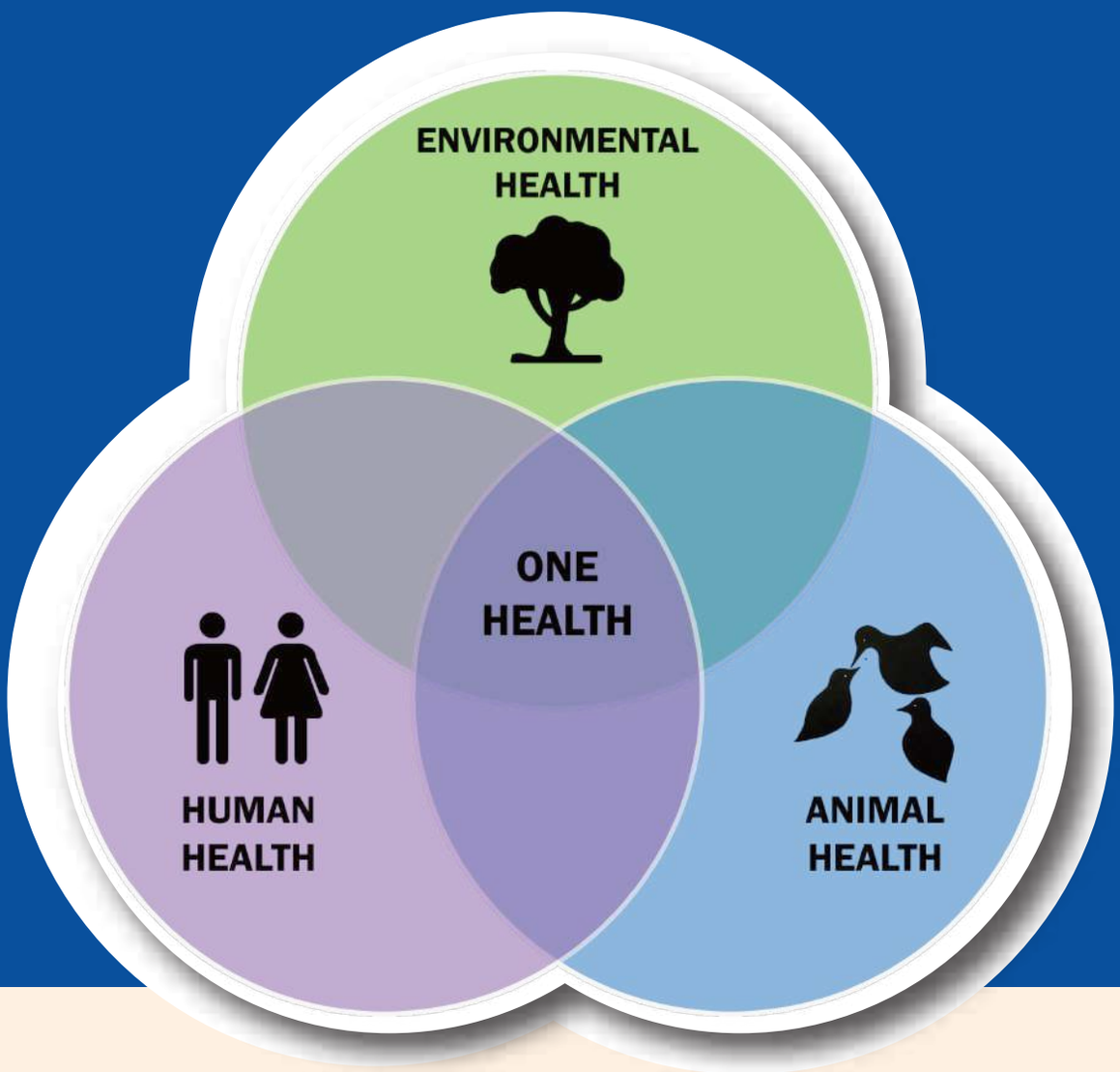
Situational Assessment of Antibiotics Use and its Resistance in Nepal



Government of Nepal
Nepal Health Research Council
Ramshah Path, Kathmandu, Nepal

A Report on

Situational Assessment of Antibiotics Use and its Resistance in Nepal

Prepared by

Government of Nepal

Nepal Health Research Council

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Preface

I am pleased to present the report of nationwide study on Antimicrobial Resistance (AMR) in Nepal. This report is the result of extensive research and collaboration between various stakeholders, all of whom are committed to combating the growing threat of antimicrobial resistance in our country. Antimicrobial resistance has emerged as a major public health issue worldwide. Various policy documents issued by the Government of Nepal have prioritized AMR as an important public health issue. So, the National Action Plan on Antimicrobial Resistance (2024-2028) has been developed with five different strategic priorities including knowledge and evidence generation through research. This nationwide study aimed to assess the situation of antibiotics use and its resistance among different stakeholders based on One-health approach is useful to guide the future strategies and approaches towards AMR in Nepal.

The Nepal Health Research Council (NHRC) took on the challenging task of conducting a community-based cross-sectional study to assess antibiotic use and resistance in Nepal in coordination with Ministry of Health and Population (MoHP) for the technical support in each phase from inception of ideas to dissemination of findings. I would like to extend my congratulations to the council for successfully completing this important research.

This report is the first of its kind to represent the whole country in terms of situational assessment of antibiotic resistance based on one-health approach with complete representation from both human and animal health. Thus, I believe that this report will be milestone in designing the AMR related policies and programs in the country. I would like to express my sincere gratitude to all those who contributed to this study, and I encourage all relevant stakeholders to review the report's findings and actively participate in the ongoing efforts to combat AMR in Nepal. Lastly, on behalf of MoHP, I would like to affirm that MoHP is committed to utilizing the findings of this study to guide the development of national policies and programs Thank you.

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Dr. Roshan Pokhrel
Secretary

Forewords

In an era marked by unprecedented developments in medicines, antimicrobial resistance (AMR) stands as a terrible challenge, threatening to undo decades of progress in treating infectious diseases. AMR is a complex issue that requires concentrated action at the local, national, and international levels as it crosses geographic boundaries and affects communities indiscriminately. The main aim of this report is to present a comprehensive assessment of the current situation of AMR in Nepal, emphasizing issues and stakeholders from both the human and animal health sectors.

I believe this report provides evidence on the situation of antimicrobial resistance in Nepal based on a one-health approach which will serve as useful information to focus on the prevention, control, and mitigation of antimicrobial resistance in Nepal. Although notable activities have been developed for combating antimicrobial resistance through interdisciplinary collaboration based on innovative approaches and systematic assessment, ample work still has to be done. So, this report represents a pivotal finding related to the evolving landscape of antimicrobial resistance. It not only assembles the latest scientific understandings; but also emphasizes the urgent need for coordinated action at all levels from local communities to international collaborations for managing AMR.

I take this opportunity to express our commitment to continually reviewing the situation of AMR in Nepal and discuss policy options for identifying the challenges, opportunities, and actions to address this issue through a collaborative one-health approach. Finally, I would like to congratulate the team of NHRC and believe that this report will help the Government of Nepal in developing innovative strategies to prevent and control the burden of antimicrobial resistance.

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Prof. Dr. Gehanath Baral
Chairman
Nepal Health Research Council

Acknowledgements

Antimicrobial resistance (AMR) is an emerging global health, making it more difficult to treat common illnesses and risking the advancements in medicine that have revolutionized the field. It affects people, communities, and healthcare systems globally and has no geographical boundaries. It is a complicated issue caused by various factors such as antibiotic abuse and overuse and gaps in infection prevention and control. A coordinated, interdisciplinary strategy encompassing the environment, agriculture, healthcare, and other fields is needed to address AMR.

This study aimed at assessing the knowledge, attitude and practices related to antibiotics use and its resistance among different stakeholders such as medical doctors/health workers, drug dispensers, outpatients, veterinarians/para-veterinarians, vet pharmacists and farmers in Nepal. Furthermore, this study was conducted in all seven provinces of Nepal and was based on a one-health approach covering human and animal health. However, environmental health component is not covered on this study.

The study revealed that very few health institutions both in human health and animal health have access to laboratory facility for Antibiotics Susceptibility Test (AST) and only half of the doctors/health workers were found to comply with the guidelines to conduct Antibiotics AST before prescribing antibiotics. The serious issue of over-the counter dispensing of drugs was frequently encountered found as almost half of pharmacies dispense antibiotics without prescriptions. The unavailability of laboratory facilities to majority of health workers revealed the lack of infrastructure to mitigate the prevailing threat of antibiotic resistance.

This study would be helpful to understand the current situation of use of antibiotics and AMR in Nepal. This report is a vital contribution to our understanding of AMR, providing a comprehensive analysis of the current status of AMR in Nepal. This finding may accelerate the policy-making process to combat AMR and design evidence-based public health interventions to address the issues leading to AMR. I hope the findings will be taken into consideration by the government and other stakeholders.

I would like to take this opportunity to express my profound gratitude to the Ministry of Health and Population (MoHP) for making financial resources available to conduct this survey and also would like to thanks to the Ministry of Agriculture and Livestock Development (MoALD), Department of Food Technology and Quality Control (DFTQC) and Department of Drug Administration (DDA) for providing technical support for the study. Finally, I would like to take this opportunity to express my gratitude to Dr. Madan Kumar Upadhyaya, Dr. Anup Bastola and and Ms. Jyoti Acharya from MOHP and Dr. Barun Kumar Sharma from MoALD for their technical and policy advice on this study. I am also thankful to research team members Dr. Meghnath Dhimal, Dr. Megha Raj Banjara, Dr. Bishnu Prasad Marasini, Mr. Shyam Kumar Mishra, Ms. Elina Khatri and Ms. Sudha Poudel for their hard work. Lastly, I thank everyone who directly or indirectly supported and coordinated the successful completion of this study.

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Dr. Pramod Joshi
Member secretary- Executive Chief
Nepal Health Research Council

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Acronyms

AHWs	Auxiliary Health Workers
AMR	Anti-microbial Resistance
AST	Antibiotic Susceptibility Test
CMA	Community Medical Assistant
ERB	Ethical Review Board
HAs	Health Assistants
HWs	Health Workers
KAP	Knowledge, Attitude and Practices
KII	Key Informant Interview
NHRC	Nepal Health Research Council
NPHL	National Public Health Laboratory
PHC	Primary Health Centre
SPSS	Statistical Package for Social Sciences
UHC	Universal Health Coverage
WHO	World Health Organization

Executive Summary

Introduction: Antimicrobial resistance (AMR) is a global public health issue with multisectoral contribution. This study aimed at assessing the knowledge, attitude and practices related to antibiotics use and its resistance among different stakeholders such as medical doctors/health workers, drug dispensers, outpatients, veterinarians/para-veterinarians, vet pharmacists and farmers in Nepal. Similarly, the issues related to antibiotics such as over the counter dispensing practices and non-compliance to dose and duration were covered in the study. This study would be helpful to understand the current situation of use of antibiotics and AMR in Nepal.

Methods: This was a mixed method cross-sectional study. A pretested semi-structured questionnaire for each of the study population was used to obtain quantitative data using face-to-face interview. Key Informant Interview (KII) was conducted to obtain qualitative information among purposively selected stakeholders of AMR from various level based on one-health aspect. Ethical approval was obtained from Ethical Review Board (ERB) of the Nepal Health Research Council (NHRC). Quantitative data was entered in Epi Data and analyzed in SPSS version 21. The qualitative interviews (KII) were transcribed and translated for thematic analysis in order to explore the factors associated with AMR in Nepal.

Findings: The majority of medical doctors/health workers were aware that antibiotics cannot cure all infections and healthy people can be carriers of antibiotic resistant bacteria. It was found that only 32% of medical doctors/health workers have access to laboratory facility for antibiotic susceptibility test (AST) in their health institutions and among which only 49% recommend AST before prescribing antibiotics. Likewise, it was found that 19% of doctors/health workers prescribe broad spectrum antibiotics despite the effectiveness of narrow spectrum antibiotics. Almost 86% of drug dispensers have heard of antibiotic resistance. It was found that almost half of the drug dispensers (43.4%) dispense antibiotics without doctor's/health worker's prescriptions. Almost one-third of outpatients were found to buy antibiotics without prescriptions and one-fourth did not consume the full course of antibiotics. The analysis of prescription slips based on WHO core prescribing indicators revealed more than one-third i.e. 37.8% of prescribed medicines were antibiotics. The consumption of Access, Watch, and Reserve group of antibiotics among the inpatients were found to be 29.8%, 70.1% and 0.1% respectively. The most frequently consumed antibiotics were Metronidazole and Ornidazole for Access group, Ceftriaxone for Watch group and Linezolid for Reserve group. The findings related to consumption of antibiotics clearly depict the over consumption of Watch group based on the standards determined by WHO. About one-third of veterinarians/para –veterinarians have access to laboratory facility for AST though among them only 32% recommend for AST prior to prescriptions. Similarly, 9% of veterinarians/para-veterinarians considered that antibiotics can be used as prophylactics. Colistin, which is a prohibited antibiotic, was found to be prescribed by almost 2% of veterinarians/para-veterinarians. The study revealed that most of the veterinary pharmacists (66%) have come across the complaint related to failure of antibiotics

treatment among animals. Likewise, about two-thirds of the veterinary pharmacists do not keep the record of animals while dispensing antibiotics. Around 44% of the farmers responded that they treat their animals by themselves. More than half of the farmers agreed that antibiotics can be used for treating all types of diseases and also can be used as growth promoters for animals. Similarly, 69% of the farmers increase dose and frequency of antibiotics if there is no any sign of recovery. Still about one–fourth of farmers did not disinfect their farm on regular basis.

Conclusion: The study revealed that very few health institutions both in human health and animal health have access to laboratory facility for AST and only half of the doctors/health workers were found to comply with the guidelines to conduct Antibiotic Susceptibility Test (AST) before prescribing antibiotics. The serious issue of over-the counter dispensing of antibiotics was found as almost half of pharmacies dispense antibiotics without prescriptions. The unavailability of laboratory facilities to majority of health workers revealed the lack of infrastructure to mitigate the prevailing threat of antibiotic resistance. The analysis of prescriptions slip based on WHO core prescribing indicators revealed over prescriptions of antibiotics. Veterinarians/para –veterinarians have good knowledge about antibiotic resistance and most of the veterinary pharmacists considered prescriptions before giving antibiotics. The findings of the study clearly depict the need to regulate over-the-counter dispensing practices of community pharmacies to avoid inappropriate use of antibiotics. In addition, it emphasizes the need of expanding laboratory facilities to district hospitals in order to conduct AST which ultimately will guide the rational choice/use of antibiotics.

CHAPTER : I INTRODUCTION

1.1 Background

Antimicrobials (including antibiotics, antivirals, antifungals and antiparasitics) are medicines used to prevent and treat infections in humans, animals and plants. Access, Watch, Reserve (AWaRe) classification of 180 antibiotics has been adopted by World Health Organization with aim of reducing antimicrobial resistance (WHO, 2019). World Organization for Animal Health (WOAH) in 2021 has categorized veterinary important antimicrobial agents for food producing animals and has listed them in Veterinary Critically Important Antimicrobial Agents, Veterinary Highly Important Antimicrobial Agents, and Veterinary Important Antimicrobial Agents. WHO and WOAH classification has been done for antibiotic stewardship at local, national and global levels with the aim of reducing antimicrobial resistance in human health and animal health setting.

Antimicrobial resistance has emerged as one of the leading public health threats of the 21stcentury. AMR occurs when bacteria, viruses, fungi, and parasites change over time and no longer respond to medicines making infections harder to treat and increasing the risk of disease spread, severe illness, and death.

The evolution of antimicrobial resistance and a dearth of new antibiotics in the pipeline raise the possibility of untreatable multidrug resistant (MDR) infections. Recently, there have been some cases of extensively drug-resistant (XDR) bacteria, also known as ‘‘superbugs’’, which might become more and more common. Nepal is one of the major contributors to the growing burden of AMR due to widespread irrational use of antibiotics along with poor health care systems poor infection control and prevention measures and inadequate biosecurity in farms. AMR in Nepal has significantly increased, with an increasing trend in the proportion of multidrug-resistant organisms over the past 20 years. Most recently, in 2019, AMR was proposed for the first time as a specific indicator of Good Health and Wellbeing, which is Goal 3 of the United Nations’ 2030 Sustainable Development Goals.

Nepal experiences an extremely huge burden of infectious diseases such as respiratory tract infections, enteric fever (typhoid, paratyphoid fever), urinary tract infections and other bacterial infections. Researchers have reported high burden of drug resistant/multidrug resistant bacteria in Nepal. The World Organization for Animal Health (WOAH) has estimated that more than 60% of all infectious diseases, including more than 75% of emerging and re-emerging diseases in humans, originate in animals. Humans and animals live in the same environment and share several pathogens. The diseases that can be transmitted from animals to humans and vice versa are known as zoonosis. Since these diseases can affect both humans and animals, and the environment plays a role of a mixing vessel, a multi-sectorial approach is helpful to minimize the transmission of these zoonotic diseases. One Health (OH) is a collaborative effort to attain optimal health for people, animals and the environment. ‘One health’ is an approach for designing and implementing programs, policies, legislation, and research in which multiple

sectors communicate and work together to achieve better public health outcomes. In line with the global efforts from WHO, FAO, WOAH, Government of Nepal has also endorsed One Health Strategy, 2076, but still multiple sectors have to develop and grow to work together to achieve better public health outcomes. Since there is very limited evidence regarding knowledge, attitude, prescription, dispensing and consumption practices of different stakeholders of AMR based on one-health approach, there is a clear need to improve the scientific understanding of the factors associated with antibiotics use.

1.2 Objectives

1.2.1 General Objective

The general objective of this study was to assess the knowledge, attitude, and use practices of antibiotics and its resistance in Nepal.

1.2.2 Specific Objectives

The specific objectives were:

- To assess knowledge, attitude and practices of antibiotics use and its resistance among medical doctors/health workers, drug dispensers and patients.
- To determine prescribing practices of antibiotics among doctors/health workers from selected health institutions.
- To determine the dispensing practices of antibiotics by pharmacies.
- To determine the consumption patterns of AWaRe groups of antibiotics among inpatients of hospitals.
- To assess knowledge, attitude and practices of antibiotics use and its resistance among veterinarians/ para-veterinarians, veterinary pharmacists and cattle/poultry farmers of Nepal.
- To explore the factors associated with anti-microbial resistance in Nepal.

CHAPTER : II METHODS

2.1 Study Design

This was a cross-sectional mixed method study using quantitative and qualitative approaches. Knowledge, Attitude and Practices (KAP) of doctors/health workers, community pharmacies, patients, veterinarians/ para-veterinarians, veterinary pharmacists and cattle/poultry farmers on antibiotics and its resistance was assessed. Similarly, antibiotics prescription practices by doctors/health workers, dispensing practices of community pharmacies and antibiotic use pattern by the outpatients were assessed. In qualitative method, Key Informant Interview (KII) was done among major stakeholders in order to explore factors associated with antimicrobial resistance in Nepal.

2.2 Sample Size and Sampling

The study respondents were selected among key actors for antibiotic resistance i.e. doctors/health workers, patients, community pharmacies, veterinarians/para-veterinarians, veterinary pharmacists and cattle/poultry farmers. The sample size for the study was computed using the Cochran's formula for single proportion. Purposive sampling was done to select each study participant.

Table 1: Sample size of the participants

Participants	Prevalence (p)	Margin of error	Sample size (Calculated)	Sample size (Covered)
Doctors/Health workers	88.6%	5%	155*7=1085	1079
Pharmacies	95%	5%	73*7=511	521
Outpatients	27%	5%	303*7=2121	2122
Veterinarians/para-veterinarians	77%	10%	68*7=476	477
Veterinary pharmacists	50%	10%	96*7=672	680
Cattle/poultry farmers	90%	5%	138*7=966	966
Inpatients (Medical & Surgical)	-	-	-	3227

2.3 Data Collection Tools and Techniques

The data collection tools were developed based on the relevant existing literatures both at national and global level. A separate set of questionnaire was developed for each study respondents. Likewise, interview guideline was prepared for collecting qualitative data.The trained field researchers conducted face to face interviews with each study participant using the structured questionnaire. The antibiotics consumption among inpatients related data were collected from medical and surgical wads of selected referral hospitals of each provinces for a month by trained nurse staff. Similarly, Key Informant Interviews (KII) were

conducted with the key stakeholders of AMR using the developed interview guidelines. The stakeholders for addressing the issue of AMR at national level were identified and approached for interview in order to explore their opinion regarding major factors contributing to antimicrobial resistance in Nepal.

2.4 Data Management and Analysis

The collected data was entered in Epi Data and analyzed using SPSS version 21. For descriptive analysis, knowledge, attitude and practice of antibiotics and its resistance have been presented in frequencies and percentages. Similarly, inferential analysis has been done to assess the association of socio-demographic characteristics with KAP on antibiotic and its resistance. The knowledge, attitude and practices regarding antibiotics and its resistance have been categorized as good and poor based on the criteria of 70% and above. Respondents with correct responses below 70% for each section of knowledge, attitude and practices have been categorized as poor whereas 70% and above were categorized as having good KAP.

2.5 Validity and Reliability of Tools

The translational and content validity of the tools were maintained by consultation and discussion with the subject experts. After the expert consultation, the feedbacks were incorporated in the questionnaires. The developed questionnaire was pre-tested and modified based on findings of the pre-testing.

2.6 Ethical Consideration

The study protocol was approved from the Ethical Review Board of Nepal Health Research Council (NHRC). The participants were explained about the study procedure, reasons of selection in the study as a participant and confidentiality of data. The participants were interviewed only after obtaining written informed consent. The data was kept confidential and no personal identifiers were used while writing the report.

CHAPTER : III RESULTS

3.1 Knowledge of Doctors/Health Workers on Antibiotics Use and Its Resistance

Socio-demographic characteristics of doctors/health workers

The majority of doctors/health workers were from the age group 25 to 34 years followed by 35-44 years (i.e. 55.8% and 30.1% respectively). Most of them were male and were medical doctors from urban area with more than half of them serving in the private sectors.

Table 2: Socio-demographic characteristics of doctors/health workers

Characteristics	Number (n=1079)	Percent
Age (average = 33 years)		
<25	53	4.9
25-34	602	55.8
35-44	325	30.1
45-54	79	7.3
>55	20	1.9
Sex		
Male	807	74.8
Female	272	25.2
Ethnicity		
Brahmin/Chhetri	620	57.5
Janajati	108	10
Newar	84	7.8
Dalit	20	1.9
Terai/Madhesi	195	18.1
Muslim	30	2.8
Others	22	2
Area		
Urban	935	86.7
Rural	144	13.3
Profession		
Doctor	768	71.2
Paramedics	311	28.8
Degree of doctors (N=768)		

MBBS	187	24.3
MD General Practitioner	45	5.9
Internal Medicine	72	9.4
Pediatrics	51	6.6
Orthopedics	63	8.2
Gynecology	62	8.1
Surgery	58	7.6
Dental	46	6
Nephrology	5	0.7
Oncology	3	0.4
Cardiology	11	1.4
Resident doctors	69	9
Dermatology	20	2.6
ENT	21	2.7
Others (Psychiatry, Anesthesiology, Neurology, Urology)	55	7.2
Type of health institution		
Government	526	48.7
Private	553	51.3
Level of health institution (N=526)		
Federal	155	29.5
Province	192	36.5
Local	179	34
Working department		
Medicine	143	13.3
Emergency	200	18.5
Surgery	102	9.5
Pediatrics	69	6.4
Obstetrics and Gynecology	75	7
OPD	290	26.9
Intensive Care Unit	10	0.9
Psychiatry	19	1.8
Dental science	37	3.4
Orthopedics	46	4.3
ENT	25	2.3
Dermatology	17	1.6
Ophthalmology	8	0.7
Cardiology	4	0.4
Others (Nephrology,Neurology, Radiology, Oncology)	34	3.2

Perceived knowledge of doctors/HWs about antibiotics use and its resistance

The findings revealed that majority of doctors/health workers knew that antibiotics cannot cure all infections and healthy people can be carrier of antibiotic resistant bacteria. Similarly, more than 89% and 88% of the respondents consider that unnecessary use of antibiotics makes it ineffective and antibiotics are not effective for use against cold and flu respectively.

Table 3: Perceived knowledge of doctors/health workers on antibiotics use and its resistance

Characteristics (N=1079)	Yes (N/%)	No (N/%)
Antibiotics cure all infections	170 (15.8)	909 (84.2)
Healthy people can be carrier of antibiotic resistant bacteria	944 (87.5)	135 (12.5)
Antibiotics being ineffective due to unnecessary use	953 (88.3)	126 (11.7)
Antibiotics are effective against cold and flu	139 (12.9)	940 (87.1)
Antibiotics have side effects	1036 (96)	43 (4)
Frequent use can decrease occurrence of infection	237 (22)	842 (78)
Antibiotics are safe to use commonly	167 (15.5)	912 (84.5)
Antibiotic resistance is problem in Nepal	1013 (93.9)	66 (6.1)
Prescriptions is linked with emergence of antibiotic resistant	961 (89.1)	118 (10.9)
Total	**1079**	**100**

Reasons for emergence and spread of antibiotic resistance

The majority of doctors/health workers perceived that use of antibiotics without prescriptions and consuming incomplete dose of prescribed antibiotics are major reasons for emergence and spread of antibiotic resistance.

