for Drugs Prescription by Type of Sources*

Sources	Respondents (%)	
	Yes	No
Essential drug list	2(5%)	38(95%)
Standard treatment guidelines	31(77.5%)	9(22.5%)
Drug formularies	2(5%)	38(95%)
Text book	23(57.5%)	17(42.5%)
Others*	32(80%)	8(20%)

* Others include labels, promotion materials, internet, and magazines

Table 11. *Percentage of Clinical that Frequently Consider Pre Cautionary Measures of Safety During Drug Prescription*

Precaution	Respondents (%)	
	Yes	No
Safety margin	38(95%)	2(5%)
Pregnancy status	38(95%)	2(5%)
Drug withdrawal	33(82.5%)	7(17.5%)

Treatment failures: Failures of treatment are listed below (Table 12).

Table 12. *Percentage of Respondents that Encountered Treatment Failure Following Treatment with Veterinary Drugs*

Frequency	Percentage (%)	
Yes	7	17.5
No	28	70
Unknown	5	12.5

DISCUSSION

Fifty-seven point five percent of the clinicians hold a degree of veterinary science and above. Practitioners with a higher-level of training might be major contributors to the provision of quality services in veterinary clinics. Seventy-seven point five percent of clinicians use Standard Treatment Guidelines (STG), and drug lists and drug formularies were also used by clinicians at a low. The survey has shown that one or more sources of information for drug prescriptions are available in clinics. Although the results of the survey indicate the presence of relevant guidelines, the prescription methods and patterns seemed in this study do not reflect their proper use. This may be attributed to the general picture that the trend of using relevant guidelines and other drug information sources for drug prescription and dispensing was relatively insufficient. This makes the practitioners little chance of updating themselves. States the present Drug Administrationration authority of Ethiopia has prepared and distributed the national

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veterinary drug list and STG to veterinarians, pharmacists, and veterinary drug-sellers.[49]

The main reason is that responsible bodies failed to give attention to this area of practice and maybe the initiative to get such materials from the source was also poor from the practitioners' side. As[50] states that relevant guidelines and other drug information sources must be present in the hand of every veterinarian for the prudent use of chemotherapeutic agents and for the success of voluntary measures taken to minimize drug resistance.

Oxtetracycline and pen-strep were available in every clinic, in addition, sulfadimidine, gentamycin, and procaine, penicillin G were the only drugs available. antibacterials from classes of chloramphenicol, quinolones, macrolides, and lincosamides were not available in all clinics. This shows that the shortage of antibacterials leads to the use of only a few antibacterials for all tentatively diagnosed and confirmed cases and results in drug resistance. As Morley et al[13] states that the use of only a few antibacterials for all bacterial diseases leads to resistance among some genera of bacteria to some drugs prescribed and the prevalence of resistance is not uniform across all types of drugs, all drugs in a specific class or among bacterial species. Albendazole and ivermectin were available in all veterinary clinics. Rafoxanide, niclosamide, nitroxynil and tetrahydro pyrimidine were not available at all clinics. This shows the absence of the drug of choice of anthelminthes to minimize losses raised from parasitic infections. As Lacey[51] states that increased productivity in ruminants through the control of helminth parasites is to a large extent, depending on the availability of low-cost effective anthelmintics. Therefore, to minimize losses raised from parasitic infections of the gastrointestinal tract, the use of veterinary drugs is becoming the most common practice. Several anthelmitics of different mechanisms of action are employed for this purpose.

Although the presence of different types of anthelmintics (drug of choice) has a crucial effect on minimizing parasitic infection, the availability of anthelmentics was low. As Hansen et al[52] states that it is therefore of great concern that the regular use of the same class of anthelmintics has led to drug resistance, helminthes, this has become a serious problem in many countries, and resistance of parasites to one or more anthelmintics is now widespread particularly in ruminants. In Ethiopia, albendazole is the most commonly used anthelmintic of veterinary importance followed by ivermectin and tetramisole.[53] Currently, albendazoles of different origins and brands are available in the market from East Africa, India, and Pakistan.