Table 4: Perceived reasons for emergence and spread of antibiotic resistance

Characteristics	Number (N=1079)	Percent of responses	Percent of cases
Using antibiotics without doctors/health workers prescriptions	1003	34.2	93.5
Consuming incomplete course of prescribed antibiotics	908	30.9	84.6
Ineffective infection prevention and control measures	584	19.9	54.4
Use of antibiotics in feed industry and livestock	370	12.6	34.5
Others (Over-use, consumption without AST, prescribing broad spectrum, no discovery of new antibiotics, mutation)	69	2.4	6.4
Total	**2934**	**100**	**273.4**

**Percentage exceeds 100 due to multiple responses*

Prevalent resistant organisms in health institutions

According to the work experience of doctors and health workers, the most prevalent resistant bacteria in the health institutions were multi-drug resistant *Pseudomonas aeruginosa,* extended spectrum beta-lactamase producing *Escherichia coli* (ESBL *E. coli*), penicillin-resistant *Streptococcus pneumoniae*

(PRSP), and methicillin-resistant *Staphylococcus aureus* (MRSA). However, significant proportion i.e. 16.5% did not know about the resistant bacteria in the health institutions.

Table 5: Prevalent resistant organisms reported by doctors/health workers

Characteristics	Number (N=1079)	Percent of responses	Percent of cases
Multidrug-resistant *Pseudomonas aeruginosa*	330	15.8	31.3
Multidrug-resistant *Acinetobacter* spp.	214	10.3	20.3
Extended spectrum beta-lactamase producing *Escherichia coli* (ESBL *E. coli*)	311	14.9	29.5
Extended spectrum beta-lactamase producing *Klebsiella pneumoniae*	218	10.4	20.7
Penicillin-resistant *Streptococcus pneumoniae* (PRSP)	293	14.0	27.8
Methicillin-resistant *Staphylococcus aureus* (MRSA)	285	13.7	27.1
Vancomycin resistant *Enterococcus* (VRE)	74	3.5	7
Don't know	345	16.5	32.8
Others (Amoxycillin resistant to *Salmonella Typhi*)	17	0.8	1.6
Total	**2087**	**100**	**198.2**

**Percentage exceeds 100 due to multiple responses*

Mechanisms of antimicrobial resistance

The knowledge of health workers on mechanisms of antimicrobial resistance was very limited. Health workers reported alteration of binding site, enzymatic process, efflux pump and thickening of cell wall of bacteria as the major mechanisms of antimicrobial resistance.

Table 6: Health workers' knowledge on mechanisms of antimicrobial resistance

Characteristics	Number (N=1079)	Percent of responses	Percent of cases
Efflux pump	374	15.7	35.2
Alteration of binding site	586	24.5	55.2
Thickening of the cell wall	363	15.2	34.2
Enzymatic process	473	19.8	44.5
Intrinsic resistance (not acquired)	306	12.8	28.8
Others (Mutation, plasmid mediated, horizontal gene transfer, biofilm, climate, toxin)	260	10.9	24.5
Total	**2387**	**100**	**224.8**

**Percentage exceeds 100 due to multiple responses*

Minimizing antibiotic resistance

Almost 95% of doctors/health workers consider that antibiotic resistance can be minimized.

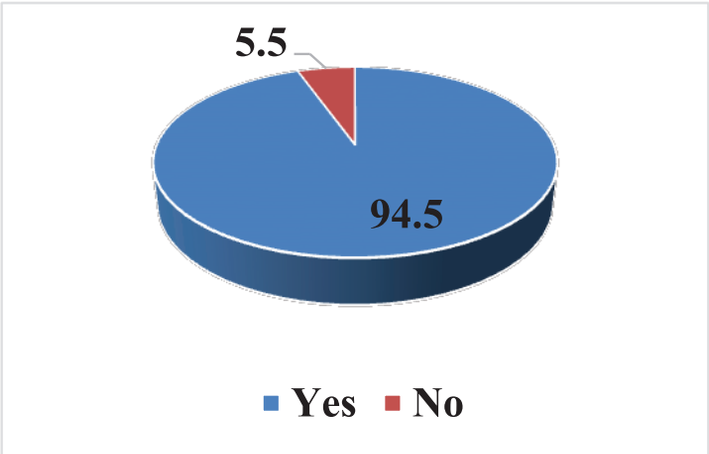

Figure 1: Minimization of antibiotic resistance

Measures to minimize antibiotic resistance

The use of antibiotics only when prescribed by doctors/health workers, consuming complete dose of prescribed antibiotics and adopting effective infection prevention and control measures were perceived as the top three measures to minimize antibiotic resistance.

Table 7: Perceptions of health workers on measures to minimize antibiotic resistance

Characteristics	Number (N=1079)	Percent of responses	Percent of cases
Using antibiotics only when prescribed by doctors/health workers	972	31.8	95.3
Consuming full course of prescribed antibiotics	842	27.6	82.5
Adopting effective infection prevention and control measures	585	19.1	57.4
Minimizing use of antibiotics in feed industry and livestock	386	12.6	37.8
Development of new antibiotics	227	7.4	22.3
Others (Prescribe after AST, rational use, develop SOPs, rational choice drugs, public awareness, training)	43	1.4	4.2
Total	**3055**	**100**	**299.5**

**Percentage exceeds 100 due to multiple responses*

3.2 Attitude of Doctors/Health Workers on Antibiotic Resistance

Almost 72% of doctors/health workers strongly agree that antimicrobial resistance is a global issue. Similarly, more than one-third of the doctors/health workers strongly agree that antibiotic resistance occurs when bacteria become resistant to antibiotics and work no longer work and also that better use of antimicrobials does not reduce problems with antibiotic resistant organisms.

Table 8: Attitude of doctors/health workers on antibiotic resistance

Characteristics	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Antimicrobial resistance is a global issue	71.5	23	2.1	0.9	2.4
Antibiotic resistance occurs when bacteria become resistant to antibiotics and no longer work	38.8	48.5	7	3.8	1.9
Better use of antimicrobials does not reduce problems with antimicrobial resistant organisms	31.8	44.2	9.9	9.2	4.9
Many infections are becoming increasingly resistant to treatment by antibiotics	39.3	52.8	4.4	1.9	1.5
Antibiotic-resistant infections make medical procedures like surgery much more dangerous	52.4	36.8	4.9	3.6	2.3

3.3 Prescription Practices of Doctors/Health Workers

We found that only 19% of doctors/health workers prescribe broad spectrum antibiotics despite the effectiveness of narrow spectrum antibiotics. Similarly, 86% of them does not prescribe antibiotics for flu which signifies rational choice of drugs.

Table 9: Prescriptions practices of antibiotics by doctors/health workers

Characteristics	Yes (N/%)	No (N/%)
Prescribing broad spectrum antibiotics despite the effectiveness of narrow spectrum	203 (18.8)	876 (81.2)
Prescribe antibiotics for flu	161 (14.9)	918 (85.1)

Antibiotics susceptibility testing (AST)

It was found that only around 49% of doctors/health workers recommend antibiotics sensitivity testing before prescribing antibiotics. Likewise, only 32% of the health facilities have laboratory facility for AST which is a significant reason for hampering rational prescriptions of antibiotics.

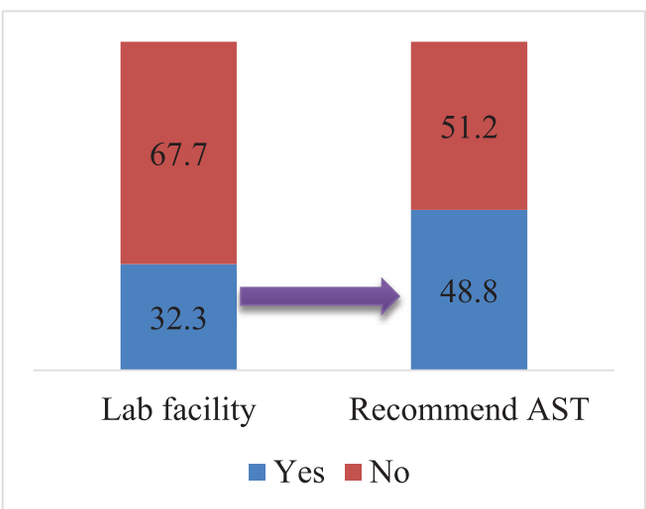

Figure 2: Availability of antibiotic susceptibility testing (AST) facility

Guidelines for antibiotics prescription

Around 59% of doctors/health workers had heard about national guideline for antibiotics prescriptions, among them only 54% had access to it.

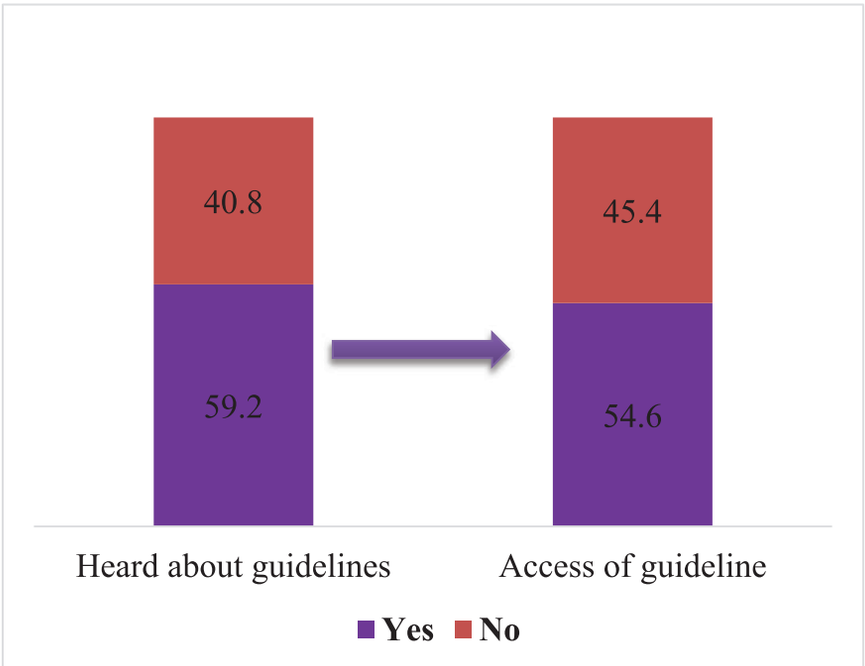

Figure 3: Access of national guidelines for antibiotics prescription

Similarly, only 17% of health facilities have separate institutional guidelines for antibiotics prescription. Majority (86%) of the doctors/health workers prescribed antibiotics based on institutional guidelines.

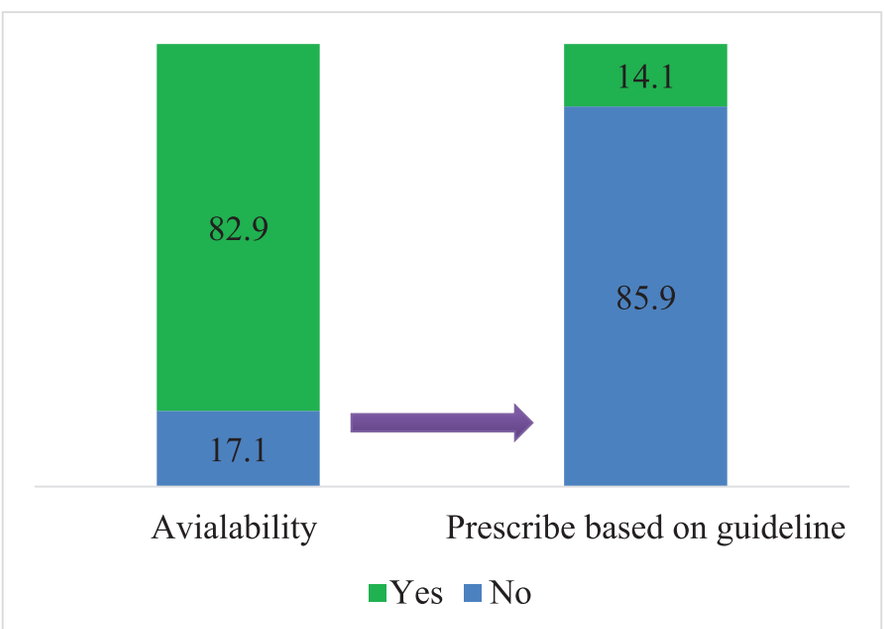

Figure 4: Availability of institutional guidelines for antibiotics prescriptions

3.4 Factors Associated with KAP Score of Doctor's/Health Workers

The studies found that majority (73.7%) of laboratories were available in urban area as compared to rural area and this was statistically significant. Likewise, health workers have lesser access of laboratory in their working area as compared to doctors. Laboratories for culture facility are available more in private health institutions (80.5%) than in government health institutions. At local level, fewer laboratories (18.4%) were available than at provincial and federal level which was statistically significant. Similarly, availability of laboratory for antibiotic susceptibility test was highest in Bagmati province (81.8%) and lowest in Karnali province (32.3%) which was statistically significant.

Table 10: Factors associated with availability of laboratory for AST

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	689 (73.7)	246 (26.3)	0.001
Rural	41 (28.5)	103 (71.5)	
Type of profession			
Doctors	626 (81.5)	142 (18.5)	0.001
Health workers (HWs)	104 (33.4)	207 (66.6)	
Health institution			
Government	285 (54.2)	241 (45.8)	0.001
Private	445 (80.5)	108 (19.5)	
Level of health institution			
Federal	127 (81.9)	28 (18.1)	0.001
Provincial	125 (65.1)	67 (34.9)	
Local	33 (18.4)	146 (81.6)	
Province			
Koshi	116 (74.8)	39 (25.2)	0.001
Madhesh	115 (74.7)	39 (25.3)	
Bagmati	126 (81.8)	28 (18.2)	
Gandaki	124 (80)	31 (20)	
Lumbini	112 (72.3)	43 (27.7)	
Karnali	49 (32.2)	103 (67.8)	
Sudurpashchim	88 (57.1)	66 (42.9)	

The study showed that doctors (59%) are more likely to suggest for AST than other health workers. Likewise, majority of health professionals residing in urban area (52.4%) recommend AST as compared to the ones residing in rural areas. Recommendation for AST was found highest in federal level (52.9%) followed by provincial level (50%) and local level (18.4%). Recommending AST was highest in Madhesh province (64.5%) and lowest in Karnali province (19.1%) which was found to be statistically significant.

Table 11: Factors associated with recommending AST by doctors/health workers

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	490 (52.4)	445 (47.6)	0.001
Rural	37 (25.7)	107 (74.3)	
Type of profession			
Doctors	453 (59)	315 (41)	0.001
Health workers (HWs)	74 (23.8)	237 (76.2)	
Health institution			
Government	211 (40.1)	315 (59.9)	0.001
Private	316 (57.1)	237 (42.9)	
Level of health institution			
Federal	82 (52.9)	73 (47.1)	0.001
Provincial	96 (50)	96 (50)	
Local	33 (18.4)	146 (81.6)	
Province			
Koshi	68 (43.9)	87 (56.1)	0.001
Madhesh	103 (66.9)	51 (33.1)	
Bagmati	73 (47.4)	81 (52.6)	
Gandaki	100 (64.5)	55 (35.5)	
Lumbini	100 (64.5)	55 (35.5)	
Karnali	29 (19.1)	123 (80.9)	
Sudurpashchim	54 (35.1)	100 (64.9)	

The majority of health professionals in urban area (60.1%) had heard about national treatment guidelines. Most of the doctors (60.7%) had heard about national guidelines as compared to other health workers. The number of health workers who had heard about guidelines was higher in provincial level (65.1%) followed by local and federal level.

Table 12: Factors associated with awareness about national treatment guidelines

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	562 (60.1)	373 (39.9)	0.132
Rural	77 (53.5)	67 (46.5)	
Type of profession			
Doctors	466 (60.7)	302 (39.3)	0.126
Health workers (HWs)	173 (55.6)	138 (44.4)	

Health institution			0.495
Government	306 (58.2)	220 (41.8)	
Private	333 (60.2)	220 (39.8)	
Level of health institution			0.021
Federal	78 (50.3)	77 (49.7)	
Provincial	125 (65.1)	67 (34.9)	
Local	103 (57.5)	76 (42.5)	
Province			0.062
Koshi	96 (61.9)	59 (38.1)	
Madhesh	107 (69.5)	47 (30.5)	
Bagmati	91 (59.1)	63 (40.9)	
Gandaki	80 (51.6)	75 (48.4)	
Lumbini	87 (56.1)	68 (43.9)	
Karnali	91 (59.9)	61 (40.1)	
Sudurpashchim	87 (56.5)	67 (43.5)	

The findings showed that access to national treatment guidelines was highest in urban area (56.4%) as compared to rural areas. Likewise, majority of doctors (58.6%) had access to national treatment guidelines as compared to other health workers which was statistically significant.The provincial level health institutions had more access (66.1%) to national treatment guidelines in comparison to federal and local level. Access to national treatment guidelines was highest for health professionals serving in Gandaki province (69.6%) and lowest in Bagmati province (44.6%).

Table 13: Factors associated with access to national treatment guidelines

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			0.014
Urban	317 (56.4)	245 (43.6)	
Rural	32 (41.6)	45 (58.4)	
Type of profession			0.001
Doctors	273 (58.6)	193 (41.1)	
Health workers (HWs)	76 (43.9)	97 (56.1)	
Health institution			0.389
Government	172 (56.4)	133 (43.6)	
Private	177 (53)	157 (47)	
Level of health institution			0.017
Federal	40 (51.3)	38 (48.7)	
Provincial	82 (66.1)	42 (33.9)	
Local	50 (49.5)	53 (51.5)	

Province			0.027
Koshi	49 (50)	49 (50)	
Madhesh	59 (54.6)	49 (45.4)	
Bagmati	41 (44.6)	51 (55.4)	
Gandaki	55 (69.6)	24 (30.4)	
Lumbini	54 (62.1)	33 (37.9)	
Karnali	46 (51.1)	44 (48.9)	
Sudurpashchim	45 (52.9)	40 (47.1)	

3.5 Knowledge of Community Pharmacies on Antibiotics Use and Its Resistance

Socio-demographic characteristics of drug dispensers

The majority of drug dispensers belonged to the age group 25 to 34 years followed by 35 to 44 years. Likewise, only 39.3% of drug dispensers were found to have completed pharmacy degree. Also, less than half of the pharmacies i.e. 48.4% had their own license whereas 47.6% of pharmacies borrowed license from others. About 4% of the pharmacies were not registered.

Table 14: Socio-demographic characteristics of drug dispensers

Characteristics	Number (n=521)	Percent
Age (average) = 34.91 years		
<25	111	21.3
25-34	179	34.4
35-44	126	24.2
45-54	73	14
>55	32	6.1
Gender		
Male	396	76.01
Female	125	23.99
Ethnicity		
Brahmin/Chhetri	290	55.66
Janajati	89	17.08
Newar	17	3.26
Dalit	12	2.30
Terai/Madhesi	103	19.77

Muslim	7	1.34
Others (Tharu, Sanyasi, Marwadi)	3	0.58
Area		
Urban	492	94.43
Rural	29	5.57
Educational level		
Pharmacy degree	205	39.3
Other health degree except pharmacy (CMA, HA, AHWs, Lab)	230	44.1
Other degree except health	29	5.6
Others (Ayurveda, orientation, Training)	57	10.9
Pharmacy registration		
Registered with others' license	248	47.6
Registered based on own license	252	48.4
Not registered	21	4

Knowledge of drug dispensers about antibiotics use and its resistance

It was found that majority of drug dispensers in pharmacies were well aware that antibiotics are used for treating bacterial diseases. Still 10% of drug dispensers perceived that antibiotics can also be used to treat viral diseases.

Table 15: Perception of drug dispensers regarding use of antibiotics

Characteristics	Number (N=341)	Percent of responses	Percent of cases
Bacterial disease	430	32.38	82.5
Cold and Flu	154	11.60	29.6
Viral disease	126	9.45	24.2
Pain	45	3.39	8.6
General weakness	19	1.43	3.6
Infection	318	23.95	61
Diarrhea	169	12.73	32.4
Others (Fever, severe cases, swelling, dehydration, UTI, typhoid, tonsillitis, pneumonia, wound)	67	5.05	12.9
Total	**1328**	**100**	**254.9**

**Percentage exceeds 100 due to multiple responses*

Perceived knowledge of drug dispensers on antibiotics

Majority of drug dispensers (i.e.,91.2%) perceived that culture and sensitivity test should be done before antibiotics prescription. Most of the drug dispensers asked for the prescription slip (95.4%) before selling

the antibiotics. Similarly, almost two-thirds of drug dispensers perceived that antibiotics consumption should not be stopped immediately after recovery of symptoms i.e., without taking the complete dose and must not be reused for future illnesses.

Table 16: Perceived knowledge of drug dispensers on antibiotics

Characteristics	Yes (N/%)	No (N/%)
Antibiotic prescribed for all diseases	39 (7.5)	482 (92.5)
Using broad spectrum antibiotics for general infection	130 (25)	391 (75)
Overdosing of antibiotics cause antibiotic resistant	457 (87.7)	64 (12.3)
Stop antibiotics consumption after symptoms subside	185 (35.5)	336 (64.5)
Reusing antibiotics residues for future illness	162 (31.1)	359 (68.9)
Culture sensitivity test before antibiotics consumption	475 (91.2)	46 (8.8)
Getting prescriptions before buying antibiotic	497 (95.4)	24 (4.6)
Buying antibiotics without prescription is a problem	473 (90.8)	48 (9.2)

Minimization of antibiotic resistance

Almost 86% of the drug dispensers have heard about antibiotic resistance and among them 95% agreed that antibiotic resistance can be minimized.

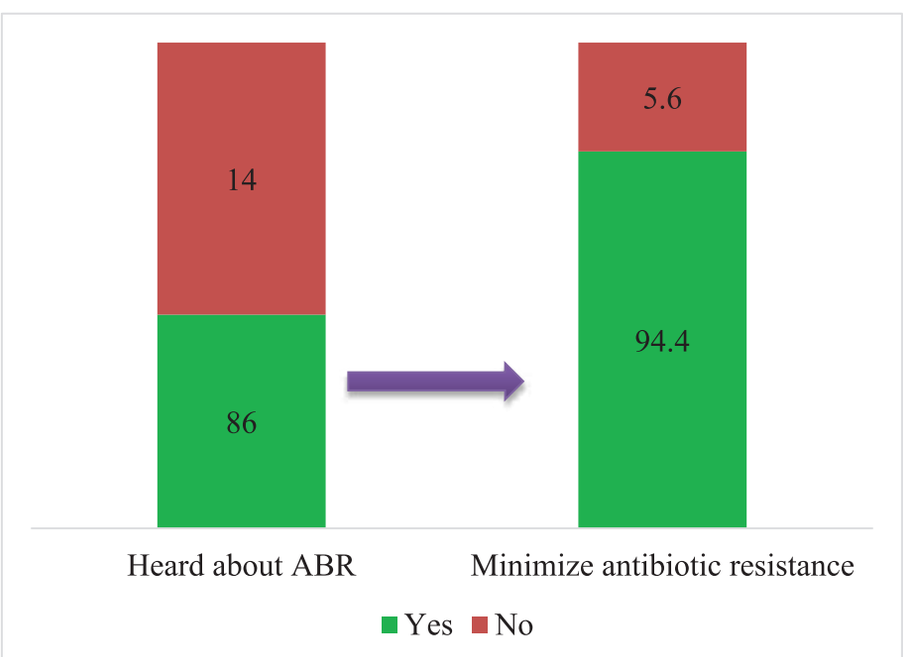

Figure 5: Antibiotic resistance and its minimization

Reasons for emergence and spread of antibiotic resistance

The use of antibiotics without prescriptions (38.8%) followed by consuming incomplete dose of antibiotics (37.9%) were mentioned by the drug dispensers as the major reasons for emergence of

antibiotic resistance.