The study has revealed that only a limited number of specific drugs from each class are commonly prescribed by the clinician. This is in agreement with the results of a survey (Meseret, personal communication) where similar classes of veterinary drugs were reported to have been available and dispensed in the veterinary pharmacies of Addis Ababa. The observation that only a few classes of veterinary drugs are currently in use reflects the long-standing use of the same agents in the area. Although the exact reasons regarding the lower diversity of veterinary drugs need further assessment, the cost of the drug that governs availability may probably be the predominant factor, amongst others that dictate drug selection by clinicians and the stoking of drug stores and pharmacies. As Verwood and Three Legged Cross Dementia Friendly Community Association (VDFCA)[49] states that the provision of complete animal healthcare necessitates the availability of safe, effective, and affordable drugs of the required quality, in adequate quantities at all times. Moreover, the available drugs must be presented, dispensed, and used rationally.

The survey has shown that most clinicians prescribed drugs verbally. This is a good sign that many veterinarians do not use prescription paper for prescribing and dispensing of drugs.[54] States that the prescription paper is an important therapeutic transaction between the clinician and the patient or owner of the patient. It brings to focus the diagnostic acumen and the therapeutic profiency of the veterinarian on instructions for palliation or restoration of the patient's health. And several of the prescription papers did not include the relevant information that should be incorporated in drug ordering and dispensing such a procedure in drug prescription is against the norm and could bring about treatment failures toxicity in the animal and above all development of drug resistance by pathogens the consequences of which are not limited to livestock alone but has grave human health implications. As WHO[55] states that a prescription paper should have the owner's name, patient species, sex, age, identification date, and instruction about the prescribed drugs, including generic name and dosage form, dose, frequency of administration, duration of treatment, prescriber's signature and name.

The frequently employed methods used in establishing a diagnosis were clinical signs, history of the patient from clients, and considering disease epidemiology prior to drug selection. Drug prescriptions are by and large based on tentative diagnosis and the number of clinics that employ laboratory methods to establish a confirmatory diagnosis is very low. The reason mentioned by many clinicians was the absence of laboratory facilities. As Quinn et al[56] states that the clinical use of veterinary drugs begins with a clinician and a detailed examination that allows a specific clinical diagnosis to be made. This might also be considered as a factor contributing to treatment failure after having used veterinary drugs. In addition, as depicted in the result, clinicians do not consider guidelines that could help minimize the development of drug resistance in drug prescriptions. Although animal and human safety issues are considered by 95% of the respondents.

Availability and cost seem the major factors considered in prescribing drugs. As Ramsay[9] states that prescribing drugs is an important skill that needs to be continuously assessed and refined accordingly. It not only reflects the clinician's knowledge of pharmacology and pathophysiology but also his/her skill in diagnosis and attitude towards selecting the most appropriate cost-effective treatment. Drug interaction is considered in drug selection at an unexpected level or at a minimum amongst alternative drugs by rank Aiello[57] states that drug interaction may result in drug resistance.

Seventeen point five percent of respondents encountered treatment failure after using veterinary drugs. Possible reasons for the failure of anti-infectives may be the incorrect diagnosis, the drug under dosage, superinfection by resistant opportunistic

infection, reinfection by the original or by other pathogenic organisms, frequent use of the same type of anti-infectives, inappropriate drug selection, absence of combination therapy, use of anti-infectives for prophylaxis considered as major causes. This is in agreement with Aiello[57] states that anti-infective treatment failures may occur due to reasons that include incorrect diagnosis, the organisms were not susceptible to the action of the anti-infectives that were selected as the anti-infective was insufficient for multiple pathogens, superinfection by a resistant opportunistic pathogen, drug interaction and inadequate supportive therapy.

CONCLUSION AND RECOMMENDATIONS

Veterinary drugs are used for the control and prevention of diseases or eradication of diseases in animal production. The availability of safe, effective, and affordable veterinary drugs of the required quality, in adequate quantity was low in relation to rational use for the provision of complete animal healthcare services. The study showed that the trends of using prescription papers for prescribing drugs were not enough and prescription papers did not include the relevant information that should be incorporated in drug ordering and dispensing drug prescriptions by and large based on tentative diagnosis and inappropriate drug selection were found to be bottlenecks for the successful drug treatment that leads to drug resistance. It needs an integrated action of all concerned bodies to upgrade the availability of safe, effective, and affordable drugs of the required quality, in adequate quantity at all times and must be presented, dispensed, and used rationally.

Relying on the above conclusion, the following recommendations were forwarded;

• Veterinary clinicians have to get access to sources of therapeutic information like treatment guidelines and materials as it that support the clinician in the provision of proper treatment of animals in the health facilities.

• Awareness and training should be provided regularly for prescribers and end users about the proper way of drug use.

• The government bodies should give attention to the veterinary clinic by providing appropriate and convenient facilities like laboratory facilities, and drugs of essential quality with essential drug lists for only available drugs.

• Veterinary clinics should be advised to implement culture, sensitivity tests, and laboratory-based diagnosis prior to drug prescription.

• Veterinary drugs, especially antimicrobial agents, should be judiciously used; and a wide-scale study is recommended to safeguard the public from drug residual effects and antimicrobial resistance development.

• Conducting quality analysis for drugs in veterinary use properly with proper handling and storage must be followed-up by all those using veterinary drugs and government bodies in charge of controlling the quality of those drugs.

ETHICAL CONSIDERATION

The study was granted an exemption from requiring ethical approval from the College of Veterinary Medicine and Agriculture Institutional Research and Review Board Committee. The researchers got permission for access to information from the office of Haramaya and Dire Dawa District Veterinary Clinics. Confidentiality of the prescribers was maintained by using a unique code.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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ANNEXES

Prescription Pattern

(Administered on clinicians found veterinary clinic)

1. Address Zone _____
Woreda _____
Town/city _____
Kebele _____ Tel. _____
2. Respondent code _____ Date _____
3. Prescriber working at
[ ] public (government)
[ ] private
[ ] NGO
Other _____
4. Method of prescription Verbal [ ]
Prescription paper [ ]
5. Verbal prescription
5.1. Name of the drug yes [ ] no [ ]
5.2. Strength of the drug yes [ ] and no [ ]
5.3. Dosage yes [ ] no [ ]
5.4. Route of administration yes [ ] and no [ ]
5.5. Frequency of administration yes [ ] and no [ ]
5.6. Duration of administration yes [ ] and no [ ]
6. Prescription paper
6.1. Date indicated yes [ ] no [ ]
6.2. Card number included yes [ ] or no [ ]
6.3. Name of drug yes [ ] no [ ]
6.4. Strength of drug yes [ ] no [ ]
6.5. Dosage yes [ ] no [ ]
6.6. Frequency of administration yes [ ] and no [ ]
6.7. Duration of administration yes [ ] and no [ ]
6.8. Route of administration yes [ ] and no [ ]
6.9. Prescribers name and or signature yes [ ] or no [ ]
6.10. Owner's name yes [ ] no [ ]
6.11. Owner's address yes [ ] no [ ]
6.12. Species of patient yes [ ] no [ ]
6.13. Sex of patient yes [ ] no [ ]
6.14. Age of patient yes [ ] no [ ]
6.15. Identification of patient yes [ ] or no [ ]
7. Prescribes qualification
[ ] Certificate
[ ] Diploma (Veterinary)
[ ]BVSc
[ ] DVM
[ ]MVSc/MSc
Other _____
8. Among antimicrobials:
8.1. Three most prescribed antibacterials
First rank _____
Second rank _____
Third rank _____
8.2. Three most prescribed antifungals
First rank _____
Second rank _____
Third rank _____
8.3. Three most prescribed antiprotozoal
First rank _____

Second rank _____
Third rank _____
9. Three most commonly prescribed anthelmintics
First rank _____
Second rank _____
Third rank _____
10. Other most commonly prescribed drugs (except antimicrobials and anthelmintics)
First rank _____
Second rank _____
Third rank _____
11. Prescription based on
[ ] clinical signs
[ ] Laboratory history
[ ] Epidemiology
Other _____
12. Which of the following do you consider in drug selection?
[ ] Efficacy
[ ] Safety
[ ] Cost
[ ] Availability
[ ] Ease of administration
[ ] Drug interaction
First rank _____
Second rank _____
Third rank _____
13. How frequently do you employ the culture and sensitivity tests after initial prescribing?
[ ] Routinely
[ ] Sometimes
[ ] Rarely
[ ] None
14. The amount of prescriptions per day (the number of prescriptions per day)
[ ]<10
[ ] 10≤50
[ ]>50
15. Do you counsel owners on prescribed drugs? yes [ ] no [ ]
16. If the answer is no (to question 15), what is (are) the reasons
1. _____
2. _____
3. _____
17. Do clients demand certain types of drugs? yes [ ] no [ ]
18. Do clients request drugs manufactured in certain countries? yes [ ] no [ ]
19. If the answer is "yes" (to question 18), the drugs of which countries are demanded
1. _____
2. _____
3. _____
20. Do you used to prescribe extra label drugs? yes [ ] no [ ]
21. If your answer to question 20 is yes, which are the drugs?
[ ] infectious diseases
[ ] helminth parasitic diseases
[ ] ancillary drugs
22. To which species of animals are ancillary drugs prescribed?
[ ] ruminants
[ ] Equids
[ ] Small animals
[ ] Poultry
23. Do you observe the safety margins for drugs prescribed in general? yes [ ]no [ ]
24. Do you take into consideration pregnant animals during prescription? yes [ ] no[ ]
25. Do you observe drug withdrawal times? yes [ ] no [ ]