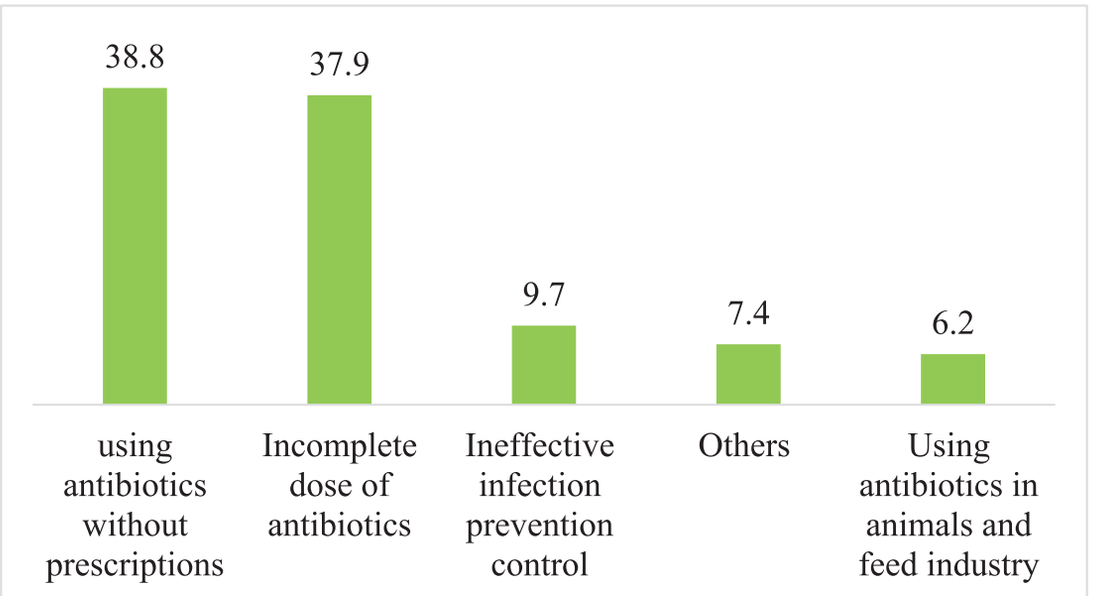

Figure 6: Perceived reasons for antibiotic resistance as mentioned by drug-dispensers

Measures to minimize antibiotic resistance

Drug dispensers perceived that antibiotic resistance could be minimized by using antibiotics with doctor's/ health worker's prescriptions followed by consuming complete dose of antibiotics.

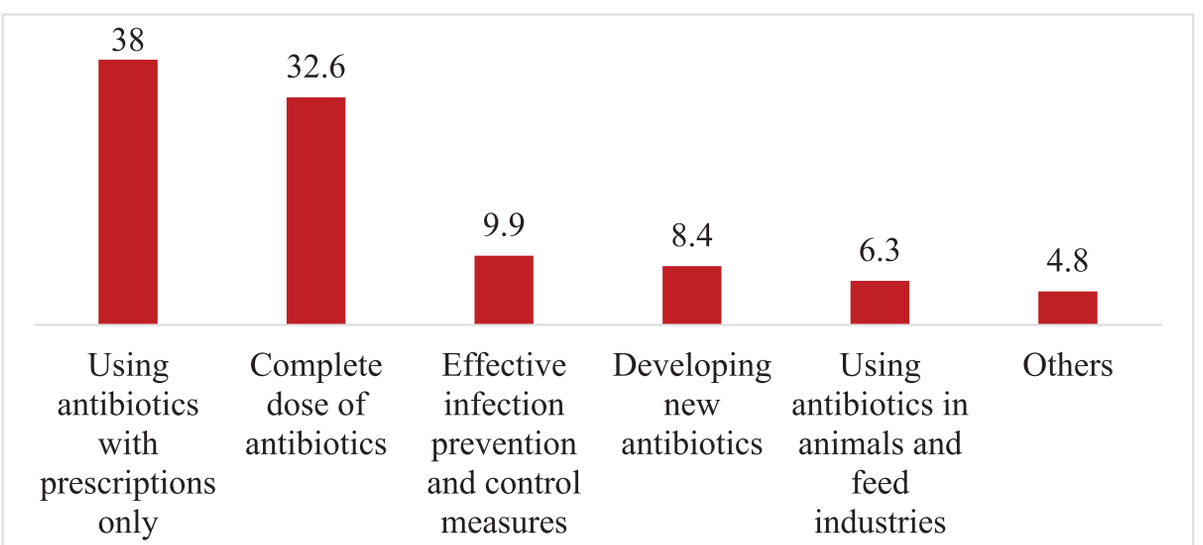

Figure 7: Perceived measures to minimize antibiotic resistance

3.6 Attitude of Community Pharmacies on Antibiotic Resistance

More than half (51%) of drug dispensers agreed that dispensing antibiotics without prescription is a serious issue. Similarly, 49% agreed that antibiotics are safe drugs, hence can be used commonly. Around 54% of the drug dispensers agreed that with the discovery and development of new antibiotics AMR problem can be solved. However, 47% mentioned that skipping one or two dose of antibiotics doses not contribute to the development of antibiotic resistance.

Table 17: Attitude of drug dispensers on antibiotic resistance

Characteristics	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Dispensing antibiotics without prescription is a serious issue.	50.7	38.4	5.8	4.6	0.6
Antibiotic are safe drugs, hence can be used commonly.	15.4	48.9	4.6	27.1	4
New antibiotics discoveries and development can solve the AMR problem.	13.4	53.6	16.3	14.6	2.1
Skipping one or two doses of antibiotics does not contribute to the development of antibiotic resistance.	10	46.3	8.4	26.9	8.4
Patients must be advised about complying with the treatment while dispensing antibiotics.	74.1	24	0.6	0.8	0.6

3.7 Dispensing Practices of Community Pharmacies

It was found that majority of the drug dispensers (43.4%) dispense antibiotics without doctor's/health worker's prescription.

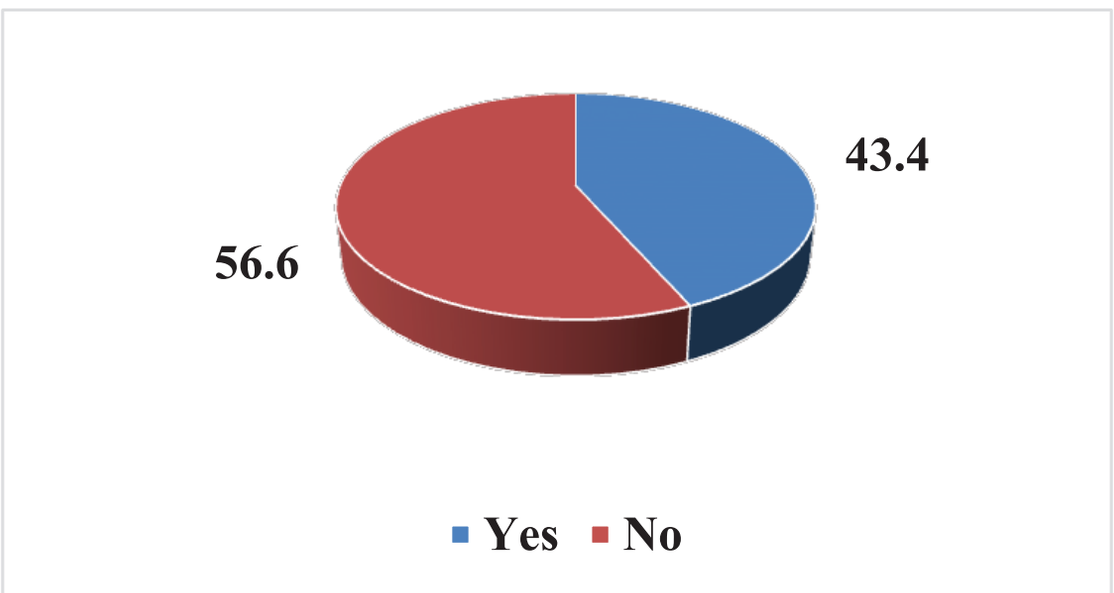

Figure 8: Dispensing antibiotics without prescriptions

Reasons for dispensing antibiotics without prescriptions

The major reasons behind dispensing antibiotics without prescriptions were known clinical history of the patient and the familier patient.

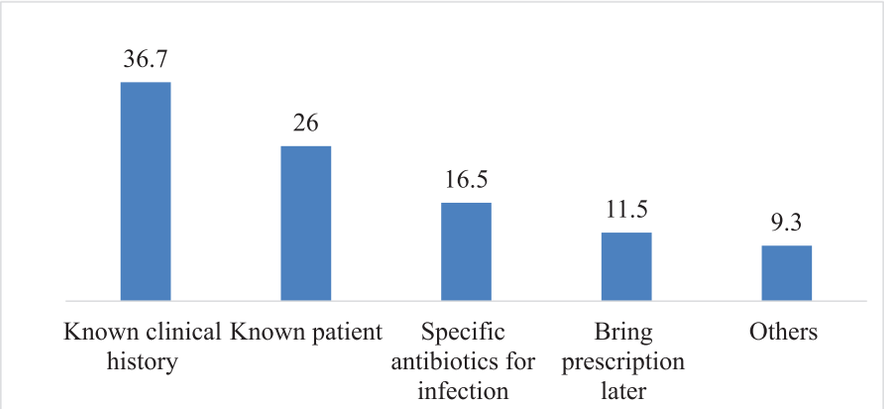

Figure 9: Reasons for dispensing antibiotics without prescriptions

Antibiotics commonly dispensed without prescriptions

Azithromycin (24.5%), Amoxycillin/Amoxyclav (20.5%), Cefixime (14.8%), Ciprofloxacin (14.1%), Metronidazole (9%), Ceftriaxone (8%) and Cotrimoxazole (8.1%) were found to be commonly dispensed antibiotics without prescriptions.

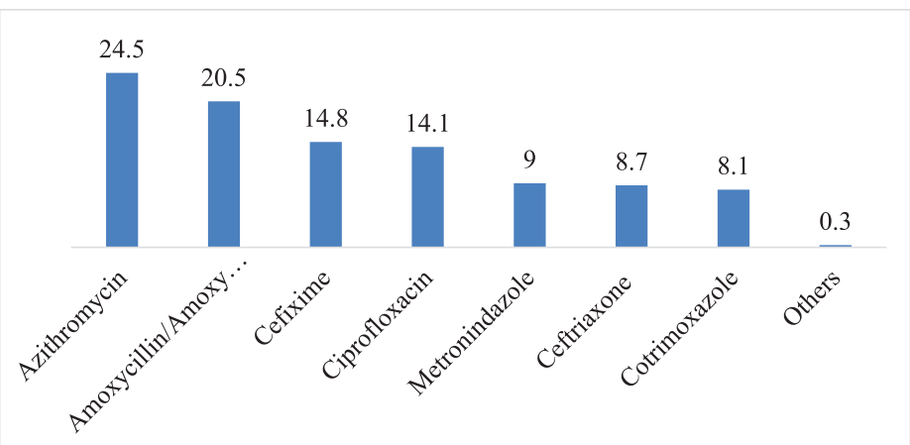

Figure 10: Commonly dispensed antibiotics without prescriptions

Counseling practices of community pharmacies

The majority i.e. 94% of drug dispensers used to counsel patients while dispensing antibiotics. Among those providing counseling, around 91% asked the patient about current medication before dispensing antibiotics.

Table 18: Counseling practices of drug dispensers

Characteristics	Yes (N/%)	No (N/%)
Ask the patient about medical allergy before giving antibiotics	471 (90.4)	50 (9.6)
Ask the patient about current medication before dispensing antibiotics	473 (90.8)	48 (9.2)
Follow and take feedback from patient after giving antibiotics	472 (90.6)	49 (9.4)
Counsel a patient during dispensing antibiotics	490 (94)	31 (6)

Components shared during counseling

Among those who provided counseling, around 96% counselled the patients about dose and route of drug administration followed by directions to consuming the complete course.

Table 19: Components shared by drug dispensers during counseling of the patients

Characteristics	Number (N=490)	Percent of responses	Percent of cases
Dose and route of the drug	464	39.1	96.3
Complete course of antibiotics	314	26.4	65.1
Drug interactions	248	20.9	51.5
Potential side effects	135	11.4	28
Others (Food habits, toxic effects, time schedule, personal hygiene)	27	2.3	5.6
Total	**813**	**100**	**246.5**

**Percentage exceeds 100 due to multiple responses*

3.8 Factors Associated with KAP Score of Drug Dispensers

The study found that majority of community pharmacies from rural area (79.3%) dispensed antibiotics without prescriptions as compared to urban area (55.3%). Higher proportions of drug dispensers with health degree other than pharmacy (65.5%) were found to dispense antibiotics without prescription as compared to the ones with a pharmacy degree (49.3%). Drug dispensers who had borrowed a license (60.5%) dispensed antibiotics without prescription as compared to those having own license (53.6%). The dispensing of antibiotics without prescriptions was found highest among community pharmacies from Bagmati province (86.5%) and lowest in Lumbini province (14.7%).

Table 20: Factors associated with dispensing antibiotics without prescriptions

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	272 (55.3)	220 (44.7)	0.011
Rural	23 (79.3)	6 (20.7)	
Educational degree			
Pharmacy	101 (49.3)	104 (50.7)	
Health degree other than pharmacy	145 (63)	85 (37)	0.022
Degree other than health	19 (65.5)	10 (34.5)	
Others (Orientation, Training)	30 (52.6)	27 (47.4)	
Registration status			
Borrowed license	150 (60.5)	98 (39.5)	
Own license	135 (53.6)	117 (46.4)	0.207
Not registered	10 (47.6)	11 (52.4)	

Province			0.001
Koshi	56 (74.7)	19 (25.3)	
Madhesh	37 (49.3)	38 (50.7)	
Bagmati	64 (86.5)	10 (13.5)	
Gandaki	48 (64)	27 (36)	
Lumbini	11 (14.7)	64 (85.3)	
Karnali	44 (60.3)	29 (39.7)	
Sudurpashchim	35 (47.3)	39 (52.7)	

Majority of rural community pharmacies (96.6%) were found to counsel patients about use of antibiotics. Drug dispensers with health degree other than pharmacy (95.7%) were the ones to counsel patients about antibiotics use as compared to the ones with other degrees. Community pharmacies with borrowed license (94.8%) counselled patients about use of antibiotics as compared to those with own license (93.3%). Counseling patients about use of antibiotics was highest in Gandaki province (100%) and lowest in Madhesh province (81.3%).

Table 21: Factors associated with counselling patients by drug dispensers

Characteristics	**Yes (n/%)**	**No (n/%)**	**p value**
Residence			0.558
Urban	462 (93.9)	30 (6.1)	
Rural	28 (96.6)	1 (3.4)	
Educational degree			0.001
Pharmacy	196 (95.6)	9 (4.4)	
Health degree other than pharmacy	220 (95.7)	10 (4.3)	
Degree other than health	27 (93.1)	2 (6.9)	
Others (Orientation, Training)	47 (82.5)	10 (17.5)	
Registration status			0.756
Borrowed license	235 (94.8)	13 (5.2)	
Own license	235 (93.3)	17 (6.7)	
Not registered	20 (95.2)	1 (4.8)	
Province			0.001
Koshi	71 (94.7)	4 (5.3)	
Madhesh	61 (81.3)	14 (18.7)	
Bagmati	69 (93.2)	5 (6.8)	
Gandaki	75 (100)	0 (0)	
Lumbini	71 (94.7)	4 (5.3)	
Karnali	71 (97.3)	2 (2.7)	
Sudurpashchim	72 (97.3)	2 (2.7)	

3.9 Knowledge of Outpatients on Antibiotics Use and Its Resistance

Socio-demographic characteristics of outpatients

Among 2122 outpatients interviewed, majority belonged to the age group of greater than 55 years. Similarly, most of the outpatients were female (57.5%). One third of them had secondary level education (33.5%) followed by primary level (21.2) whereas 14.3% were illiterate.

Table 22: Socio-demographic characteristics of outpatients

Characteristics	Number(N=2122)	Percent
Age (years)		
<25	308	14.5
25-34	374	17.6
35-44	422	19.9
45-54	387	18.2
>55	631	29.7
Gender		
Male	898	42.3
Female	1224	57.5
Ethnicity		
Brahmin/Chhetri	1072	50.5
Janajati	353	16.6
Newar	68	3.2
Dalit	207	9.8
Terai/Madhesi	319	15.0
Muslim	82	3.9
Others	21	1.0
Address		
Urban	1460	68.8
Rural	662	31.2
Educational status		
Illiterate	304	14.3
Literate	428	20.2
Primary (1-8)	450	21.2
Secondary(9-12)	710	33.5
Bachelor and above	230	10.8
Total	**2122**	**100**

Knowledge of outpatients on antibiotics use and its resistance

It was also found that almost 57.8% and 72.9% of outpatients have heard about antibiotics and antibiotic resistance respectively.

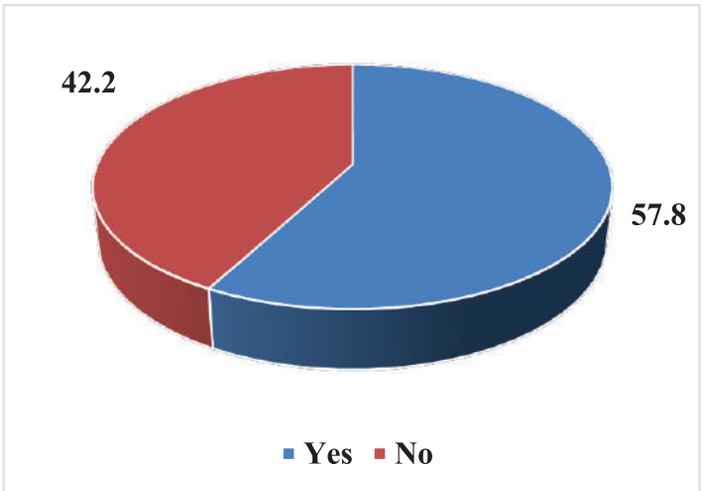

Figure 11: Outpatients heard about antibiotics

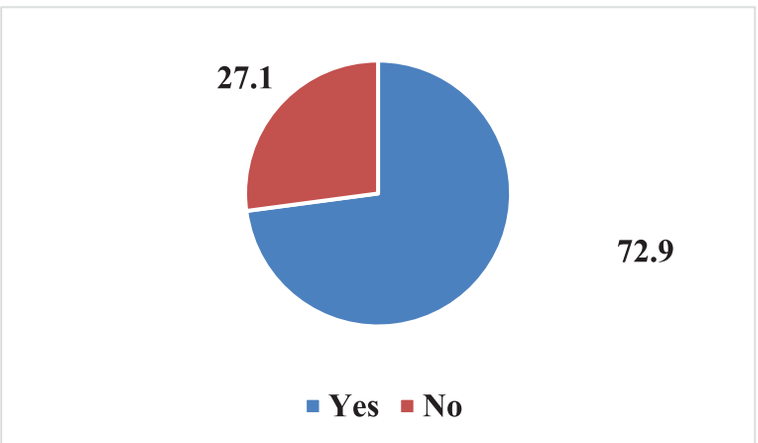

Figure 12: Outpatients heard about antibiotic resistance

Perceived knowledge of outpatients on antibiotics use and its resistance

Majority of the outpatients (95%) perceived that prescription is necessary for consuming antibiotics. Most of the outpatients (87.4%) believed that consuming multiple antibiotics for single condition gave better result. Similarly, around 70% perceived that antibiotics can be stopped when symptoms get improved.

Table 23: Perceived knowledge of outpatients on antibiotics

Characteristics (n=1226)	Yes (N/%)	No (N/%)
Prescription necessary for consuming antibiotics	95 (7.7)	1131 (92.3)
Necessity of lab tests before taking antibiotics	220 (17.9)	1006 (82.1)
Costly antibiotics are effective	925 (75.4)	301 (24.6)
Multiple antibiotics for a single condition produce better result	1072 (87.4)	154 (12.6)
Stopping antibiotics when symptoms gets improved	856 (69.8)	370 (30.2)

Symptoms treated with antibiotics

About two-third of the outpatients perceived that antibiotics can be used to treat fever followed by infection and pain.

Table 24: Perceptions of outpatients on symptoms to be treated with antibiotics

Characteristics	Number (N=1222)	Percent of responses	Percent of cases
Fever	784	25.5	64.2
Headache	289	9.4	23.6
Cough and cold	482	15.7	39.4
Sore throat	337	10.9	27.6
Pain	387	12.6	31.7
Infection	512	16.6	41.9
Diarrhea	225	7.3	18.4
Others(Itching, wounds, burn, severe cases, malaise, allergy, nausea, vomiting)	63	2	5.2
Total	**3079**	**100**	**252**

**Percentage exceeds 100 due to multiple responses*

Reasons for emergence of antibiotic resistance

Among the outpatients who have heard about antibiotic resistance, majority (85.8%) mentioned that antibiotic resistance occurs by using antibiotic without doctor's/ health worker's prescription. Furthermore, majority of the outpatients (90.4%) believed that antibiotic resistance could be minimized.

Table 25: Outpatients' perceptions on reasons for antibiotic resistance

Characteristics	Number (N=332)	Percent of responses	Percent of cases
Using antibiotics without doctors/health workers prescriptions	285	39.5	85.8
Consuming incomplete dose of antibiotics	235	32.5	70.8
Ineffective infection prevention and control measures	112	15.5	33.7
Use of antibiotics in feed industry and livestock	74	10.2	22.3
Others (Overuse of antibiotics, incomplete use, high dose, inappropriate diagnosis, regular consumption for simple case)	16	2.2	4.8
Total	**722**	**100**	**217.5**

**Percentage exceeds 100 due to multiple responses*

Measures to minimize antibiotic resistance

The majority of the patients perceived that using antibiotics based on doctor/health worker's prescriptions and consuming full course of prescribed antibiotics were major ways for minimizing antibiotic resistance.

Table 26: Outpatient's perceptions on measures to minimize antibiotic resistance

Characteristics	Number (N=300)	Percent of responses	Percent of cases
Using antibiotics only when prescribed by doctors/health workers	255	36.2	85
Consuming full course of prescribed antibiotics	213	30.2	71
Adopting effective infection prevention and control measures	110	15.6	36.7
Minimizing use of antibiotics in feed industry and livestock	54	7.7	18
Development of new antibiotics	60	8.5	20
Others (Developing guidelines, awareness program, AST, minimum use of antibiotics, complete diagnosis, training)	13	1.8	4.3
Total	**705**	**100**	**235**

**Percentage exceeds 100 due to multiple responses*

3.10 Attitude of Outpatients on Antibiotic Resistance

31.8% of the outpatients agreed that antibiotic resistance is a global health issue whereas around half (45.7%) of them were neutral on it. Almost half of the outpatients (54.8%) agreed that antibiotics use without doctor's prescription is safe. Similarly, more than half (53.7%) of the outpatients agreed that the effectiveness of treatment would be reduced if a full course of antibiotics was not completed. Also, 51.1% strongly agreed that antibiotics should be used only after doctor's or health worker's prescriptions. About 32% agreed that antibiotics should be used as growth promoters in livestock farm.

Table 27: Outpatient's attitude on antibiotic resistance

Characteristics	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Antibiotics resistance is a global health issue.	19.5	31.8	45.7	1.9	1.1
Antibiotics use without doctor's prescription is safe.	33.9	54.8	3.4	6.3	1.5
The effectiveness of treatment would be reduced if a full course of antibiotics was not completed.	20.4	53.7	19.7	5.3	0.9
Antibiotics should be used as growth promoters in livestock farm.	22.4	32	32.5	11.1	0
People should use antibiotics only when they are prescribed by a doctor or health workers.	51.1	44.3	3	0.8	0.7

3.11 Use Pattern of Antibiotics by Outpatients

Majority of the outpatients (85.4%) consulted with doctors/health workers before taking antibiotics.

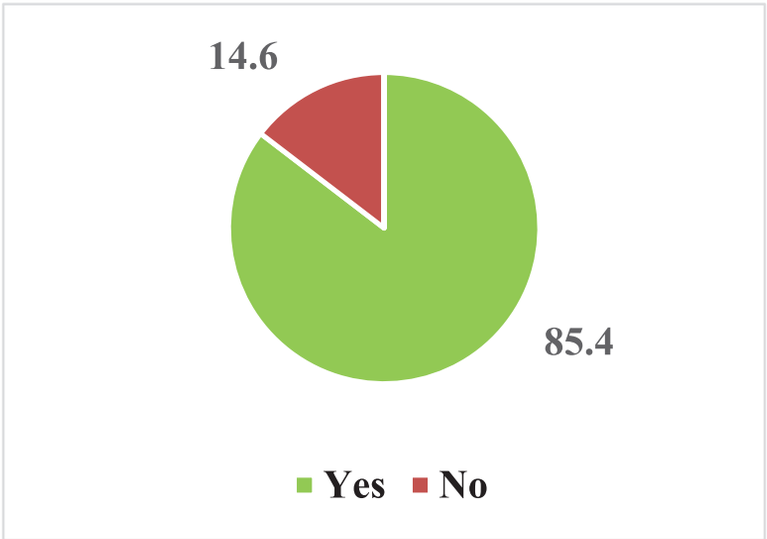

Figure 13: Consulting doctors/health workers for using antibiotics

Majority of the outpatients (91.6%) used to check expiry date before consuming antibiotics. Around 22% of them saved residual antibiotics for treating similar symptoms in the future. Also, around 18% and 13% of outpatients used antibiotics after suggestions from family/friends and shared antibiotics among family/friends during sickness respectively. About one-fourth (i.e. 22%) of the outpatients did not consume full course of antibiotics. Similarly, about 10% and 8% of the outpatients consumed antibiotic as prophylaxis and consume double dose antibiotic for fastest recovery respectively.

Table 28: Use pattern of antibiotics by outpatients

Characteristics (n=1226)	Yes (N/%)	No (N/%)
Use of antibiotics after suggestions from family/friends	212 (17.3)	1014 (82.7)
Sharing antibiotics among family/friends during sickness	165 (13.5)	1061 (86.5)
Suggesting antibiotics to family/friends when they are sick	267 (12.6)	959 (45.2)
Stopping antibiotic without full course	270 (22)	956 (78)
Using antibiotic as prophylaxis	114 (9.3)	1112 (90.7)
Checking expiry date of antibiotic before using	1123 (91.6)	103 (8.4)
Consuming double dose antibiotic for fastest recovery	90 (7.3)	1136 (92.7)
Saving residual antibiotics for treating similar symptoms in future	274 (22.3)	952 (77.7)

Buying antibiotics without prescriptions

Additionally, around 28% of the outpatients mentioned that they buy antibiotics without doctor's/health worker's prescriptions.