26. did you used to prescribe combination therapy?
[ ] antimicrobial with antimicrobial
If yes which _____

_____

_____

[ ] antimicrobial anthelmintics
If yes which _____

_____

_____

[ ] antimicrobial anthelmintics If yes which _____

_____

_____

27. Have you ever encountered no response after treatment? yes [ ] no [ ]
28. If your answer to question 27 is yes, fill out the following Table.

	Species	Disease	Drug
Antimicrobials	1. 2. 3.		
Anthelmintics	1. 2. 3.		
Acaricides	1. 2. 3.		

29. Which of the following drugs are available in your vicinity? (please tick: 'X')

	Drug	Yes	No
Antibacterials	Penicillin		
	Aminoglycosides		
	Tetracyclines		
	Quinolones		
	Chloramphenicol		
	Macrolides		
	Lincosamides		
	Sulphonamides		
	Cephalosporins		
Antiprotozoals	Coccidiostats		
	Trypanocides		
Antifungal	Amphotericin/nystatin		
	Imidazoles (e.g. clotrimazole)		
	Grisiofulvin		
	Iodides		
Antinematodals	Benzimidazoles (e.g. albendazole)		
	Imidazothiazoles (eg. Levamisole)		
	Tetrahydropyrimidine (e.g. py-rantel)		
	Ivermectins		
Antitrematodals	Rafoxanide		
	Niclosamide		
	Nitroxynil		
Ectoparaciticides	Organophosphates		
	Chlorinated hydrocarbons		
	Pyrithrins		

30. Which antimicrobials did you initially prescribe?
[ ] narrow spectrum
[ ] broad spectrum
31. Which antimicrobial agents do you use for topical application?
[ ] resistance known
[ ] resistance unknown
32. Do you prescribe antibacterials for prophylaxis?
33. What is your source of information on prescription? yes[ ] no [ ]
[ ] test books
[ ] STG
[ ] DL/EDL
[ ] Formularies
[ ] Labels
[ ] Promotion materials/leaf lets
[ ] Magazine/journals
[ ] Internet
Other _____
34. Did you receive training on prescription? yes [ ] no [ ]

Supporting Questions

35. Experience as a clinician
[ ]<5-years
[ ]>5≤10-years
[ ]>10-years
36. Number of clinicians working in the clinic
[ ]1 [ ]2 [ ]3 [ ]>3
37. If a private clinic, the nature of employment
[ ] Owner
[ ] Employed (contract)
[ ] Part-time
38. Which species of animals are frequently treated at the clinic?
[ ] Small animals [ ] small animals
[ ] Cattle [ ] equids
[ ] Sheep and goats [ ] poultry
39. How many animals on average are treated per day?
Cattle_____
Sheep_____
Goats_____
Equids_____
Dogs_____
Cats _____
Poultry _____
40. If you employ a culture and sensitivity test, where is it carried out?
[ ] In the clinic
[ ] In an outside laboratory
41. Do you prescribe ancillary treatments for infectious disease yes [ ] no [ ]
42. Do you prescribe antimicrobials for dietary diarrhea? yes [ ] no [ ]
43. If you conduct surgery, do you prescribe antibacterials during surgery? yes [ ] no [ ]
44. Do you counsel owners on the importance of Nutritional support and nursing care? yes [ ] or no [ ]
45. Which products (new or old) do you prefer?
[ ] new
[ ] old
46. Do you think that there is a lack of chemotherapeutic agents in the market? yes [ ] no [ ]

47. If your answer is "yes" for question 46, which drugs are in short supply?

[ ]Antibacteials [ ]anti-inflammatory
[ ]Antifugals [ ]analgesics
[ ] Antiprotozoals [ ]antipyretics
[ ] Anthelmintics [ ]acaricides
[ ] Vitamins [ ] minerals
[ ] Dermal preparations [ ] ophthalmic drugs