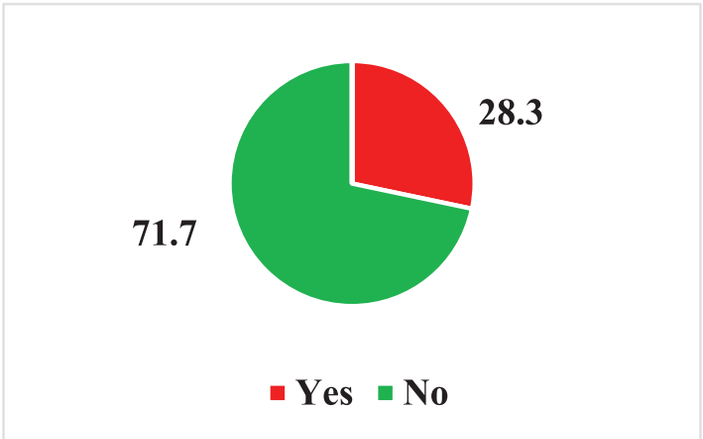

Figure 14: Buying antibiotics without prescriptions

Symptoms for buying antibiotics without prescriptions

More than half of the outpatients (68.3%) buy antibiotics without prescriptions for treating fever followed by symptoms of throat pain (56.9%).

Table 29: Outpatients' perceptions on symptoms for buying antibiotics without prescriptions

Characteristics	Number (N=341)	Percent of responses	Percent of cases
Fever	233	28.3	68.3
Throat pain	194	23.5	56.9
Cold and flu	115	14	33.7
Diarrhea	98	11.9	28.7
Infections	81	9.8	23.8
Pain	94	11.4	27.6
Others (Wound infection, cough, emergence case, vomiting, stomachache)	9	1.1	2.6
Total	**824**	**100**	**241.6**

**Percentage exceeds 100 due to multiple responses*

Reasons for buying antibiotics without prescriptions

Almost half of the outpatients buy antibiotics without prescriptions due to easy availability of antibiotics in nearby pharmacies followed by for emergency situation, previous experience and lack of time to visit health facilities.

Table 30: Outpatient's perceptions on reasons for buying antibiotics without prescriptions

Characteristics	Number (N=341)	Percent of responses	Percent of cases
Easy availability in nearby pharmacy	299	46.3	87.7
Lack of time to visit health facility	76	11.8	22.3
For emergency conditions	134	20.7	39.3

Unaffordable medical care at health institutions	41	6.3	12
Previous experiences	95	14.7	27.9
Others	1	0.2	0.3
Total	**646**	**100**	**189.4**

**Percentage exceeds 100 due to multiple responses*

Reasons for not consuming complete dose

About 85% of the respondents stated that improvement in health condition was a major reason for non-compliance to complete the dose of antibiotics followed by forgetting to take antibiotics.

Table 31: Reasons for not consuming complete dose of antibiotics

Characteristics	Number (N=266)	Percent of responses	Percent of cases
Improvement in health condition	227	46.8	85.3
Financial constraints	31	6.4	11.7
Forget to take antibiotics	107	22.1	40.2
Lack of knowledge and information	73	15.1	27.4
When antibiotics do not have any impacts	44	9.1	16.5
Others (Drug interaction, side effects)	3	0.6	1.1
Total	**485**	**100**	**182.3**

**Percentage exceeds 100 due to multiple responses*

3.12 Prescription Patterns of Antibiotics using WHO Indicators

The prescription slips of all outpatients visiting health facilities for the treatment were observed to note down the basic information based on WHO core prescribing indicators. It was found that 84.6% of the drugs were not prescribed by their generic name. Similarly, more than one-third i.e. 37.8% of prescribed medicines were antibiotics which is higher than the standard mentioned by WHO. There was minimum number of injectable drugs i.e., 9.4%. Over half (58%) of the patients had medicines prescribed from the essential drug list. Dose, strength, dosage form, route and duration were mentioned in most of the prescription slips.

Table 32: Prescription practices based on WHO indicators

Characteristics	Number(N=2122)	Percent
Number of medicine prescribed	Average (Mean)	Std. deviation
	4.27	4.831
Drugs prescribed with generic name		
Yes	326	15.4
No	1796	84.6
Prescribed antibiotics		
Yes	802	37.8

No	1320	62.2
Prescribed injectable drugs in this visit		
Yes	200	9.4
No	1922	90.6
Prescribed drugs from Essential Drug List (EDL)		
Yes	1230	58
No	892	42
Doses regimen related information mentioned in prescription		
Dose		
Yes	2091	98.5
No	31	1.5
Strength		
Yes	2070	97.5
No	52	2.5
Dosage form		
Yes	2105	99.2
No	17	0.8
Route		
Yes	2002	94.3
No	120	5.7
Duration		
Yes	2072	97.6
No	50	2.4

3.13 Consumption of Antibiotics based on AWaRe Classification

The consumption of antibiotics based on the AWaRe classification showed that the majority of antibiotics consumed were from the Watch group i.e. 70% followed by Access group i.e. 29.8% and least 0.1% was from Reserve group.

Table 33: Consumption of AWaRe classification

Characteristics	Number (n)	Percent (%)
Access	1549	29.8
Watch	3643	70.1
Reserve	7	0.1
Total	**5199**	**100.0**

The five most frequently consumed antibiotics were found to be Ceftriaxone, Metronidazole, Ornidazole, Piperacillin tazobactam and Azithromycin respectively.

Table 34: Consumption of antibiotics

Name of antibiotics	Number (n)	Percent (%)
Access		
Amikacin	91	1.8
Amoxycillin	188	3.6
Ampicillin	40	.8
Ampicillin cloxacillin	18	.3
Cefadroxil	2	.0
Cefazoline	3	.1
Clindamycin	101	1.9
Doxycycline	107	2.1
Flucloxacillin	112	2.2
Gentamycin	12	.2
Metronindazole	477	9.2
Nitrofurantoin	11	.2
Ornidazole	373	7.2
Secnidazole	1	.0
Tetracycline	13	.3
Watch		
Azithromycin	232	4.5
Cefepime	108	2.1
Cefixime	95	1.8
Cefoperazone	124	2.4
Cefotaxime	89	1.7
Cefpodoxime	9	.2
Ceftazidime	3	.1
Ceftriaxone	1791	34.4
Cefuroxime	91	1.8
Ciprofloxacin	86	1.7
Clarithomycin	14	.3
Imipenem	6	.1
Levofloxacin	237	4.6
Meropenem	86	1.7
Moxifloxacin	46	.9
Norfloxacin	3	.1
Ofloxacin	7	.1
Piperacillin	136	2.6
Piperacillin tazobactam	446	8.6
Rifaximin	16	.3
Tobramycin	5	.1
Vancomycin	13	.3
Reserve		
Linezolid	7	.1
Total	**5199**	**100.0**

Similarly, the average number of DDDs used for each antibiotics were found to be higher than the standard Daily Defined Dose (DDD) stated by WHO for each antibiotics. The average DDD for Azithromycin, Cefixime, Cefpodoxime, Ciprofloxacin, Clarithromycin and Doxycycline were found to be extremely higher than the standard cut-off stated by WHO.

Table 35: Consumption based on DDDs per 100 OBDs

Name of antibiotics	WHO standard (DDD)	Mean (DDD)	Mean (DDDs per 100 OBDs)
Amikacin	1	3.7	66.8
Amoxycillin	3 (1.5)	5	101.5
Ampicillin	6	1.4	38.6
Ampicillin cloxacillin	8	1.3	41.6
Azithromycin	0.50	7	139.9
Cefadroxil	2	2	33.3
Cefazoline	3	1.7	61.1
Cefepime	4	3.6	75.9
Cefixime	0.40	4.1	78.7
Cefoperazone	4	2.5	66.9
Cefotaxime	4	4.1	69.2
Cefpodoxime	0.40	12.6	334.4
Ceftazidime	4	3.9	48.1
Ceftriaxone	2	3.6	85.6
Cefuroxime	0.50	4.1	81.5
Ciprofloxacin	0.80 (1)	2.8	64.0
Clarithomycin	0.5	12.2	159.6
Clindamycin	1.8 (1.2)	5.8	72.9
Doxycycline	0.10	10	196.4
Flucloxacillin	2	4.6	101.9
Gentamycin	0.24	2.8	54.8
Imipenem	2	4.4	49.6
Levofloxacin	0.50	6.4	102.1
Linezolid	1.20	4.8	51.9
Meropenem	3	5.9	73.3
Metronidazole	1.5 (2)	3.8	80.3
Moxifloxacin	0.40	5	94.6
Nitrofurantoin	0.20	5	84.1
Norfloxacin	0.80	3.5	83.3
Ofloxacin	0.40	4.5	126.2
Ornidazole	1 (1.5)	4.3	81.2
Piperacillin	14	4.9	80.1
Piperacillin tazobactam	14	4.9	79.6
Rifaximin	0.60	12.4	190.0
Secnidazole	2	.50	25.0
Tetracycline	1	1.5	26.2
Tobramycin	0.24	2.7	42.6
Vancomycin	2	5.2	73.8

3.14 Factors Associated with KAP Score of Outpatients

Higher proportion of outpatients residing in rural area (89.8%) were found to consult health professionals before consuming antibiotics as compared to those from urban area (84%). Outpatients having basic level educational degree (87.9%) were major to consult health professional before consuming antibiotics as compared to others. Highest proportion of outpatients from Sudurpashchim province (96.3%) consulted with health professional before consuming antibiotics as compared to those from Karnali province (68.6%) which was statistically significant.

Table 36: Factors associated with consulting health professionals

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	782 (84)	149 (16)	0.013
Rural	265 (89.8)	30 (10.2)	
Educational degree			
Illiterate	49 (77.8)	14 (22.2)	
Literate	98 (85.2)	17 (14.8)	0.374
Basic level	210 (87.9)	29 (12.1)	
Secondary level	504 (85.6)	85 (14.4)	
Bachelor and above	186 (84.5)	34 (15.5)	
Province			
Koshi	167 (84.8)	30 (15.2)	
Madhesh	193 (91)	19 (9)	
Bagmati	169 (80.5)	41 (19.5)	0.001
Gandaki	130 (92.9)	10 (7.1)	
Lumbini	125 (83.3)	25 (16.7)	
Karnali	105 (68.6)	48 (31.4)	
Sudurpashchim	158 (96.3)	6 (3.7)	

Majority of outpatients from rural area (32.9%) were found to buy antibiotics without prescriptions as compared to urban area. Higher proportion of literate outpatients (39.1%) bought antibiotics without prescriptions as compared to others. Outpatients from Bagmati province (46.7%) and Gandaki province (7.9%) were the highest and lowest to buy antibiotics without prescriptions respectively.

Table 37: Factors associated with buying antibiotics without prescriptions

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	250 (26.9)	681 (73.1)	0.045
Rural	97 (32.9)	198 (67.1)	
Educational degree			
Illiterate	17 (27)	46 (73)	
Literate	45 (39.1)	70 (60.9)	
Basic level	71 (29.7)	168 (70.3)	0.012
Secondary level	168 (28.5)	421 (71.5)	
Bachelor and above	46 (20.9)	174 (79.1)	

Province			0.001
Koshi	63 (32)	134 (68)	
Madhesh	67 (31.6)	145 (68.4)	
Bagmati	98 (46.7)	112 (53.3)	
Gandaki	11 (7.9)	129 (92.1)	
Lumbini	26 (17.3)	124 (82.7)	
Karnali	46 (30.1)	107 (69.9)	
Sudurpashchim	36 (22)	128 (78)	

About 80.1% of outpatients from urban area were found not to consume complete dose of antibiotics as compared to outpatients from rural area. Outpatients with educational level of bachelor degree and above (11.8%) were found to be the lowest population to consume complete dose of antibiotics as compared to other educational level. Outpatients from Bagmati province (32.4%) and Gandaki province (5.7%) were the highest and lowest proportion to consume complete does of antibiotics.

Table 38: Factors associated with consuming complete dose of antibiotics

Characteristics	**Yes (n/%)**	**No (n/%)**	**p value**
Residence			0.001
Urban	185 (19.9)	746 (80.1)	
Rural	85 (28.8)	210 (71.2)	
Educational degree			0.001
Illiterate	14 (22.2)	49 (77.8)	
Literate	42 (36.5)	73 (63.5)	
Basic level	70 (29.3)	169 (70.7)	
Secondary level	118 (20)	471 (80)	
Bachelor and above	26 (11.8)	194 (88.2)	
Province			0.001
Koshi	33 (16.8)	164 (83.2)	
Madhesh	50 (23.6)	162 (76.4)	
Bagmati	68 (32.4)	142 (67.6)	
Gandaki	8 (5.7)	132 (94.3)	
Lumbini	24 (16)	126 (84)	
Karnali	48 (31.4)	105 (68.6)	
Sudurpashchim	39 (23.8)	125 (76.2)	

Higher proportion of outpatient from rural area (91.9%) were found not to be using antibiotic as prophylaxis as compared to those from urban area (90.3%). Outpatients having educational degree of bachelor level and above (16.8%) were the major consumer of antibiotics as prophylaxis as compared to other educational degree. The use of antibiotics as prophylaxis by outpatients was found to be significantly associated with province with high proportion of outpatients (20.3%) from Madhesh province using it as prophylaxis.

Table 39: Factors associated with using antibiotics as prophylaxis

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	90 (9.7)	841 (90.3)	0.430
Rural	24 (8.1)	271 (91.9)	
Educational degree			
Illiterate	6 (9.5)	57 (90.5)	
Literate	8 (7)	107 (93)	
Basic level	13 (5.4)	226 (94.6)	0.001
Secondary level	50 (8.5)	539 (91.5)	
Bachelor and above	37 (16.8)	183 (83.2)	
Province			
Koshi	10 (5.1)	187 (94.9)	
Madhesh	43 (20.3)	169 (79.7)	
Bagmati	38 (18.1)	172 (81.9)	0.001
Gandaki	4 (2.9)	136 (97.1)	
Lumbini	1 (0.7)	149 (99.3)	
Karnali	0 (0)	153 (100)	
Sudurpashchim	18 (11)	146 (89)	

Majority of illiterate (12.7%) outpatients and the ones from urban area (11.2%) increased the dose of antibiotics for fast recovery as compared to others. Similarly, higher proportions of outpatients from Bagmati province (20.5%) increased the dose of antibiotics for fast recovery.

Table 40: Factors associated with increasing dose of antibiotics for fastest recovery

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	57 (6.1)	874 (93.9)	0.004
Rural	33 (11.2)	262 (88.8)	
Educational degree			
Illiterate	8 (12.7)	55 (87.3)	
Literate	10 (8.7)	105 (91.3)	
Basic level	20 (8.4)	219 (91.6)	0.099
Secondary level	44 (7.5)	545 (92.5)	
Bachelor and above	8 (3.6)	212 (96.4)	
Province			
Koshi	8 (4.1)	189 (95.9)	
Madhesh	23 (10.8)	189 (89.2)	
Bagmati	43 (20.5)	167 (79.5)	
Gandaki	4 (2.9)	136 (97.1)	0.001
Lumbini	1 (0.7)	149 (99.3)	
Karnali	4 (2.6)	149 (97.4)	
Sudurpashchim	7 (4.3)	157 (95.7)	

3.15 Knowledge of Veterinarians/Para-veterinarians on Antibiotics Use and its Resistance

Socio-demographic characteristics of veterinarians/para-veterinarians

It was found that majority of the veterinarians/ para-veterinarians were from the age group 25- 34 years, and among which most were male with Diploma in Animal Sciences (JTA) (50.5%) degree followed by veterinary technicians (81.6%) than veterinary doctors. Most conducted mixed practice especially in government sector.

Table 41: Socio-demographic characteristics of veterinarians/para-veterinarians

Characteristics	Number (n=477)	Percent
Age (years)		
<25	85	17.8
25-34	1154	32.3
35-44	133	27.9
45-54	78	16.4
>55	27	5.7
Gender		
Male	387	81.11
Female	90	18.9
Ethnicity		
Brahmin/Chhetri	322	67.5
Janajati	42	8.8
Newar	18	3.8
Dalit	16	3.4
Terai/Madhesi	70	14.7
Muslim	1	0.2
Others	8	1.7
Address		
Urban	405	84.9
Rural	72	15.1
Educational status		
M.V.Sc	32	6.7
B.V.Sc& AH	36	7.5
ISc. Veterinary Sciences/ Animal science	45	9.4
Diploma in Animal Sciences (JT)	241	50.5
Junior Technician Level (JTA)	109	22.9
Orientation	8	1.7
Others (Msc. Aquaculture)	6	1.3
Veterinary profession		
Veterinary doctors	64	13.4
Veterinary technicians	404	84.7
Others (Fisheries)	9	1.9

Type of veterinary practice		
Poultry practice	19	4
Pet animals' practice	23	4.8
Farm animal practice(cattle, pig, sheep, goat)	41	8.6
Mix practice (Pet and Farm animals)	389	81.6
Others(Fishery)	5	1
Type of service		
Government	249	52.2
Private	228	47.8
Total	**477**	**100**

Knowledge of veterinarians/para-veterinarians on antibiotics use and its resistance

Majority of the veterinarians /para–veterinarians perceived that antibiotics could be used for the treatment of bacterial infection (68.8%) followed by viral infection.

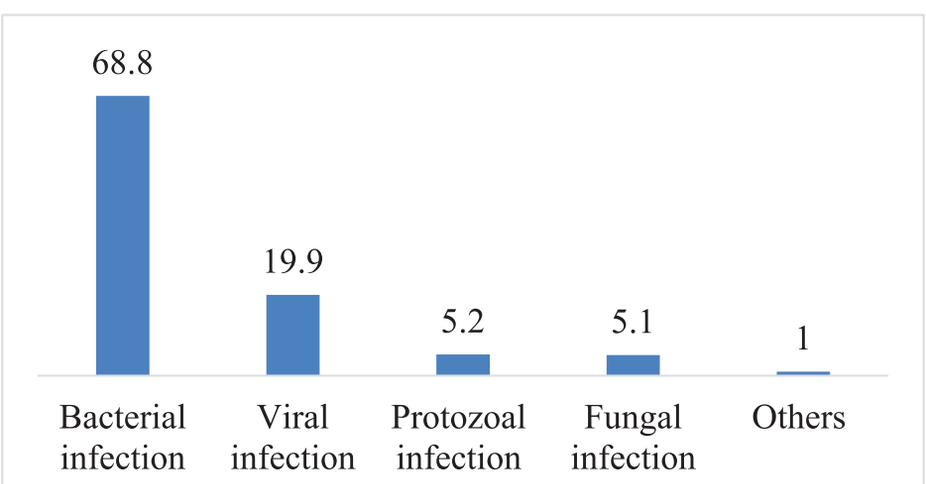

Figure 15: Knowledge of veterinary workers on the use of antibiotics

Average course of antibiotics

Most of the veterinarians/para-veterinarians stated that average course duration of antibiotics is 5 days. 36.1% and 18.2% also mentioned 3 and 7 days respectively as the duration for the antibiotic treatment.

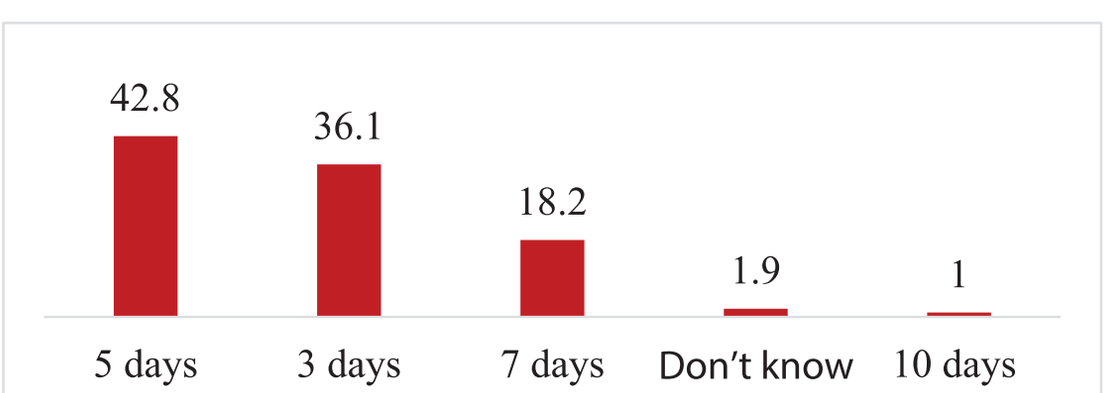

Figure 16: Average course of antibiotics as stated by veterinarians

Perceived knowledge about antibiotics by veterinarians/para-veterinarians

The majority of the veterinarians/para–veterinarians perceived that correct dose and dosage of antibiotics should be given to all animal species. Almost, one fourth of them perceived that consuming antibiotics can be stopped once signs and symptoms resolve. Also, about 9% of veterinarians/para-veterinarians considered that antibiotics could be used for prophylactic purpose to prevent animals getting sick in future. Similarly, 82.4% of veterinarians/para-veterinarians knew that resistant bacterium spread between animals and human. Also, 78.8% and 96.4% of veterinarians/para-veterinarians have heard about withdrawal period and perceive that withdrawal period need to be observed among animals that are under treatment of antibiotics respectively.

Table 42: Perceived knowledge about antibiotic by veterinarians/para-veterinarians

Characteristics (n=477)	**Yes (N/%)**	**No (N/%)**
Correct dose and dosage of antibiotics for all types of animal species	388 (81.3)	89 (18.7)
Stopping antibiotics once the animal stop showing signs and symptoms	109 (22.9)	368 (77.1)
Antibiotics to animals that are not sick to prevent it from becoming sick in the future	42 (8.8)	435 (91.2)
Antibiotics to all animals when one animal in a flock or herd is sick	39 (8.2)	438 (91.8)
Antibiotics as growth promoter in animals	39 (8.2)	438 (91.8)
Difficult to treat animal infected with resistant bacteria	372 (78)	105 (22)
Heard about drug withdrawal period	376 (78.8)	101 (21.2)
Observe withdrawal period for milking cattle/poultry treated with antibiotics	460 (96.4)	17 (3.6)
Resistant bacterium be spread between animals and human	393 (82.4)	84 (17.6)
Practicing good animal husbandry and hygiene prevent development of AMR	424 (88.9)	53 (11.1)
Using antibiotics as prophylactic can prevent illness in future	435 (91.2)	42 (8.8)
Total	**477**	**100**

Antibiotic resistance and stewardship

Majority (92.9%) of the veterinarians/para –veterinarians had heard of antibiotic resistance. Only 33.8% of the veterinarians and para –veterinarians had heard about antibiotic stewardship.

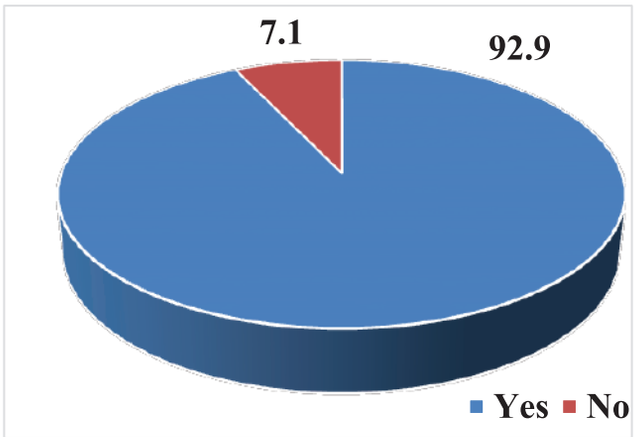

Figure 17: Veterinarians/para-veterinarians heard of antibiotic resistance

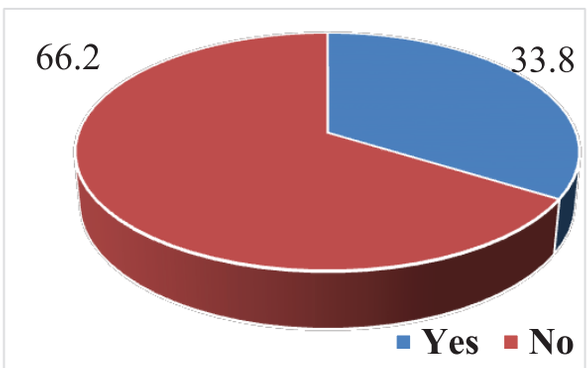

Figure 18: Heard about antibiotic stewardship by veterinarians/para-veterinarians

Route of transmission

Veterinarians/para-veterinarians mentioned that major route of transmission of antibiotic resistant bacteria is through consumption of meat and milk from infected animal (32.2%), contact with contaminated food (28.1%), direct contact with infected animals (24.6%) and sharing environment with pet animals (15.1%) respectively.

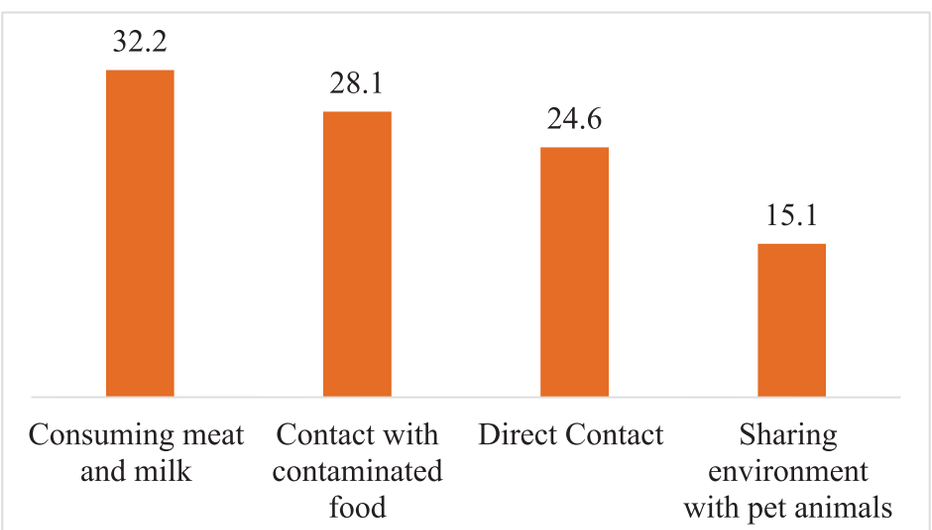

Figure 19: Perceived route of transmission of antibiotic resistant bacteria by veterinarians/para-veterinarians

Reasons for emergence of antibiotic resistance

Unnecessary prescription of antibiotics for viral infection (61.2%), inappropriate dosing of antibiotic therapy (60.3%) and lack of antibiotic sensitivity testing (AST) facilities (34.1%) were identified by veterinarians/para-veterinarians as the major three reasons for emergence of antibiotic resistance.

Table 43: Perceptions of veterinarians/para-veterinarians on reasons for emergence of antibiotic resistance

Characteristics	Number (N=443)	Percent of responses	Percent of cases
Unnecessary prescription of antibiotics for viral infections	271	20.1	61.2
Inappropriate dosing of antibiotic therapy	267	19.8	60.3
Lack of AST facilities	151	11.2	34.1
Lack of guidelines on antibiotic usage	104	7.7	23.5
Farmers demands for antibiotics	155	11.5	35
Use of antibiotics in feed industry and livestock	143	10.6	32.3
Poor biosecurity practices	92	6.8	20.8
Easy accessibility of antimicrobials	133	9.9	30
Others (Incomplete course, inappropriate dose, unnecessary use, inadequate quality of drugs)	30	2.2	6.8
Total	**1346**	**100**	**303.8**

3.16 Attitude of Veterinarians/Para-veterinarians on Antibiotic Resistance

More than half of the respondents strongly agreed with the statement that antimicrobial resistance is a significant issue. Similarly, around 44.7% agreed about addition of antibiotics in feed as growth promoter for livestock to be a cause of antibiotic resistance. More than half (59.1%) of the respondents agreed that poor biosecurity practices could contribute to the development of antimicrobial resistance. About 61.8% of the respondents strongly agreed that an appropriate withdrawal period was needed before selling meat/milk of animal treated with antibiotics to avoid antibiotic residues.

Table 44: Attitude of veterinarians/para-veterinarians on antibiotics use and its resistance

Characteristics	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Antimicrobial resistance is a significant issue.	57.7	34.8	3.1	2.1	2.3
It is important to add antibiotics in feed as growth promoter in livestock.	39.2	44.7	6.7	5.7	3.8
Poor biosecurity practices are one of the contributors to AMR development.	23.3	59.1	7.5	7.3	2.7
Giving antibiotics to healthy animals will prevent it from future illness.	54.1	37.3	3.4	3.6	1.7
An appropriate withdrawal period is needed before selling meat/milk of animal treated with antibiotics to avoid residues.	61.8	29.8	2.7	2.5	3.1

3.17 Antibiotics Prescription Practices of Veterinarians/Para-veterinarians

It was found that almost 11% of veterinarians/para –veterinarians always encountered owner initiated treatment.

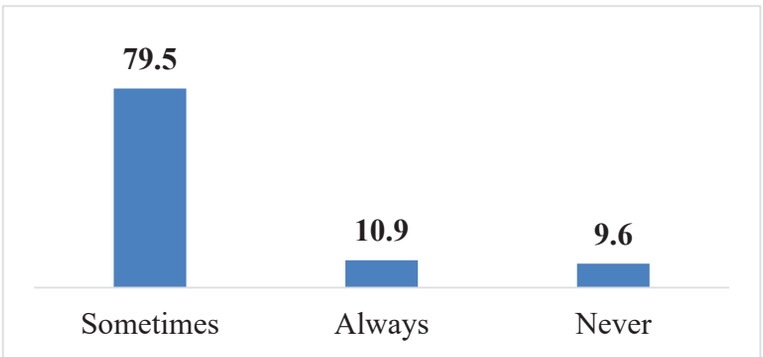

Figure 20: Owner-initiated treatment encountered by veterinarians/para-veterinarians

Antibiotic susceptibility test (AST) for prescription of antibiotics

The findings revealed that only 34% of veterinarians/para-veterinarians had access to laboratory facility for AST in their working area. Among them only 32% recommended antibiotic susceptibility testing prior to antibiotics prescriptions.

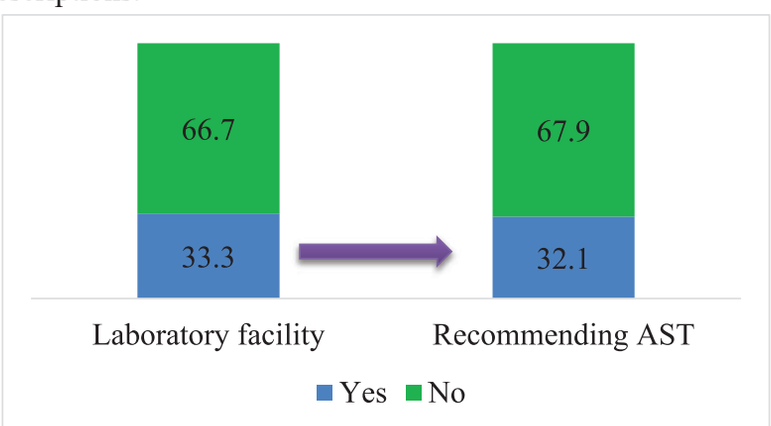

Figure 21: Antibiotic susceptibility test (AST) for prescribing antibiotics to animals

Additionally, it was found that only 18% of veterinarians/para-veterinarians always recommended for antibiotic susceptibility test before prescribing antibiotics.

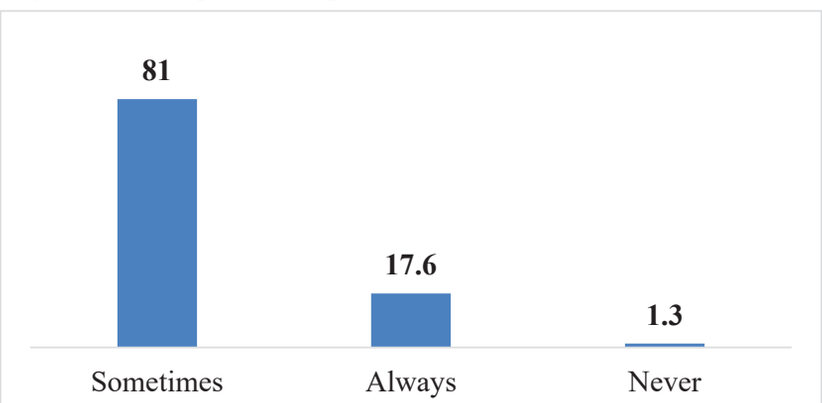

Figure 22: Frequency of recommending AST test for the treatment of animals

Reasons for not recommending AST for the treatment of animals

It was found that majority of the veterinarians/para-veterinarians (77%) didn't recommend for AST because of unavailability of laboratory facility followed by urgent case requiring immediate antibiotic therapy. Other reasons for not recommending for AST were long waiting time for the sensitivity results, farmer's inability to pay for AST, lack of knowledge and recurrent conditions respectively.

Table 45: Reasons for not recommending AST for the treatment of animals

Characteristics	Number (n= 324)	Percent of responses	Percent of cases
Lack of knowledge	51	8.6	15.9
Recurrent conditions	41	6.9	12.8
Unavailability of laboratory facility	247	41.4	76.9
Unable to pay for AST test	52	8.7	16.2
Urgent case requiring immediate antibiotic therapy	126	21.1	39.3
Long waiting time for sensitivity results	74	12.4	23.1
Others (Emergency case, expensive, time consuming)	5	0.8	1.6
Total	**596**	**100**	**185.7**

**Percentage exceeds 100 due to multiple responses*

Prescription practices of veterinarians/para –veterinarians

It was found that more than half (55.48%) of veterinarians/para-veterinarians were found to prescribe antibiotics prior receiving AST results. The majority of veterinarians/para-veterinarians were found to consider the type of bacteria involved in infection before selecting antibiotics. Similarly, 72.3% recommend antibiotics based on half-life period of drugs. More than half of the veterinarians/para-veterinarians kept animal's record while prescribing antibiotics. Almost 42% of veterinarians/para-veterinarians were found not stating withdrawal period in prescription. About 52% of the respondents had heard about category of antimicrobials as per WOAH. Around 50% of the veterinarians /para-veterinarians prescribed prophylactic antibiotics in poor biosecurity practices.

Table 46: Prescription practices of veterinarians/para-veterinarians

Characteristics (n=477)	Yes (N/%)	No (N/%)
Prescribing antibiotics before receiving AST result	266 (55.8)	211 (44.2)
Considering type of bacteria involved in infection before selecting antibiotics	395 (82.8)	82 (17.2)
Stating withdrawal period in prescriptions	281 (58.9)	196 (41.1)
Recommending antibiotics based on half-life period of drugs	345 (72.3)	132 (27.7)
Heard about category of antimicrobials as per WHO/ WOAH	248 (52)	229 (48)
Prescribing prophylactic antibiotics in poor biosecurity practices	238 (49.9)	239 (50.1)
Keep animals record for prescribing antibiotics	278 (58.3)	199 (41.7)

Keeping animals' record for prescribing antibiotics

It was found that three-quarter of the veterinarians keep the record of animals' prior prescribing antibiotics while only about 56% of para-veterinarians keep the record. Similarly, majority of veterinarians/para-veterinarians working in government sector (68.7%) keep the record of animals as compared to those working in private sector (46.9%).

Table 47: Keep animals record by veterinarians/para-veterinarians

Characteristics (n=477)	Yes (N/%)	No (N/%)	Total
Veterinarians	48 (75)	16 (25)	64 (100)
Para-veterinarians	225 (55.7)	179 (44.3)	404 (100)
Others	5 (55.6)	4 (44.4)	9 (100)
Total	**199 (41.7)**	**278 (58.3)**	**477 (100)**

Table 48: Keep animals record by service sector

Characteristics	Yes (N/%)	No (N/%)	Total
Government	171 (68.7)	78 (31.3)	249 (100)
Private	107 (46.9)	121 (53.1)	228 (100)
Total	**278 (58.3)**	**199 (41.7)**	**477 (100)**

Following anti-biogram report provided by the laboratory

Around 40% of the veterinarians/para-veterinarians always followed anti-biogram report provided by the laboratory before prescribing antibiotics to the diseased animal. Similarly, more than half of the veterinarians (56.3%) always followed the anti-biogram report provided by laboratory as compared to para-veterinarians (37.6%).

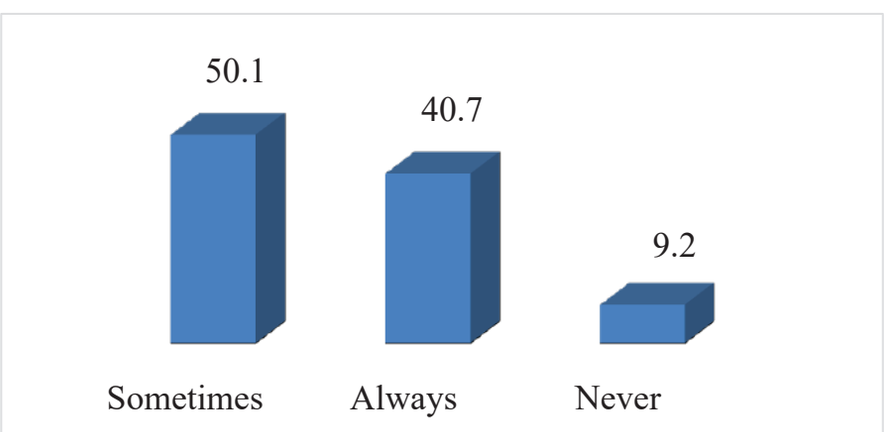

Figure 23: Following anti-biogram report provided by veterinarians/para-veterinarians

Table 49: Following the anti-biogram report provided by laboratory based on profession

Characteristics(n=477)	Never	Sometimes	Always	Total
Veterinarians	2 (3.1)	26 (40.6)	36 (56.3)	64 (100)
Para-veterinarians	42 (10.4)	210 (52)	152 (37.6)	404 (100)
Others	0 (0)	3 (33.3)	6 (66.7)	9 (100)
Total	**44 (9.2)**	**239 (50.1)**	**194 (40.7)**	**477 (100)**

Prescribing antibiotics in combination

Around 15% of veterinarians/para-veterinarians always prescribed combined antibiotics to the diseased animals. Likewise, about 14% of para-veterinarians never prescribed antibiotics in combination while 20.3% of veterinarians always prescribe antibiotics in combination.

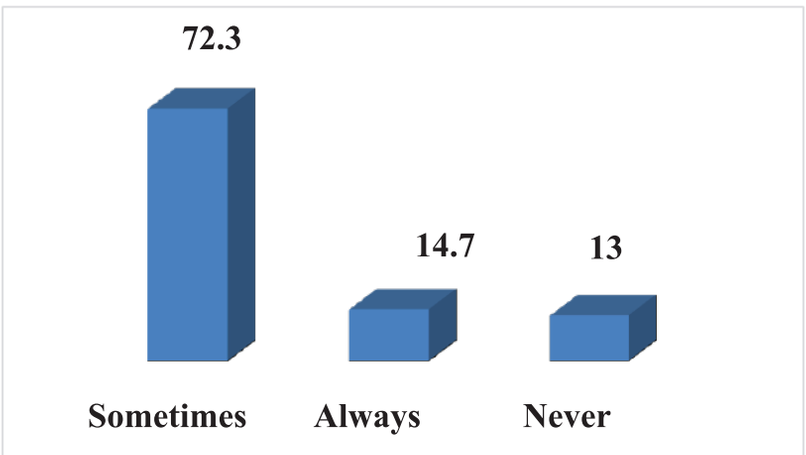

Figure 24: Prescribing combined antibiotics for the treatment of animals

Table 50: Prescribing antibiotics in combination by profession

Characteristics (n=477)	Never	Sometimes	Always	Total
Veterinarians	4 (6.3)	47 (73.4)	13 (20.3)	64 (100)
Para-veterinarians	55 (13.6)	293 (72.5)	56 (13.9)	404 (100)
Others	3 (33.3)	5 (55.6)	1 (11.1)	9 (100)
Total	**62 (13)**	**345 (72.3)**	**70 (14.7)**	**477 (100)**

Type of animal disease for prescription of antibiotics

Most of the veterinarians/para-veterinarians prescribed antibiotics for animals infected with prolonged illness followed by animals having respiratory problems.

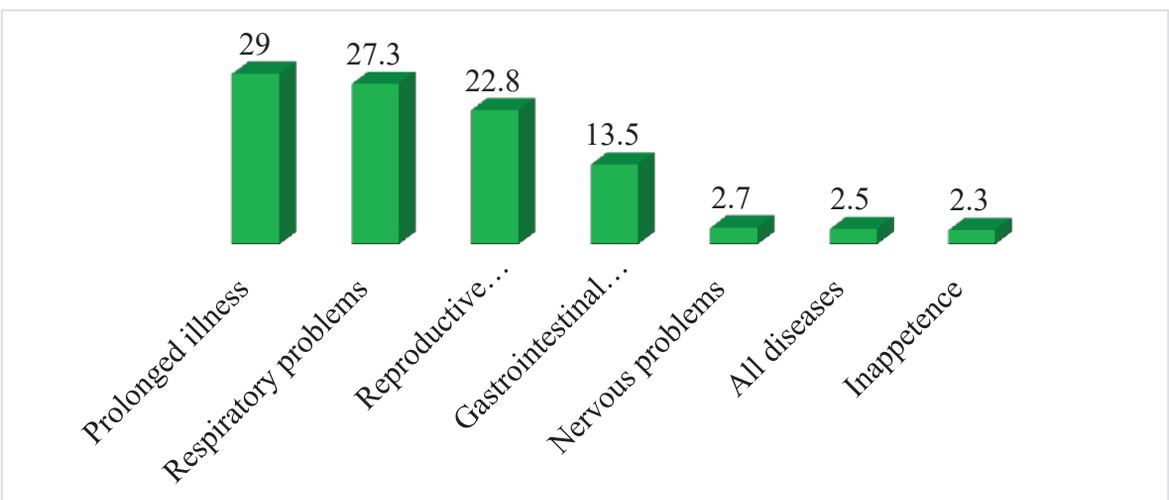

Figure 25: Antibiotic prescription pattern for type of animal disease

Duration of antibiotics prescription for the treatment of animals

Duration of antibiotic prescription for the treatment of animals varied according to the respondents. The majority of veterinarians/para-veterinarians prescribe antibiotics for 3 days (45.3%), 5 days (39%) and 7 days (9.6%). Also, about 3% of veterinarians/para-veterinarians responded that the duration for the treatment of animals.

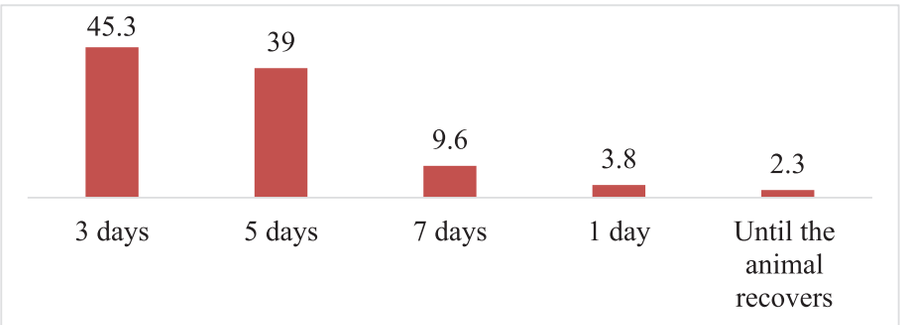

Figure 26: Duration for antibiotic prescription for the treatment of animals

Commonly prescribed antibiotics for animals

The most commonly prescribed antibiotics were Oxytetracycline (11.7%), Gentamicin (10%), Enrofloxacin (9.9%), Tetracycline (9.8%) and so on. Likewise, around 2% of the respondents report Colistin as the most commonly prescribed antibiotics for animals.

Table 51: Commonly prescribed antibiotics for the treatment of animals

Characteristics	Number (n=477)	Percent of responses	Percent of cases
Oxytetracycline	430	11.7	90.1
Tetracycline	361	9.8	75.7
Benzathine Penicillin	127	3.5	26.6
Procaine Penicillin	243	6.6	50.9
Ampicillin cloxacillin	279	7.6	58.5
Amoxicillin	290	7.9	60.8
Cefotaxime	153	4.2	32.1
Sulphonamides	211	5.8	44.2
Streptomycine	139	3.8	29.1
Gentamicin	368	10	77.1
Amikacin	80	2.2	16.8
Enrofloxacin	364	9.9	76.3
Ciprofloxacin	243	6.6	50.9
Colistin	60	1.6	12.6
Tylosin/Tiamutin	168	4.6	35.2
Chloramphenicol	125	3.4	26.2
Others (Doxycycline, Neomycin, Levofloxacin, Ceftriaxone, Cephalosporin, Cotrimoxazole)	27	0.7	5.7
Total	**3669**	**100**	**769**

**Percentage exceeds 100 due to multiple responses*

Factors influencing antibiotics selection for the treatment of animals

Majority of the veterinarians/para-veterinarians selected antibiotic on the basis of their previous experiences (76.3%). Only very few (24.3%) of them followed antibiotic sensitivity result for selecting antibiotics for the treatment of animals.

Table 52: Factors influencing antibiotics selection for the treatment of animals

Characteristics	Number (n=477)	Percent of responses	Percent of cases
Veterinary education and training	349	30.8	73.2
Previous experiences	364	32.2	76.3
Antibiotic sensitivity result	116	10.2	24.3
Withdrawalperiod	96	8.5	20.1
National prescription policies/guidelines	91	8	19.1
Published scientific literatures	102	9	21.4
Others (Case study, urgent case, fast recovery, experience, symptoms)	14	1.2	2.9
Total	**1036**	**100**	**237.3**

**Percentage exceeds 100 due to multiple responses*

3.18 Factors Associated with KAP Score of Veterinarians/Para-veterinarians

The majority of veterinarians/para-veterinarians from rural area (80.6%) and having educational degree of JTA (72.5%) did not have access to the laboratory facility for AST. Similarly, higher proportion of veterinary doctors (59.4%) had access to laboratory as compared to veterinary technicians. Similarly, majority of veterinarians/para-veterinarians practicing poultry (52.6%) had access to laboratory as compared to other practices. Majority of laboratories were available in government service (41.4%) as compared to the private sector. Additionally, the availability of laboratory was higher in Gandaki province (66.2%) as compared to others and the lowest in Lumbini province (11.6%).

Table 53: Factors associated with availability of laboratory for veterinarians/Para-veterinarians

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			0.007
Urban	145 (35.8)	260 (64.2)	
Rural	14 (19.4)	58 (80.6)	
Educational degree			0.001
MVSc	25 (78.1)	7 (21.9)	
BVSc & AH	16 (44.4)	20 (55.6)	
ISc. VS & AH	14 (31.1)	31 (68.9)	
JT	70 (29)	171 (71)	
JTA	30 (27.5)	79 (72.5)	
Orientation	1 (12.5)	7 (87.5)	
Others	3 (50)	3 (50)	

Profession			0.001
Veterinary Doctors	38 (59.4)	26 (40.6)	
Veterinary Technicians	116 (28.7)	288 (71.3)	
Others	5 (55.6)	4 (44.4)	
Type of practices			0.147
Poultry	10 (52.6)	9 (47.4)	
Pet animals	6 (26.1)	17 (73.9)	
Domestic animals	10 (24.4)	31 (75.6)	
Mixed	130 (33.4)	259 (66.6)	
Others	3 (60)	2 (40)	
Type of service			0.001
Government	103 (41.4)	146 (58.6)	
Private	56 (24.6)	172 (75.4)	
Province			0.001
Koshi	12 (17.6)	56 (82.4)	
Madhesh	21 (30.9)	47 (69.1)	
Bagmati	19 (27.9)	49 (72.1)	
Gandaki	45 (66.2)	23 (33.8)	
Lumbini	8 (11.6)	61 (88.4)	
Karnali	22 (32.4)	46 (67.6)	
Sudurpashchim	32 (47.1)	36 (52.9)	

The majority of veterinarians/para-veterinarians from urban area (32.3%) and having MVSc degree (81.3%) were found to recommend AST test as compared to those residing in rural areas and having other educational degrees. Likewise, majority of veterinary doctors (59.4%) recommended AST as compared to veterinary technicians. Additionally, the veterinarians/para-veterinarians practicing poultry (52.6%) and serving in government sector (35.3%) were found to recommend AST test as compared to their counterparts. Highest proportion of veterinarians/para-veterinarians from Bagmati province (45.6%) recommended AST test as compared to other provinces.

Table 54: Factors associated with recommending AST by veterinarians/para-veterinarians

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			0.764
Urban	131 (32.3)	274 (67.7)	
Rural	22 (30.6)	50 (69.4)	
Educational degree			0.001
MVSc	26 (81.3)	6 (18.8)	
BVSc & AH	17 (47.2)	19 (52.8)	
ISc. VS & AH	11 (24.4)	34 (75.6)	
JT	70 (29)	66 (66)	
JTA	21 (19.3)	88 (80.7)	
Orientation	5 (62.5)	3 (37.5)	
Others	3 (50)	3 (50)	

Profession			0.001
Veterinary doctors	38 (59.4)	26 (40.6)	
Veterinary technicians	110 (27.2)	294 (72.8)	
Others	5 (55.6)	4 (44.4)	
Type of practices			0.155
Poultry	10 (52.6)	9 (47.4)	
Pet animals	7 (30.4)	16 (69.6)	
Domestic animals	10 (24.4)	31 (75.6)	
Mixed	123 (31.6)	266 (68.4)	
Others	3 (60)	2 (40)	
Type of service			0.110
Government	88 (35.3)	161 (64.7)	
Private	65 (28.5)	163 (71.5)	
Province			0.023
Koshi	20 (29.4)	48 (70.6)	
Madhesh	19 (27.9)	49 (72.1)	
Bagmati	31 (45.6)	37 (54.4)	
Gandaki	30 (44.1)	38 (55.9)	
Lumbini	18 (26.1)	51 (73.9)	
Karnali	18 (26.5)	50 (73.5)	
Sudurpashchim	17 (25)	51 (75)	

Majority of veterinarians/para-veterinarians from urban area (41.2%), having JTA degree (52.3%) did not state withdrawal period in their prescription as compared to their counterparts. Likewise, veterinary technicians (42.6%) did not state withdrawal period in prescription slips as compared to veterinary doctors. Veterinarians/para–veterinarians practicing domestic animals (51.2%) and serving in private sector (42.1%) were found not stating withdrawal period as compared to their counterparts. Additionally, veterinarians/para-veterinarians from Koshi (70.6%) and Sudurpashchim (22.1%) were the highest and lowest for not stating withdrawal period on prescription slip respectively.

Table 55: Factors associated with stating withdrawal period by veterinarians/para-veterinarians

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			0.879
Urban	238 (58.8)	167 (41.2)	
Rural	43 (59.7)	29 (40.3)	
Educational degree			0.006
MVSc	18 (56.3)	14 (43.8)	
BVSc & AH	30 (83.3)	6 (16.7)	
ISc. VS & AH	24 (53.3)	21 (46.7)	
JT	146 (60.6)	95 (39.4)	
JTA	52 (47.7)	57 (52.3)	
Orientation	6 (75)	2 (25)	
Others	5 (83.3)	1 (16.7)	

Profession			0.301
Veterinary doctors	43 (67.2)	21 (32.8)	
Veterinary technicians	232 (57.4)	172 (42.6)	
Others	6 (66.7)	3 (33.3)	
Type of practices			0.562
Poultry	10 (52.6)	9 (47.4)	
Pet animals	12 (52.2)	11 (47.8)	
Domestic animals	20 (48.8)	21 (51.2)	
Mixed	236 (60.7)	153 (39.3)	
Others	3 (60)	2 (40)	
Type of service			0.666
Government	149 (59.8)	100 (40.2)	
Private	132 (57.9)	96 (42.1)	
Province			0.001
Koshi	20 (29.4)	48 (70.6)	
Madhesh	36 (52.9)	32 (47.1)	
Bagmati	49 (72.1)	19 (27.9)	
Gandaki	47 (69.1)	21 (30.9)	
Lumbini	44 (63.8)	25 (36.2)	
Karnali	32 (47.1)	36 (52.9)	
Sudurpashchim	53 (77.9)	1 (22.1)	

Higher proportion of veterinarians/para- veterinarians from urban area (73.6%) and having BVSc & AH educational degree (80.6%) prescribed antibiotics based on half-life period. Similarly, majority of veterinary doctors (78.1%) and having mixed practices (74%) were found to prescribe antibiotics based on half-life period as compared to their counterparts. Additionally, veterinarians/para- veterinarians from Sudurpashchim (98.5%) and Madhesh (25%) province were found to have highest and lowest proportion of veterinarians/para-veterinarians from government services (53.3%) prescribed antibiotics based on half period than private sector.

Table 56: Factors associated with prescription based on half-life period

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			0.147
Urban	298 (73.6)	107 (26.4)	
Rural	47 (65.3)	25 (34.7)	
Educational degree			0.003
MVSc	24 (75)	8 (25)	
BVSc & AH	29 (80.6)	7 (19.4)	
ISc. VS & AH	33 (73.3)	12 (26.7)	
JT	187 (77.6)	54 (22.4)	
JTA	66 (60.6)	43 (39.4)	
Orientation	2 (25)	6 (75)	
Others	4 (66.7)	2 (33.3)	

Profession			
Veterinary Doctors	50 (78.1)	14 (21.9)	0.490
Veterinary Technicians	288 (71.3)	116 (28.7)	
Others	7 (77.8)	2 (22.2)	
Type of practices			
Poultry	13 (68.4)	6 (31.6)	0.407
Pet animals	14 (60.9)	9 (39.1)	
Domestic animals	26 (63.4)	15 (36.6)	
Mixed	288 (74)	101 (26)	
Others	4 (80)	1 (20)	
Type of service			
Government	184 (73.9)	65 (26.1)	0.424
Private	161 (70.6)	67 (29.4)	
Province			
Koshi	48 (70.6)	20 (29.4)	0.001
Madhesh	51 (25)	17 (25)	
Bagmati	35 (51.5)	33 (48.5)	
Gandaki	46 (67.6)	22 (32.4)	
Lumbini	64 (92.8)	5 (7.2)	
Karnali	34 (50)	34 (50)	
Sudurpashchim	67 (98.5)	1 (1.5)	

3.19 Knowledge of Veterinary Pharmacists on Antibiotics Use and Its Resistance

Socio-demographic characteristics of veterinary pharmacists

Majority of the veterinary pharmacists belonged to the age group 35-44 years. Among the veterinary pharmacists, 75 % were male and 25% were female. Around 71% of the pharmacies were operated by people from private sector followed by cooperative (23%) and 6% by people working in government sector.

Table 57: Socio-demographic characteristics of veterinary pharmacists

Characteristics	Number (N=680)	Percent (%)
Age (average= 36 years)		
<25	94	13.8
25-34	238	35
35-44	187	27.5
45-54	113	16.6
>55	48	7.1
Gender		
Male	515	75.7
Female	165	24.3
Ethnicity		
Brahmin/Chhetri	452	66.5

Janajati	85	12.5
Newar	22	3.2
Dalit	19	2.8
Terai/Madhesi	92	13.5
Muslim	2	0.3
Others	8	1.2
Residential area		
Urban	575	84.6
Rural	105	15.4
Type of veterinary pharmacy		
Government(Pharmacy owned by people working in government)	42	6.2
Cooperative	158	23.2
Private	480	70.6
Total	**680**	**100**

Knowledge of veterinary pharmacists on antibiotics use and its resistance

The veterinary pharmacists perceived that antibiotics were used to treat bacterial disease (62.5%), viral diseases (26.8%), fungal disease (5.7%), protozoal disease (3.7%) and other disease (1.3%) respectively.

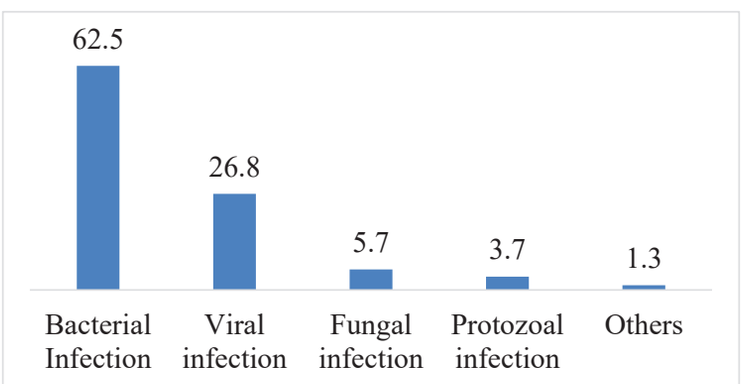

Figure 27: Perception of veterinary pharmacists for the use of antibiotics

Average course duration of antibiotics for the treatment of animals

Around two-fifth (42%) of veterinary pharmacists perceived that average course duration of antibiotics was 3 and 5 days.

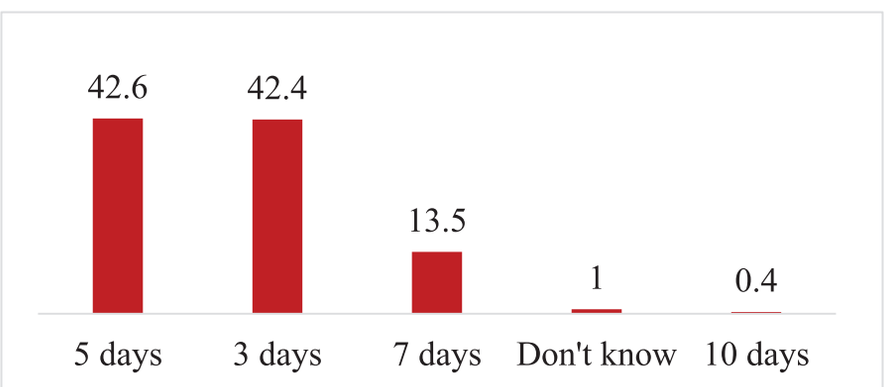

Figure 28: Veterinary pharmacists' perceptions on average course duration of antibiotics for the treatment of animals

Perceived knowledge on antibiotics and its resistance

About 80% of the veterinary pharmacists perceived that correct dose and dosage of antibiotics should be given for all types of animal species. Also, 85% of them responded that antibiotics should not be given to all animals when one in a flock or herd is sick. Similarly, 81% and 27% of the veterinary pharmacists had heard about antibiotic resistance and antibiotic stewardship.

Table 58: Perceived knowledge of veterinary pharmacists on antibiotics and its resistance

Characteristics (n=680)	Yes (N/%)	No (N/%)
Correct dose and dosage of antibiotics for all types of animal species	542 (79.7)	138 (20.3)
Antibiotics to all animals when one animal in a flock or herd is sick	101 (14.9)	579 (85.1)
Heard about antibiotic resistance	553 (81.3)	127 (18.7)
Heard about antibiotic stewardship	186 (27.4)	494 (72.6)

Perceptions of veterinary pharmacists on reasons for emergence and spread of antibiotic resistance

Majority of the veterinary pharmacists responded that unnecessary prescription of antibiotics for viral infections followed by inappropriate use of antibiotics in livestock and farmers demands for antibiotics were the major reasons for emergence and spread of antibiotic resistance.

Table 59: Perceptions of veterinary pharmacists on reasons for emergence and spread of antibiotic resistance

Characteristics	Number (N=680)	Percent of responses	Percent of cases
Unnecessary prescription of antibiotics for viral infections	355	25.3	66
Inappropriate dosing of antibiotic therapy	207	14.8	38.5
Lack of AST facilities	146	10.4	27.1
Lack of guidelines on antibiotic usage	79	5.6	14.7
Farmers demands for antibiotics	230	16.4	42.8
Inappropriate use of antibiotics in livestock	249	17.8	46.3
Poor biosecurity practices	95	6.8	17.7
Others (Inappropriate dose, regular use of antibiotics, genetic, lack of knowledge)	40	2.9	7.4
Total	**1401**	**100**	**260.4**

**Percentage exceeds 100 due to multiple responses*

3.20 Attitude of Veterinary Pharmacists on Antibiotic Resistance

It was found that around 44% of veterinary pharmacists strongly agreed that antimicrobial resistance is a significant issue. Similarly half of them agreed that an appropriate withdrawal period is needed before selling to avoid antibiotic residue in food animals. Also 50% of them disagreed on giving antibiotic with feed/water as a growth promoter in livestock. About 60% agreed that poor biosecurity practices are one of the contributors for development of AMR.

Table 60: Attitude of veterinary pharmacists on antibiotic resistance

Characteristics	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Antimicrobial resistance is a significant issue	44.3	40.3	13.7	1	0.7
Giving antibiotics to animals that are not sick will prevent it from becoming sick in the future	1	6.2	3.8	51.6	37.4
An appropriate withdrawal period is needed before selling to avoid antibiotic residue in food animals	37.5	51.5	8.1	2.1	0.9
It is important to add antibiotics with feed/water as a growth promoter in livestock	1	9.7	7.4	49.7	32.2
Poor biosecurity practices are one of the contributors to AMR development	18.7	59.1	16.8	4.1	1.3

3.21 Antibiotics Dispensing Practices of Veterinary Pharmacists

Majority (84%) of the veterinary pharmacists considered prescriptions before giving antibiotics. Although, 66% of the veterinary pharmacists did not keep animals' record for dispensing antibiotics, majority of them considered weight of the diseased animal before prescribing antibiotics. Most of the veterinary pharmacists (66%) had encountered the complaints on failure of antibiotic treatment in animals.

Table 61: Antibiotic dispensing practices of veterinary pharmacists

Characteristics (n=680)	Yes (n/%)	No (n/%)
Owner requests for antibiotic without prescription	514 (75.6)	166 (24.4)
Considers prescriptions before giving antibiotics	570 (83.8)	110 (16.2)
Keeps a animals' record for dispensing antibiotics	230 (33.8)	450 (66.2)
Considers weight of animal before prescribing antibiotics	572 (84.1)	108 (15.9)
Participated in any training/conference/seminar/workshop on AMR	221 (32.5)	459 (67.5)
Returns due to antibiotic treatment failure	452 (66.5)	228 (33.5)

Average duration of antibiotics

Majority of the veterinary pharmacists i.e. 43% and 37% dispensed antibiotics for 3 days and 5 days respectively.

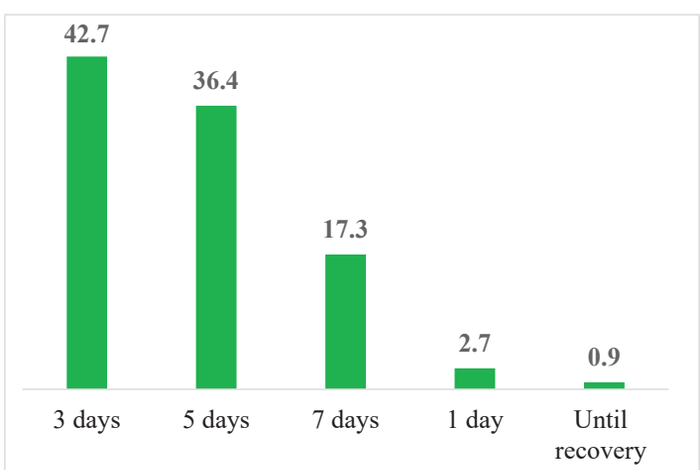

Figure 29: Average duration of antibiotic dispensing practice by veterinary pharmacists

Dispensing combined antibiotics

The findings revealed that around 73% of the veterinary pharmacists dispensed combination of two or more antibiotics sometimes while only 15% of veterinary pharmacists regularly dispensed combined antibiotics.

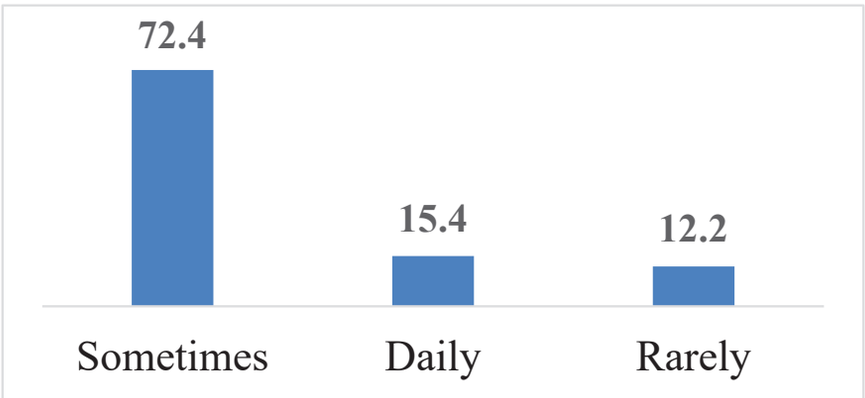

Figure 30: Dispensing combined antibiotics by veterinary pharmacists

Antibiotics commonly dispensed by veterinary pharmacists

Tetracycline, Oxytetracycline, Enrofloxacin and Gentamycin were identified as the most commonly dispensed antibiotics from the vet pharmacies.

Table 62: Commonly dispensed antibiotics by the veterinary pharmacists

Characteristics	Number (N=680)	Percent of responses	Percent of cases
Tetracycline	597	13.7	87.8
Oxytetracycline	583	13.4	85.7
Norfloxacin	274	6.3	40.3
Ciprofloxacin	294	6.7	43.2
Enrofloxacin	566	13	83.2
Strepto-penicillin	150	3.4	22.1
Amoxycillin	356	8.2	52.4
Cloxacillin	250	5.7	36.8
Cephalosporins	129	3	19
Colistin	80	1.8	11.8
Amprolium	123	2.8	18.1
Gentamycin	518	11.9	76.2
Amikacin	112	2.6	16.5
Tylosin	280	6.4	41.2
Others (Doxymicin, Levofloxacin, Sulphonamide, Menazvet, Doxycyline, Cotrimoxazole)	55	1.3	8.1
Total	**4367**	**100**	**642.2**

**Percentage exceeds 100 due to multiple responses*

3.22 Factors Associated with KAP Score of Veterinary Pharmacists

The majority of veterinary pharmacists from urban area (85.4%) and having B.V.Sc. & A.H degree (100%) considered prescriptions while dispensing antibiotics. Majority of veterinary pharmacies owned by government officials (90.5%) considered prescription while dispensing antibiotics as compared to co-operative and private pharmacies. Similarly, highest proportion of veterinary pharmacists from Bagmati province (98.9%) considered prescriptions while dispensing antibiotics as compared to Karnali province (59.8%) with lower proportion.

Table 63: Factors associated with considering prescription while dispensing antibiotics

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	491 (85.4)	84 (14.6)	0.009
Rural	79 (75.2)	26 (24.8)	
Educational degree			
MVSc	14 (82.4)	3 (17.6)	
BVSc & AH	30 (100)	0 (0)	
ISc. VS & AH	41 (74.5)	14 (25.5)	0.001
JT	287 (89.4)	34 (10.6)	
JTA	66 (68)	31 (32)	
Others	132 (82.5)	28 (17.5)	
Type of pharmacy			
Government	38 (90.5)	4 (9.5)	
Cooperative	114 (72.2)	44 (27.8)	0.001
Private	418 (87.1)	62 (12.9)	
Province			
Koshi	102 (96.2)	4 (3.8)	
Madhesh	90 (94.7)	5 (5.3)	
Bagmati	90 (98.9)	1 (1.1)	
Gandaki	82 (83.7)	16 (16.3)	0.001
Lumbini	80 (82.5)	17 (17.5)	
Karnali	58 (59.8)	39 (40.2)	
Sudurpashchim	68 (70.8)	28 (29.2)	

Veterinary pharmacists from urban area (66.6%) and private pharmacies (75.4%) were found to keep animals' records as compared to their counterparts. The higher proportions of veterinary pharmacists from Lumbini province (82.5%) were found to keep animals' records as compared to lowest in Madhesh province (44.2%).

Table 64: Factors associated with keeping animals' record by veterinary pharmacists

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	383 (66.6)	192 (33.4)	0.577
Rural	67 (63.8)	38 (36.2)	
Educational degree			
MVSc	5 (29.4)	12 (70.6)	
BVSc & AH	12 (40)	18 (60)	
ISc. VS & AH	26 (47.3)	29 (52.7)	0.001
JT	213 (66.4)	108 (33.6)	
JTA	57 (58.8)	40 (41.2)	
Others	137 (85.6)	23 (14.4)	
Type of pharmacy			
Government	14 (33.3)	28 (66.7)	0.001
Cooperative	74 (46.8)	84 (53.2)	
Private	362 (75.4)	118 (24.6)	
Province			
Koshi	63 (59.4)	43 (40.6)	
Madhesh	42 (44.2)	53 (55.8)	
Bagmati	65 (71.4)	26 (28.6)	0.001
Gandaki	66 (67.3)	32 (32.7)	
Lumbini	80 (82.5)	17 (17.5)	
Karnali	58 (59.8)	39 (40.2)	
Sudurpashchim	76 (79.2)	20 (20.8)	

3.23 Knowledge of Cattle/Poultry Farmers on Antibiotics Use and Its Resistance

Socio-demographic characteristics of cattle/poultry farmers

The majority of the farmers belonged to age group 35-44 years and were male (57.6%). Most of them were from urban area. Similarly, three-quarters of them were cattle farmers. About 36% of the respondents had secondary level education.

Table 65: Socio-demographic characteristics of cattle/poultry farmers

Characteristics	Number (N=966)	Percent
Age (average= 41years)		
<25	93	9.6
25-34	198	20.5
35-44	293	30.3
45-54	234	24.2
>55	148	15.3

Gender		
Male	556	57.6
Female	410	42.4
Ethnicity		
Brahmin/Chhetri	456	47.2
Janajati	218	22.6
Newar	23	2.4
Dalit	92	9.5
Terai/Madhesi	153	15.8
Muslim	18	1.9
Others (Paudar, Kirant, Sanyasi)	6	0.6
Residential area		
Urban	779	80.6
Rural	187	19.4
Type of animal farm		
Cattle (Cow, Buffalo, Goat, Pig, Sheep)	750	77.6
Poultry	216	22.4
Educational status		
Illiterate	103	10.7
Literate	204	21.1
Basic level	250	25.9
Secondary level	347	35.9
University level and above	62	6.4
Total	**966**	**100**

Knowledge of cattle/poultry farmers on antibiotics use and its resistance

Majority of the cattle/poultry farmers (93%) had heard of antibiotics.

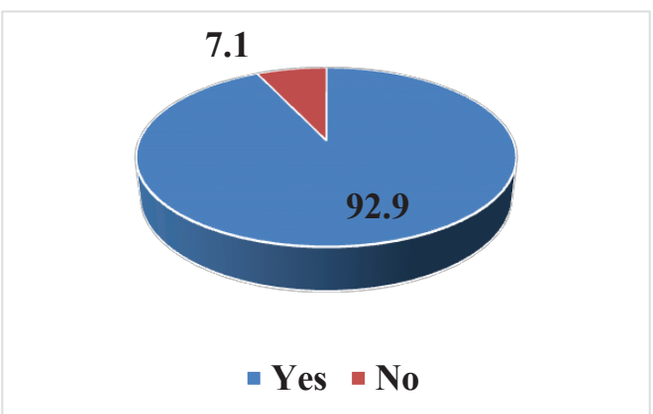

Figure 31: Heard about antibiotics by cattle/poultry farmers

Approximately 41% of the respondents had heard about antibiotic resistance.

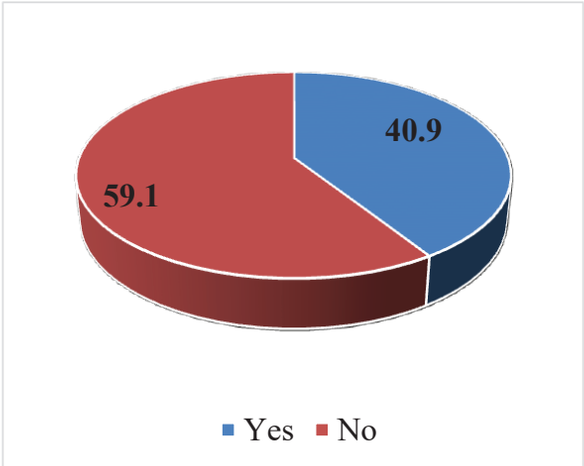

Figure 32: Heard about antibiotic resistance by cattle/poultry farmers

Perceived knowledge of cattle/poultry farmers about antibiotics

About 83% of the farmers perceived that antibiotics were used for treating bacterial infections followed by 67.7% for viral infections.

Table 66: Perceived knowledge of cattle/poultry farmers on use of antibiotics in animals

Characteristics	Number (n=897)	Percent of responses	Percent of cases
Bacterial infections	734	40.8	82.9
Viral infections	599	33.3	67.7
Parasitic infections	134	7.4	15.1
Protozoa infections	184	10.2	20.8
Zoonotic infections	91	5.1	10.3
Others (Fever, Chronic, Fungal, Dermatitis, Diarrhea, Pneumonia, Mastitis, Pain, Kill mites, insects, cough, weakness, worm infestation)	57	3.2	6.4
Total	**1799**	**100**	**203.3**

**Percentage exceeds 100 due to multiple responses*

Perceived knowledge of farmers on antibiotics use

Almost 7% of farmers perceived that it is inappropriate to use antibiotics without veterinarian's prescriptions. Likewise, about one-fifth of the farmers perceived that antibiotics could be used as growth promoters for animals. Similarly, about 39% of farmers had heard about antibiotics residues and more than four-fifth of farmers perceived that antibiotics residues were transmitted through meat/egg/milk.

Table 67: Perceived knowledge of farmers on antibiotics use

Characteristics (n=897)	Yes (N/%)	No (N/%)
Appropriate to use antibiotics without prescriptions of veterinarians	57 (6.4)	840 (93.6)
Using antibiotics as growth promoters for animals	188 (21)	709 (79)
Heard about antibiotics residues	346 (38.6)	551 (61.4)
Transmission of antibiotics residues through meat/egg/milk (n=346)	288 (83.2)	58 (16.8)

Reasons for emergence and spread of antibiotic resistance

The use of antibiotics without doctors/health workers prescriptions and consuming incomplete dose of antibiotics were by the farmers as the major reasons for emergence of antibiotic resistance.

Table 68: Farmers perceptions on the reasons for emergence of antibiotic resistance

Characteristics	Number (n=897)	Percent of responses	Percent of cases
Using antibiotics without doctors/health workers prescriptions	283	45.9	80.2
Consuming incomplete dose of antibiotics	206	33.4	58.4
Ineffective infection prevention and control measures	55	8.9	15.6
Use of antibiotics in feed industry and livestock	55	8.9	15.6
Others (Overuse of drugs, doctor's negligence, use of expired drugs, lack of knowledge)	17	2.8	4.8
Total	**616**	**100**	**174.5**

**Percentage exceeds 100 due to multiple responses*

3.24 Attitude of Cattle/Poultry Farmers on Antibiotic Resistance

It was found that more than half of the farmers agreed that antibiotics can be used for all types of diseases in animals and also antibiotics can be used in animal for weight gain. Almost 54.3% of them were neutral in the statement that there is relationship between antibiotic use in animals and development of resistance in animals/human. Likewise, 43% of the farmers disagreed that use of the same antibiotics for long period could lead to antibiotic resistance. About 36.6% of them disagreed about using antibiotics in animals even though respondents were conscious about its harmful effects to poor biosecurity practices to public health.

Table 69: Attitude of cattle/poultry farmers on antibiotic resistance

Characteristics	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Antibiotics can be used for all types of diseases in animals.	13.5	52.3	8.1	19.6	6.5
Antibiotics can be used in animal for weight gain.	15.2	50.7	13.6	17.9	2.6
There is relationship between antibiotic use in animals and development of resistance in animals/ humans.	8	33.6	54.3	3.5	0.7
Use of same antibiotics for long period can lead to antibiotics resistance.	1.9	6.4	38.6	43	10.1
I use antibiotics in animals even though I am conscious about its harmful effects to public health.	12.7	23.2	21.1	36.6	6.5

3.25 Use Patterns of Antibiotics by Cattle/Poultry Farmers

Around 44% of the farmers responded that they treated their animals by themselves. Majority of the farmers treated animals by using local medicine (37.4%) followed by buying drugs (30.5%) and isolating sick animals from other animals (15.5%) as measures for self-treatment.

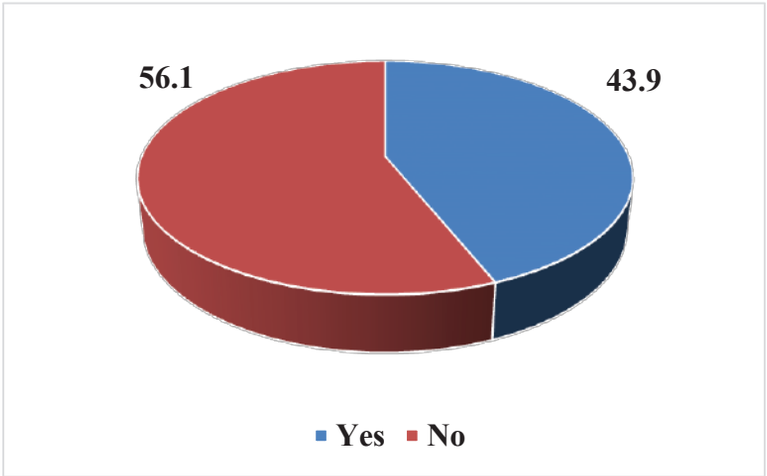

Figure 33: Self-treatment practices of cattle/poultry farmers

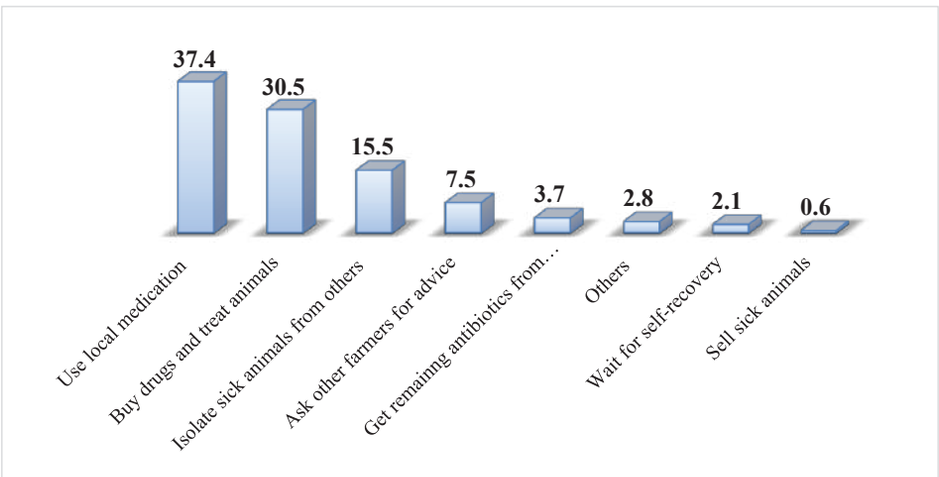

Figure 34: Measures of self-treatment of animals/poultry by farmers

Additionally, the findings revealed that more than half of the farmers sought animal health workers for treating sick animals followed by veterinarians.

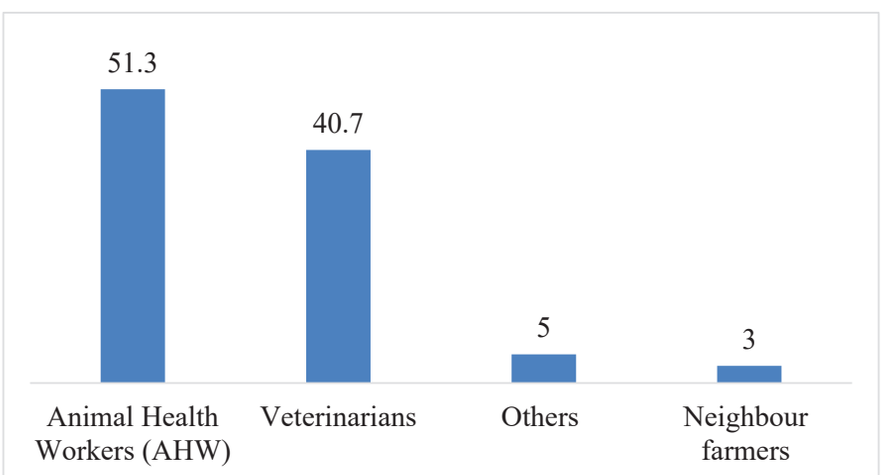

Figure 35: Practitioners for seeking care to treat sick animals

Most of the farmers (96.4%) and (81.2%) consulted veterinarians before using antibiotics in sick animals to get treatment of animals with antibiotics. Likewise, about 94% of the farmers responded that they provided complete dose of antibiotics for treating sick animals. Similarly, 69% of the farmers increased

dose and frequency of antibiotics if no any sign of recovery was noticed. Still about one–fourth of the farmers did not disinfect their farms on a regular basis.

Table 70: Use pattern of antibiotics by farmers

Characteristics (n=897)	Yes (N/%)	No (N/%)
Ever treated animals with antibiotics	728 (81.2)	169 (18.8)
Consult veterinarians before using antibiotics in sick animals	702 (96.4)	26 (2.7)
Provide complete dose of antibiotics for treating sick animals	684 (94)	44 (6)
Increase dose and frequency of antibiotics if no any sign of recovery	504 (69.2)	224 (30.8)
Disinfect your farm on regular basis	685 (76.4)	212 (23.6)

Sources of getting antibiotics

About 44% of the farmers got antibiotics from veterinary pharmacists, 26.4% from veterinarians, and 27.2% from veterinary technicians. About 3% of the farmers obtained antibiotics from neighboring farmers.

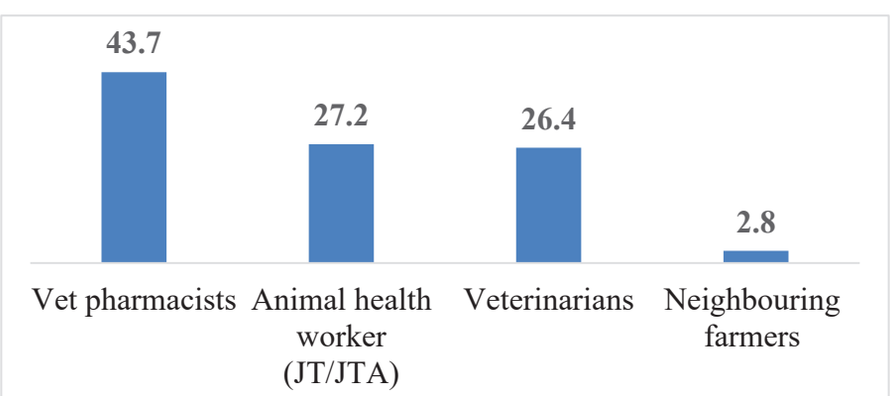

Figure 36: Farmer's source of getting antibiotics for sick animals

Consulting veterinarians/para-veterinarians before using antibiotics

Only 29% of the farmers took counseling frequently from veterinarians/para-veterinarians before using antibiotics. More than half (68%) of the respondents took counseling for sometimes before treating sick animals with antibiotics.

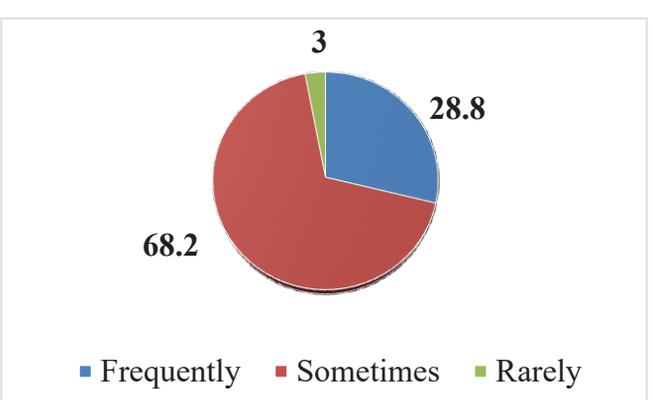

Figure 37: Frequency of consulting veterinarians by farmers

Using residual antibiotics for future

More than half (55%) of the farmers were found to be using residual antibiotics for future.

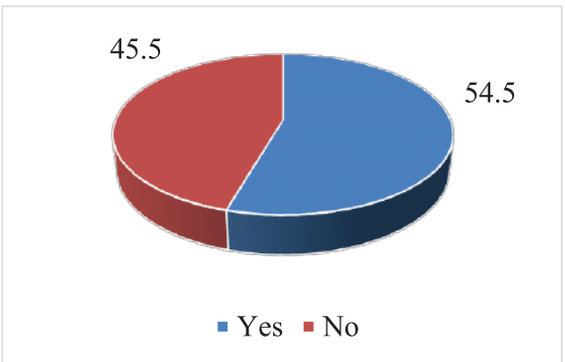

Figure 38: Farmer's using residual antibiotics for future

Reasons for not giving complete dose of antibiotics to animals

It was found that around 62% of the farmers discontinued antibiotics due to disappearance of the symptoms followed by not working by the medicine. Also, about 9% of the farmers discontinued antibiotics because of not getting any improvement.

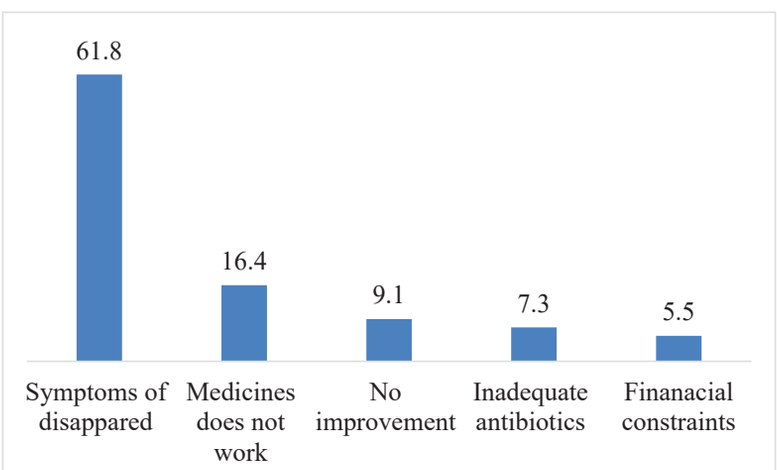

Figure 39: Farmer's perceptions on the reasons for not giving complete dose of antibiotics to animals

Increasing dose of antibiotics if no sign of recovery

It was found that almost 70% of farmers were found to increase the dose of antibiotics when there is no sign and symptoms of recovery in diseased animals.

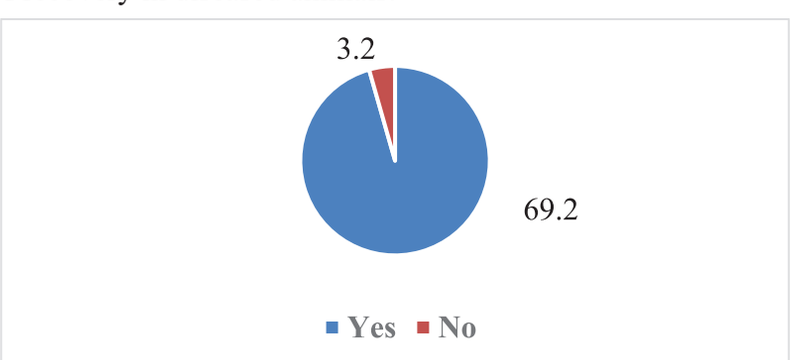

Figure 40: Increasing dose of antibiotics if no recovery

3.26 Factors Associated with KAP Score of Farmers

The study found that higher proportion of farmers from rural area (97.4%) and having cattle farm (96.6%) were found to consult with veterinarians/para-veterinarians before giving antibiotics as compared to their counterparts. All farmers having university degree and above (100%) consulted veterinarians prior to using antibiotics. Similarly, all the farmers from Madhesh (100%) and Karnali (100%) province were found to be consult veterinarians/para-veterinarians prior to giving antibiotics to animals as compared to their counterparts in the Bagmati province (88.9%).

Table 71: Factors associated with consulting veterinarians/para-veterinarians

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	552 (96.2)	22 (3.8)	0.463
Rural	150 (97.4)	4 (2.6)	
Farm type			
Cattle	542 (96.6)	19 (3.4)	0.623
Poultry	160 (95.8)	7 (4.2)	
Educational degree			
Illiterate	52 (96.3)	2 (3.7)	
Literate	155 (98.1)	3 (1.9)	0.211
Basic level	173 (96.6)	6 (3.4)	
Secondary level	267 (94.7)	15 (5.3)	
University and above level	55 (100)	0 (0)	
Province			
Koshi	87 (89.7)	10 (10.3)	
Madhesh	135 (100)	0 (0)	
Bagmati	72 (88.9)	9 (11.1)	0.001
Gandaki	107 (97.3)	3 (2.7)	
Lumbini	127 (97.7)	3 (2.3)	
Karnali	62 (100)	0 (0)	
Sudurpashchim	112 (99.1)	1 (0.9)	

Farmers of rural areas (94.8%) were found to provide complete dose of antibiotics as compared to urban areas (93.7%). Cattle farmers (94.8%) were found to be highest to provide complete dose of antibiotics as compared to poultry farmers (92.8%). Farmers having educational degree of basic level (97.8%) provided complete dose of antibiotics to the animals as compared to illiterate farmers (88.9%). The highest proportion of farmers from Lumbini province (99.2%) were found to provide complete dose of antibiotics as compared to lowest proportion from Koshi province (84.5%).

Table 72: Factors associated with providing complete dose of antibiotics

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	538 (93.7)	36 (6.3)	0.618
Rural	146 (94.8)	8 (5.2)	
Farm type			
Cattle	529 (94.3)	32 (5.7)	0.481
Poultry	155 (92.8)	12 (7.2)	

Educational degree			0.039
Illiterate	48 (88.9)	6 (11.1)	
Literate	151 (95.6)	7 (4.4)	
Basic level	175 (97.8)	4 (2.2)	
Secondary level	259 (91.8)	23 (8.2)	
University and above level	51 (92.7)	4 (7.3)	
Province			0.001
Koshi	82 (84.5)	15 (15.5)	
Madhesh	132 (97.8)	3 (2.2)	
Bagmati	70 (86.4)	11 (13.6)	
Gandaki	101 (91.8)	9 (8.2)	
Lumbini	129 (99.2)	1 (0.8)	
Karnali	61 (98.4)	1 (1.6)	
Sudurpashchim	109 (96.5)	4 (3.5)	

It was found that farmers residing in rural areas (81.8%) were higher in proportion to increase the dose and frequency of antibiotics as compared to urban areas. Likewise, higher proportions of cattle farmers (71.1%) were found to increase the dose and frequency of antibiotics as compared to poultry farmers. Literate farmers (74.7%) increased the dose and frequency of antibiotics as compared to the ones with other degrees. The highest and lowest proportion of farmers from Madhesh (96.3%) and Sudurpashchim (35.4%) increases dose and frequency of antibiotics in animals.

Table 73: Factors associated with increasing dose and frequency of antibiotics

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			0.001
Urban	378 (65.9)	196 (34.1)	
Rural	126 (81.8)	28 (18.2)	
Farm type			0.043
Cattle	399 (71.1)	162 (28.9)	
Poultry	105 (62.9)	62 (37.1)	
Educational degree			0.371
Illiterate	39 (72.2)	15 (27.8)	
Literate	118 (74.7)	40 (25.3)	
Basic level	123 (68.7)	56 (31.3)	
Secondary level	185 (65.6)	97 (34.4)	
University and above level	39 (70.9)	16 (29.1)	
Province			0.001
Koshi	84 (86.6)	13 (13.4)	
Madhesh	130 (96.3)	5 (3.7)	
Bagmati	37 (45.7)	44 (54.3)	
Gandaki	71 (64.5)	39 (35.5)	
Lumbini	119 (91.5)	11 (8.5)	
Karnali	23 (37.1)	39 (62.9)	
Sudurpashchim	40 (35.4)	73 (64.6)	

The study showed that highest proportions of farmers who regularly disinfected the farm were those residing in rural areas (88.8%) and practicing cattle farms (76.7%). Similarly, farmers with university and above level degree (88.5%) were highest to disinfect their farm as compared to illiterate (64.9%) farmers. The highest and lowest proportion of farmers respectively from Sudurpashchim (97%) and Bagmati (29.3%) province were found to disinfect their farm regularly.

Table 74: Factors associated with regular disinfection of farm

Characteristics	Yes (n/%)	No (n/%)	p value
Residence			
Urban	527 (73.3)	192 (26.7)	0.001
Rural	158 (88.8)	20 (23.6)	
Farm type			
Cattle	533 (76.7)	162 (23.3)	0.671
Poultry	152 (75.2)	50 (24.8)	
Educational degree			
Illiterate	48 (64.9)	26 (35.1)	
Literate	149 (78.8)	40 (21.2)	0.018
Basic level	173 (73.9)	61 (26.1)	
Secondary level	261 (77)	78 (23)	
University and above level	54 (88.5)	7 (11.5)	
Province			
Koshi	128 (94.8)	7 (5.2)	
Madhesh	133 (95.7)	6 (4.3)	
Bagmati	36 (29.3)	87 (70.7)	0.001
Gandaki	72 (57.1)	54 (42.9)	
Lumbini	128 (92.8)	10 (7.2)	
Karnali	59 (57.3)	44 (42.7)	
Sudurpashchim	129 (97)	4 (3)	

3.27 Qualitative Findings

Qualitative interviews were conducted among various stakeholders of antimicrobial resistance based on one health concept in order to explore the factors associated with antimicrobial resistance in Nepal. From animal health sector, Director from Directorate of Livestock and Fisheries Development (DLFD) and Veterinary Officer of Veterinary Hospital and Livestock Service Expert Center (VHLSEC) were interviewed in each province. Likewise, from human health sector Director from Provincial Health Directorate (PHD), Director of Hospitals and Health Workers working in Primary Health Care Centers (PHCCs) were interviewed in each province. The qualitative data obtained from this study were transcribed, translated and coded for further thematic analysis. The themes were generated based on the five different sections of developed guidelines and narratives were categorized.

Perception about antimicrobial resistance

Antimicrobial resistance occurred due to any mutations in the genes of any bacteria, fungi, parasites that cause the medicines to not function properly. It is a condition of ineffectiveness of antimicrobials due to its misuse, over and under use. It threatens the effective treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses and fungi. Due to this, it is very difficult to control the spreading of diseases and its treatment which might ultimately leads to death of patients. Nowadays, the

use of antimicrobials is more common among human and animal sector. The qualitative findings revealed that most of the stakeholders are well aware about the meaning of antimicrobial resistance.

We need to give antibiotics for any kind of infection, but the thing is whether it works or not once it reaches the body. If antibiotics doesn't work in the body then we understand it as antimicrobial resistance in our common language.

-Doctor, Government Hospital, Karnali Province

It is a condition when antibiotics no matter how much taken and how much treatment done, doesn't work properly, doesn't heal the disease as required and becomes ineffective.

-Director, Directorate of Fisheries and Livestock Development, Sudurpashchim Province

Misuse of antimicrobial cause resistance to organism which is known as antimicrobial resistance.

-Health Workers, Primary Health Care Centers, Gandaki Province

People who do not have the authority to use antimicrobials are using the drugs whenever they want. So, the medicines does not work properly afterwards even when they are provided adequately.

-Director, Provincial Health Directorate, Karnali Province

Current practice of antimicrobials use

The current practice of antimicrobials use among humans, livestock and agriculture was explored from the qualitative interviews. The appropriate use of antimicrobials matters for the emergence and spread of antimicrobial resistance. The haphazard use and negligence in treatment practices in current time increases the risks of relapse cases due to treatment failure since the appropriateness of antimicrobial use determine the effectiveness of treatment. It poses financial burden on general population and nation as well.

Human health:

The practice of antimicrobials use is very high in human beings rather than in livestock.

-Director, Private Hospital, Sudurpashchim Province

Nowadays, antibiotics are being sold like chocolates in pharmacies. For example: Few days ago, I had tonsillitis so went to a health post few blocks away from here. I knew that gargle and drinking hot water will manage the conditions but I visited there just for counseling. The health personnel gave me a Paracetamol for pain and azithromycin for tonsillitis though I had told him that I am a breastfeeding mother. Few days later, without taking medicines I felt better on drinking hot water and taking rest. So, we are always in a rush. We patients as well as doctors need fast recovery and prescribed accordingly. This practice is very high in humans.

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

Animal health:

In rural area, we have few number of vet/para-vet as most of them are concentrated in urban areas. People treat their animals by using residual antibiotics which was previously provided by veterinarians for similar symptoms. We took history and ask about the medicines given to animal before visiting hospital. Most of the time antibiotics are already given. The misuse of antibiotics is maximum even in the capital of Karnali Province, Surkhet.

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

The use of antibiotics in this manner causes very negative effect in animals, poultries and vegetables as well. The antibiotics tend to get transferred to human body if we continue to use it.

-Director, PrivateHospital, Lumbini Province

Environment health:

The usage of antimicrobials was lesser in Agriculture sector but at present time the usage of different fungicides and bactericides has been increased due to the increase in different diseases. The effect of this practice on human population is not known by the farmers.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Sudurpashchim Province

Farmers use antibiotics as insecticides and we eat it in the form of vegetables.

-Director, Private Hospital, Sudurpashchim Province

Current situation of antimicrobial resistance in Nepal

Antimicrobial resistance is being currently considered as one of the burning issues as it concerns the global public health. At present it is considered as a very hot topic as issues are being raised regarding the appropriate use of antibiotics. The use of antibiotics is more common nowadays as compared to earlier because people are more focused on fastest recovery and easy availability. Due to easy availability of antimicrobials in nearby shop, people tend to buy it and self-medicate without being concerned about correct dose and duration. People are using antimicrobials irrespective of their need.

Annually around 7 lakhs people are found to be dead due to the problem of antimicrobial resistance. The problem of AMR is considered as a huge public health problem.

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

It has been established as a global threat and as per the data almost 1.4 million people die with antimicrobial resistance. The problem is increasing everywhere not only in Nepal but everywhere it's increasing.

-Director, Private Hospital, Lumbini Province

I think the problem is very high not only here in Far-western region but all over Nepal. People who run pharmacies tend to give antibiotics to people in the starting phase and moreover they give broad spectrum antibiotics even when narrow spectrum drugs can be given.

-Director, Private Hospital, Sudurpashchim Province

Perceived factors contributing to AMR

The major reasons for causing antimicrobial resistance were explored. The personal, institutional and regulatory factors for causing antimicrobial resistance were identified. In Nepal, antimicrobials are easily available anywhere at any time for anyone. So, people tend to visit medical shops and use antibiotics haphazardly without maintaining the dose, dosage, and duration of antibiotics. The use of medicines without its indications affects the effectiveness of the drugs.

Personal factors causing antimicrobial resistance in Nepal

Self-medication

The main reason is overuse of medicines without doctor's prescription and availability of medicines everywhere.

-Director, Provincial Health Directorate, Karnali Province

Unnecessary use

General population's perception that "every ill has a pill" and their practice to take antibiotics even for common cold are major reasons for antimicrobial resistance.

-Director, Provincial Health Directorate, Gandaki Province

Incomplete dose

Be it in case of animals or human beings, an adequate dosage of medicines has been given by the doctors, but people tend not to complete the dosage of given medicines once the symptoms subside.

-Director, Directorate of Fisheries and Livestock Development, Lumbini Province

Inadequate awareness

Farmers having little knowledge is also another main contributing factors. If the poultry get cold due to even some wind or allergy, they start antibiotics. Lack of knowledge about the prescribers, amount, dosage and lack of proper monitoring is the reason for emergent of AMR.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Sudurpashchim Province

Public preferences

The main reason is that we become too overconfident by ourselves, we become doctors by ourselves.

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

Economic condition

Since people have to pay lot of money for lab tests and diagnosis in the hospitalsthey buy medicines by own-self to recover in fewer days. So, economic condition of people is one of the reasons for causing AMR.

-Director, Provincial Health Directorate, Karnali Province

Professional ethics

If person runs a pharmacy and check the patients then he/she might give one or more antibiotics with greed of money. These practices should be stopped.

-Director, Provincial Health Directorate, Sudurpashchim Province

Unavailability of prescribers

We lack professionals in a rural area; only 30% is prescribed by professionals while other is prescribed by non-professionals who are not doctors. The misuse of antimicrobials is among unprofessional. The use of antimicrobials is higher in human and animal health sector. The diseases are increasing due to issue of biosecurity and hygiene. If farmers keep on using medicines as per their wish, the resistance increases.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Lumbini Province

Institutional factors causing antimicrobial resistance in Nepal

Unclear law/policies

We don't have code of ethics, protocols and guidelines for how, when and to whom drugs should be prescribed. It is unclear that who can and can't prescribe antimicrobials.

-Health Worker, Primary Health Care Centers, Lumbini Province

The permission to open hospitals and pharmacies is given to anyone. There is no proper rule for people to prescribe and dispense medicines. The patient are given antibiotics randomly, the problem is common.

-Health Worker, Primary Health Care Centers, Karnali Province

Easy accessibility

As per the Drug Act, antibiotics falls under category A and B but it is available as chocolates here in Nepal which allows people to have its access easily. So everyone uses antibiotics as per their wish.

-Director, Provincial Health Directorate, Lumbini Province

Unregistered pharmacies

In some rural areas where the access to health is low, pharmacies are being run without approval. There is also a practice of selling medicines by carrying them on bags which might also be the cause of AMR. People might sell the medicines without theoretical and certified knowledge which may lead to resistance development. Similarly, pharmacists are selling antibiotics and medicines such as hormones which are restricted for sale without prescription which leads towards increasing resistance.

-Director, Directorate of Fisheries and Livestock Development, Gandaki Province

Inadequate laboratory facility

We don't have a proper lab to test. It would be good if we could perform antibiotic sensitivity test and provide medicines. Suppose if we have a case of respiratory distress here in our hospital, we need to give them antibiotics without AST test. It would have been better if we could conduct the antibiotic sensitivity test and provide the medicines.

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

Lack of surveillance

The main institutional factor is that our organization lack proper surveillance system.

-Health Worker, Primary Health Care Centers, Karnali Province

Health workers'motivation

Institutional reasons includes laziness of doctors. We doctors just stay in OPD and ask paramedics to look after a patient which is not good practice. It needs to be improved but I don't see any chances of improvement because doctors have invested too much money on their education but when it's time to get salary they hardly get one third of the investment. That is why they don't give their best but if the salary is increased then I think every doctor will give their best for their job.

-Medical Officer, Primary Health Care Centers, Lumbini Province

No evidence based practices

Till my knowledge there is no specific evidence based data from any research or study about the exact usage of antibiotics and their resistances in Nepal. As everyone is focused in curative health and getting basic health services very few people take this issue seriously. Sometimes we hear about the issue of antimicrobial resistance in news but we don't have the exact data regarding the resistance. Also, very few people have concerns towards it.

-Director, Provincial Health Directorate, Karnali Province

Regulatory factors causing antimicrobial resistance in Nepal

Lack of coordination

The concerned authorities under government of Nepal especially Ministries do not have coordination with one another. Ministry of Health is doing activities separately, and so is Ministry of drug Quality Control and Ministry of Agriculture and livestock development. If a forum could be developed where all of the ministries could work together, then only there will be way out for institutional development.

-Director, Directorate of Fisheries and Livestock Development, Gandaki Province

Lack of monitoring

The main reason is the lack of proper monitoring by the authorized bodies regarding the use of antibiotics in villages or by the lower level/trained staffs.

-Director, Directorate of Fisheries and Livestock Development, Sudurpashchim Province

The issue of antimicrobial resistance rises due to lack of proper controlling system from the ground level.

-Director, Private Hospital, Sudurpashchim Province

Confused roles and responsibilities

In federal system there is confusion in the distribution of responsibilities. The municipality level pose various responsibilities but they have not even made a team for monitoring and inspection. Timely inspection of the pharmacies should be done. Action should be taken against any misconduct according to the rules. But such actions are not taken. Pharmacist is needed at municipality level that can inspect the activities but there is no such provision. Organogram is not up to standard. Due to this, the regulatory actions are not well implemented.

-Director, Provincial Health Directorate, Karnali Province

Unavailability of guidelines

One of the regulatory factors for antimicrobial resistance in Nepal is the absence of National guideline or directory for treatment in the field of veterinary or on any health sector. We have to depend on the knowledge that we studied on books of some author which might not be country specific.

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

Limited structure for regulation

There is a need of different organizations like DDA in order to look after the drug selling practices. But there is no such structure at provincial level. There is an urban development ministry but nothing such as DDA. Also, we do not have authorized bodies to control and check the quality of the medicines. So, such responsible body is important.

-Director, Provincial Health Directorate, Karnali Province

Financial factors causing antimicrobial resistance in Nepal

People can't afford the complete dose hence buy the antimicrobial that is sufficient to cure the problem for shorter time which is leading towards the underuse of antimicrobials.

-Director, Directorate of Fisheries and Livestock Development, Gandaki Province

Amoxycillin group of medicine is distributed for free by government. Pharmacies have no profit with amoxycillin group. In contrast, cephalosporin group of medicine has profit. Additionally, general public prefer pharmacists over doctors as they think that the medicine to be prescribed by both of them is same and they don't want to pay extra consulting fee.

-Health Worker, Primary Health Care Centers, Lumbini Province

Farmers cannot come here and pay for the doctor's fee and treatment charges. Despite of it, if they call a technician for treatment the charges can be just up to Rs,100-200. So this economic reason also causes AMR..

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

Plans, polices and strategies

Stakeholders of AMR

Every person who uses the antibiotics are the stakeholders. The issue of AMR could not be addressed by a single person or sector. All stakeholders should be made responsible on it as human are not only the sufferer of AMR even animals and plants are being affected.

The main stakeholder is Drug Administration Division. Others are the bodies responsible to monitor the pharmacies like Animal Welfare Division, DDA and Veterinary Quality Control Division.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Sudurpashchim Province

Everyone are the stakeholders including pharmaceutical companies, pharmacies, distributors, doctors and other prescribers, veterinarian doctors, farmers, antibiotics consumers and different government bodies. Everyone are considered as the major stakeholders.

-Director, Directorate of Fisheries and Livestock Development, Lumbini Province

Existing plans, policies and strategies regarding AMR

While exploring the existing plan, policies and strategies relating to AMR, there is a need to understand the fact that Drug Act of Nepal is responsible to regulate drugs in Nepal be it Allopathic, Ayurveda or Veterinary. The policy comprises various information regarding drugs allowed for import, export and use in Nepal. Veterinary Drug Act has not been implemented till today. Drug Act, 2035 is the sole act for regulating drugs in Nepal. However, there is treatment guideline "National Antibiotic Treatment Guideline in 2014" developed for clear guidance to use antibiotics for treating diseases.

Ever since the issue of antibiotic residue in the chicken and milk was found, Nepal Government, Animal health Division has restricted the import of feed supplements with antibiotics to be used in poultry feed. We have drug act 2034, which have stated that a person registered in Nepal Medical Council is only a doctor, so if that's the thing, even we veterinarians are not doctors. The act suggests that only a doctor can prescribe antibiotics so even we cannot prescribe it. These rules should be modified with time otherwise our prescriptions will be illegal. Also we have Animal health and Livestock Service Act and Animal Slaughter House and Meat Inspection Act. Based on this act, the meat should be inspected and the slaughter houses should also be registered but in reality there are so many meat shops which are not registered. There are acts for the inspection but the act has not been enacted.

-Director, Directorate of Fisheries and Livestock Development, Lumbini Province

I don't exactly have the idea about the policy. But I know about celebrating AMR day where different pictorial description was done and awareness was spread.

-Director, Provincial Health Directorate, Karnali Province

Health institutions follow the Standard Treatment Protocol. DDA has updated the essential drug list, 5th edition. There is standard Treatment Protocol for every disease.We too have pharmacy guidelines which states about making own hospital formulary and medicines and it should be done only in generic name after obtaining permission from respective bodies. Another one is reporting pharmacovigiliance to center hospitals. There is no such hospital in Lumbini Province at present. There is a need of publishing drug bulletin on regular basis but everything is paper based. Mainly, the monitoring part is slightly weak.

-Director, Provincial Health Directorate, Lumbini Province

Barriers and challenges

Challenges for developing plan, policies and strategies

There are various challenges and barriers identified for developing plan, policies and strategies for addressing the issue of antimicrobial resistance which are explained as:

Insufficiency of evidences

In order to develop policies and strategies, we need data and exact figures about the issue. We need to conduct different researches like this one which is oriented in creating evidences. The main challenge is that we don't know the exact situation of the problem.

-Director, Directorate of Fisheries and Livestock Development, Lumbini Province

Lack of coordination

There is no coordination and collaboration between ministries and other stakeholders which is

problematic. Also, there is not much coordination between local government and federal government. There is no linkage in between leading to a gap. So, it's been difficult to carry the issue ahead in a bold manner.

-Director, Directorate of Fisheries and Livestock Development, Gandaki Province

Unavailability of laboratory

A proper laboratory is also needed to test the sensitivity of antibiotics. So, it's important to have a well-equipped laboratory and make plans and policies accordingly.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Sudurpashchim Province

Inadequate training

We need to go forward with a proper planning within different time periods. It is very important to provide training. Training should be given to all health workers and discussed about the side effects, advantages, disadvantages and the effect of multi drug resistance.

-Director, Private Hospital, Sudurpashchim Province

There are many remote areas in Nepal where health professional don't get training about antimicrobial resistance and this may be the main cause of misuse of antibiotics leading to antimicrobial resistance. Though developed cities like Kathmandu and Pokhara don't have much problem of antimicrobial resistance but situation is different in places like Jajarkot and Rukum which is geographically complicated, where doctors and health workers are not available.

-Health Worker, Primary Health Care Centers, Gandaki Province

Lack of implementation

The main reason is due to lack of proper implementation of the rules and regulations in our country. For an example: We are not able to give the services as much as we should have given. So lack of implementation is a problem.

-Director, Provincial Health Directorate, Karnali Province

Inadequate awareness

Public should be made aware about correct dosage and intake of full course of medicines. Many commercial farmers don't have idea about the withdrawal period of medicines. So they should be made aware about it. Also, people should be aware about the manufacturing and awareness aspects as well.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Lumbini Province

Lack of responsiveness

The regulatory rules are developed but not properly formulated. There are so many people from our field who don't care enough towards this issue. Politicians are major responsible to make law and rules. So, these people should be oriented about AMR and make aware about how it acts like slow poison in spite of any huge epidemic as Covid.

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

Protest by pharmaceutical companies

The pharmacies and pharmaceutical companies can protest against the implementation of strict rules and regulations. If monitoring is done effectively and strict action is taken then there will be a bar for the companies to produce and sell low quality antibiotics. Even distributor can protest against it as they are found to be distributing much low quality of medicines. If such thing is stopped then they can protest against it.

-Director, Government Hospital, Karnali Province

No discoveries of newer antibiotics

It's been a long time we haven't had new antibiotics. So those antibiotics working effectively in current time have not been developed recently. This is the reason for occurring AMR.

-Director, Directorate of Fisheries and Livestock Development, Gandaki Province

Challenges for implementing plan, policies and strategies

The policies have always been made good in Nepal but the problem we have is in the implementation phase. It is very difficult to implement the developed plan, polices and strategies due to various reasons.

Confusion on roles and responsibilities

It's very important for us to have a quality assurance measures. Everything *about the number of pharmacies in the hospital and roles & responsibilities of each professional* has been mentioned on the *Minimum Service Standard. But it has not been well implemented. The rules are made at central level and shared to state government but the responsible stakeholder at state level isnot mentioned. There are two people in this VDC but nobody is given the role. Also, none of them wants to take the lead. This is the problem of our country. We do have different roles and responsibilities but implementation is lacking.*

-Director, Provincial Health Directorate, Karnali Province

Inadequate human resources

I think human resource for health is not sufficient as it is based on O&M survey conducted many years ago. We have crisis of health workforce. In hospital settings, there is scarcity of health workers. Focusing on human health, number of health workers in hospital is inadequate to ensure the rational prescribing by promoting the sensitivity testing of antibiotics. So, they are not able to work effectively.

-Director, Provincial Health Directorate, Gandaki Province

If a doctor is available then they give proper suggestions and medications. So, the treatment can be effective. Still today, if you go to upper Karnali region, you find a doctor only in 3 hospitals out of 10. A doctor has studied everything about medications. They know better than a 15 months trained personnel or JTA. So, we have lack of skilled manpower in our Karnali Province.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Karnali Province

Lack of coordination

The challenges to implement policies and strategies are; lack of coordination and collaboration between inter-government (Local, provincial and federal). Their relationship is not alike what it should be. Due to which we are facing difficulty in implementing any kind of program.

-Director, Directorate of Fisheries and Livestock Development, Gandaki Province

Unnecessary politicization of issue

In rural areas, people are calling own-self as doctor and prescribing antibiotics based on two to three month training. Earlier such trainings used to be provided more frequently as there was very few numbers of doctors. If we strictly follow this regulation, then their business will be collapsed. Since they are linked with any of the political party and it is common to politicize any issue in Nepal, none of the acts and regulations will be strictly followed. They have their own union and associations from where they politicize the issue.

-Director, Government Hospital, Gandaki Province

Inadequate awareness

It's very important to orient everyone about AMR. like we conduct a yearly seminar regarding Rabies, conduct awareness campaigns, likewise it's important to do such for AMR as well. The main thing is that the person who has the power doesn't understand the issue and its very difficult to make them understand. If people become as aware as we are now, then it will be easy to implement else it will be very difficult to implement.

-Director, Directorate of Fisheries and Livestock Development, Karnali Province

Impact of AMR

Most of the commonly prescribed antibiotics which were sensitive 5-7 years ago are now resistant. Cost effective and easy accessible antibiotics are resistant and not working. So, the expensive and inaccessible antibiotics should be used. This increases the treatment cost for an individual and add financial burden.

Human health

The consequence of AMR is death, disability, impairment, and handicapped. Although, antibiotics saves life but if this doesn't work than there is no other option than premature death. Thus, this is a big scandal. This is not a good thing and we need to control it. This is very serious issue.

-Director, Provincial Health Directorate, Madhesh Province

Animal Health

There are different impacts such as loss of wealth, death of animals, disability, loss of body parts and cases of sterility. We can take an example of vultures. Vulture are extinct in Nepal due to use of diclofenac. Government has now banned it but the random use of such medicines has affected the environment. It should not be used as possible. If it is needful to use then should be used in a correct manner.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Karnali Province

Environment health

In environment also, as the bacteria slowly gets resistant to antibiotics, they also change their strain and grow strength, that causes other new diseases, and we don't have its solution. That bacterial growth might occur in a way where it is not destroyed by any antibiotics.

- Director, Directorate of Fisheries and Livestock Development, Madhesh Province

Action to be taken by government

Develop policy and guidelines

Government should strengthen the act in an integrated manner and the departments should make guidelines and implement them as soon as possible. The policies implemented should be regularly monitored, the solutions to the problem should be given.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Lumbini Province

It is very important to make a proper guideline from the government sector regarding the antibiotics, its type and everything. So, if we start giving antibiotics with a proper diagnosis, then we can control resistance.

-Director, Private Hospital, Lumbini Province

Allocation of budget

To carry out any kind of activity the foremost need is of budget. So, the government (all local, provincial and federal government) should allocate the budget for one health and AMR then only the tasks can be carried ahead.

- Director, Directorate of Fisheries and Livestock Development, Gandaki Province

Focus on prevention

The main focus we should do on vaccine program. We can prevent and treat bacterial diseases through vaccines. In case of non-infectious diseases, we need to go forward in good management practice. Easy availability of vaccines and good quality availability is also important. Government should make a good law and process and forward it in a good way for implementation, and conduct effective monitoring.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Karnali Province

Research

We need to also be focused on the health literacy and research should also be conducted regarding the situation.

-Director, Provincial Health Directorate, Karnali Province

Advocacy and awareness program

The next thing is through advocacy. The awareness messages can be given through pamphlets and picture, leaflets by the health organizations. We conduct different national, provincial, district level or local level programs and can conduct awareness programs from this level and move forward.

-Director, Provincial Health Directorate, Lumbini Province

Coordination

A community must be formed including human health, animal health and environmental health and coordinated work should be done together to move forward.

-Animal Health Worker, Veterinary Hospital and Livestock Service Expert Center, Sudurpashchim Province

Fair distribution

Government can motivate all the pharmaceuticals companies that have been randomly opened to produce a good quality of drugs and assure that government will help to provide the drugs to the distributors in a proper manner. If such scheme can be made, if would be good for everyone.

-Director, GovernmentHospital, Karnali Province

Strict punishment

It is important for us to get focused strictly. We need to focus on punishment system and feedback mechanisms more. The policies that are made are very good but the problem is in the implementation phase, so we need to focus on that section more.

-Director, Provincial Health Directorate, Karnali Province

Digital recording

If the record of medicines supply and dispenser can be maintained then it would be the best. Recording of the medicines outlet should be made, it would be much better if the record is maintained digitally. The outlet of antibiotics from each places if recorded digitally, by the provincial and local level, then it would be good. There are few outlets in local and provincial level and the recording is possible and if the record is maintained as per the outlets then it would be more effective. Like if a hospital gave some antibiotics and the person becomes resistant, then other people can be careful about the practice in future.

-Director, Provincial Health Directorate, Lumbini Province

Curriculum

The antimicrobial resistance should be included in the curriculum of school and colleges through Ministry of Education. Ministry of education should take a lead to impart knowledge on AMR up to school level and clubs. Mother groups, FCHVs, political association should be used to spread awareness.

-Director, Government Hospital, Gandaki Province

Expansion of regulatory structure

DDA is in Kathmandu and it's not possible for one organization to cover everywhere. Since DDA is responsible, it should be developed in province level. If it happens, the organization will be in touch and will have a better controlling capacity.

-Director, Provincial Health Directorate, Lumbini Province

Expansion of laboratory structure

Infrastructure should be strengthened. Laboratory facilities should be accessible so that health workers can give antibiotics only after testing.

-Director, Provincial Health Directorate, Gandaki Province

Regulation (Regular monitoring)

Law should be formed with clear definitions of the prescribers from PHCCs level to central level. Punishment for the unauthorized prescriptions should be stated clearly. There should be clear demarcation regarding level of prescribers for different antibiotics. Regulatory body for AMR should be assigned for central, provincial and local level.

-Director, Government Hospital, Gandaki Province

Way forward

Antimicrobial resistance means simply all those antibiotics which used to work effectively now doesn't work now because of organism mutation or other acquired resistance mechanisms. Nowadays this is an increasing trend in every sector including agriculture, livestock and human. There is irrational use of antibiotics among humans and animal sector. The risk of antimicrobial resistance is huge, and it has been a long time since a new generation antibiotics has been formulated. If this situation continues we will have to bear very harsh consequences. Thus, we all should focus on this issue based on one health concept including agriculture, livestock and human health to minimize its impacts. The issue of antimicrobial resistance is not of one sectors, hence all the stakeholders such as doctors, health workers, patients, drug dispensers, farmers, animal health division, and food departments need to equally committed and involved in addressing this issue. The rules and regulations should be developed, updated, revised and implemented. The laboratory facilities for antibiotic susceptibility test should be expanded up to local level. The study also identified the issue of inadequacy of skilled human resources for ensuring the prescriptions of antibiotics in rational manner. Similarly, people should be made aware about antimicrobial resistance. For addressing this, an integrated approach should be taken by involving all stakeholders. Everyone should come together and regulate the uses of antibiotics among patients, animals and agriculture.

CHAPTER : IV Conclusion

The study assessed the knowledge, attitude, and use on practices of antibiotics andantibiotic resistance among different stakeholders of human and animal health sector. The majority of doctors/health workers were aware that antibiotics could cure all infections and healthy people can be carrier of antibiotic resistant bacteria. Around 32% of doctors/health workers have access to laboratory facility for AST in their health institutions and among them only 49% recommend culture sensitivity test before prescribing antibiotics. Also, only 54% of doctors/health workers have access to national guideline for antibiotics prescriptions. Additionally, it was found that almost half of the drug dispensers (43.4%) dispensed antibiotics without prescriptions. Almost one-third (28%) and one-fourth (i.e.22%) of the outpatients were found to buy antibiotics without prescriptions and did not complete full course of antibiotics which is not a good consumption practice. About one-third i.e. 37.8% of prescribed medicines were antibiotics. Unnecessary use of antibiotics without prescriptions and consuming incomplete dose of antibiotics were perceived as the major reasons for emergence and spread of antibiotic resistance. The antibiotics consumption by inpatients reported highest consumption from Watch group i.e. 71% followed by access group i.e. 29.8%. This signifies the lowest consumption of access group of antibiotics as recommended by WHO which threaten the existence of human in this era with global threat of antimicrobial resistance.

Furthermore,only around one-third of veterinarians/para-veterinarians have access to laboratory facilities for AST testing in their working area. Also, only 32% of them recommend antibiotics for susceptibility testing prior to antibiotics prescriptions which was due to unavailability of laboratory facility. Around 40% of the veterinarians/para-veterinarians always followed anti-biogram report provided by the laboratory before prescribing antibiotics. Similarly, it was revealed that the majority of the veterinary pharmacists i.e. 43% and 37% dispensed antibiotics for 3 days and 5 days respectively. Tetracycline, Oxytetracycline and Enrofloxacin were identified as the most commonly dispensed antibiotics from the vet pharmacies. The findings revealed that more than half of the farmers agreed that antibiotics can be used for all types of diseases in animals. Around 44% of the farmers responded that they treated their animals by themselves with majority using local medicine followed by buying drugs and isolating sick animals from other animals. Also, more than two-thirds of the farmers increase dose and frequency of antibiotics if no any sign of recovery was noticed which not a correct practice is. Still about one–fourth of farmers did not disinfect their farm on regular basis. More than half of the farmers used residual antibiotics for future.

The lack of proper law, regulations, monitoring and supervisory framework has been identified as the major reasons for facilitating antimicrobial resistance. While the national guidelines for prescribing antibiotics have been developed, there are disparities in its distribution across the country as study revealed that most of the health professionals do not have access to the updated guidelines and protocols. Also there is a need to develop and communicate on the national treatment guideline for animal health sector. The findings identified the wide shortcomings in availability of plan, policy and its real scenario implementation

especially regarding regulation of over the counter antibiotics dispensing. This study clearly depicts the need to develop and update policy for antibiotics dispensing along with clear demarcation of the qualifications for prescribers at national level.

Limitations of the study

This study analyzed antibiotic consumption pattern by inpatients admitted to medical and surgical ward of the selected referral hospitals of Nepal. Currently, there is no national level data analysis on antibiotics consumption by inpatient till date. Since there were few studies focused on antibiotic consumption in Nepal, this study will generate new evidences regarding it. By exploring the factors associated with antibiotic resistance in Nepal, this study could be useful in setting priorities for developing and implementing the regulating policies. However, this study is limited by the observational study design and could not prove the causal relationship between antibiotics use pattern and antibiotic resistance. Also, this study focused on knowledge, attitude and use practices of antibiotics by different stakeholders based on their perceptions which may cause different biases. Another limitation is that this study lacked the follow up of the individual study participant in order to observe their actual practice regarding antibiotic use.

Recommendations

- The infrastructure for testing the susceptibility to antibiotics needs to be strengthened up to the local level health/animal health facilities for ensuring rational use of antibiotics.
- Despite the development of various policy documents and guidelines relating to antibiotics prescriptions, majority of health professionals were found unaware about it and do not have access of it. The concerned authorities/departments should focus on distributing latest updated policy documents and guidelines to all level health professionals through appropriate means and make them aware about its availability.
- Treatment guidelines for different level of service providers need to be developed and communicated in animal health sector.
- Although health professionals mentioned that they counsel patients for consuming complete dose of antibiotics, the patients were found not to consume complete dose of antibiotics. Therefore, the health professionals should counsel their patients effectively for consuming complete dose of antibiotics.
- Further health education should be provided to all (including people in the community) on proper use of antibiotics through local health workers and volunteers (FCHVs). Health education and information regarding the importance of antibiotics susceptibility test and counseling farmers about appropriate dose of antibiotics must be provided to veterinarians and veterinary pharmacists.
- Strict monitoring and regulations should be in place to prevent dispensing of antibiotics from the community pharmacies/vet pharmacies without prescriptions.
- There should strict monitoring of pharmacies as well as veterinary pharmacies which are selling reserve/prohibited antibiotics.
- It was found that already banned antibiotic colistin is still in use in animal farms therefore strict monitoring should be done to veterinary pharmacies which are selling those prohibited antibiotics.
- Proper communication on withdrawal period should be made to the farmers to reduce antimicrobial residue in food of animal origin to safeguard public health. Resources including financial investment for laboratory capacity building at different tiers both for vet and public health must be increased for making culture and AST services accessible in order to ensure rational use of drugs.

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