Orinigal Article

AMR Challenges and Opportunities in Karnali Province: Present Scenario, Outcome and One Health Approach Perspective

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Abstract: Antimicrobial resistance (AMR) is a serious concern to public health, with an estimated 10 million deaths per year by 2050 as a result of AMR. Five major goals have been set out by the FF project on AMR in response to this growing challenge. The project's primary goal is to strengthen the bacteriology unit's capabilities, which includes the Veterinary Laboratory, in light of its critical role in the diagnosis and treatment of illness. Second, putting an emphasis on laboratory staff capacity building highlights the significance of qualified experts in producing precise and fast findings. Thirdly, the experiment highlights the necessity of thorough AMR surveillance in order to monitor new resistance trends. Fourth, in order to address the components of AMR that affect both human and animal health, it is imperative to increase knowledge about appropriate Antimicrobial Usage (AMU). Finally, the undertaking shows how important it is to coordinate and work with other AMR-focused laboratories in order to create a unified front against this worldwide health threat. To sum up, the FF project on antimicrobial resistance (AMR) takes a comprehensive approach to addressing the various facets of AMR and acknowledges the need for international collaboration in order to protect public health and lessen the disastrous effects of AMR as one health perspective.

Keywords: veterinary laboratory services, animal disease epidemics, FF project

1. INTRODUCTION

Antibiotics have been used extensively in the past 50 years to treat, prevent, and promote growth in both human and animal health [1,2]. On the other hand, antibiotic resistance describes the situation in which pathogenic bacteria become resistant to particular antibiotics as a result of their improper and widespread use. The problem has gained greater prominence because to studies from throughout the world suggesting that antibiotic efficacy began to deteriorate towards the end of the 20th century [3]. Antimicrobial resistance (AMR) is becoming an increasingly serious issue that not only restricts available treatments but also raises the risk of infection, lengthens hospital stays, raises mortality, lowers quality of life, and increases costs [4,5]. Veterinarians and grill poultry farmers in Nepal were asked to analyse antibiotic usage and resistance. This was done through a thorough scenario analysis and Knowledge, Attitudes, and Practices (KAP) assessment [6,7]. The study investigates the current scenario, as well as the knowledge, attitudes, and practices related to antimicrobial use and resistance among broiler

poultry farmers in Nepal [8]. Focusing on a critical aspect of agricultural practices, the research aims to provide a comprehensive situational analysis. The paper delves into the intricate dynamics of antibiotic usage in the broiler poultry industry, shedding light on potential contributing factors. The study contributes valuable insights into addressing challenges associated with antimicrobial resistance in the context of poultry farming in Nepal [9]. Antimicrobial resistance (AMR) is one of the world's most pressing health issues. One Health is a cooperative effort encompassing a range of disciplines to address health issues in the human, animal, and environmental domains [10]. The reason that AMR is linked to these elements is because antimicrobials are overused and misused in industries like human medicine, livestock, and agriculture. The fact that there hasn't been any new antibiotic research in more than 20 years makes it even more vital to maintain the potency of already available antibiotics [11,12]. The complicated and little-understood dynamics of AMR origin, distribution, and transmission in populations involve bacterial, host, and environmental variables, despite the fact that the role of antimicrobial usage in AMR development has been widely investigated [13,14]. Capacity development is an urgent requirement for the Bacteriology Unit, which focuses on vector-borne illnesses such Visceral Leishmaniasis (VL) [15]. The absence of fundamental skills and knowledge among laboratory professionals impedes the efficiency and accuracy of diagnostic operations, hence impeding the unit's capacity to effectively address the mounting issues associated with infectious illnesses [16]. Furthermore, in order to quickly detect new risks, it is imperative that the unit's Antimicrobial Resistance (AMR) surveillance be strengthened. Because of their ignorance of Antimicrobial Usage (AMU), staff members engage in subpar behaviours that contribute to the spread of AMR. Furthermore, there is a clear absence of cooperation and coordination with other labs that are actively involved in AMR research and control initiatives [17]. This disjointed strategy reduces the overall effect and the success of the initiatives. It is essential to address these issues by implementing a thorough capacity-building programme that includes training for lab staff, improved AMR surveillance, and promoting cooperation with other AMR-focused laboratories in order to strengthen the Bacteriology Unit and make a substantial contribution to the larger public health agenda. This study explores the state of antimicrobial practices in the veterinary and poultry farming industries today, illuminating the prevalent beliefs and practices around the use of antibiotics. In addition to addressing issues related to the growing concern of antimicrobial resistance in Nepal's livestock and poultry industries, the study aims to provide important insights into understanding the dynamics of antimicrobial resistance in this particular context and may also inform strategies for the prudent use of antibiotics.

1.1 Initiation of Collaboration with Fleming Fund Project

Accurate estimates of the burden of antimicrobial resistance (AMR) are essential for comprehending the worldwide effects on health and expenses, as well as for guiding the cost-effectiveness analyses of treatments tackling this urgent problem. Central veterinary laboratory, as a reference veterinary laboratory initiated with the collaboration to FF project in 2017 from AMR workshop. This workshop had prepared some design to the establishment of AMR tackling system in the country. So we did risk asessment in four veterinary laboratory for the preparation of AMR project, after completion of drafting process of AMR, we are being selected as a AMR participatory Laboratory in the FF project. From the capacity development program in this project, we four veterinary lab (phase 1st) received different equipments as densitometer with 0.25, 0.5, and 0 McFarland standards, a dishwashing machine, a Vitek machine, a refrigerator and defreeze unit, and a variety of culture medium have all been recently delivered to our lab. We, laboratory working person recently attended training classes that covered a wide range of important subjects including diagnostic methods, surveillance. In order to improve my knowledge and abilities in the laboratory biosecurity and biosafety practices were covered in the course, guaranteeing that participants had a complete grasp of how to perform a labwork with environment safe and secure. I,as a bacteriology incharge, also got opportunity to attend training on antimicrobial resistance (AMR), which helped me understand the nuances and difficulties of this important field of research. The collecting and processing of samples was another important topic we addressed, and it gave me the tools I needed to handle and analyse samples effectively.

A thorough examination of external quality assurances (EQAs) was also covered in the training programme, offering insights into the actions required to maintain high standards in laboratory processes. A crucial element of the instruction was biorepository administration, which focused on the appropriate setup and upkeep of biological examples. In addition, I learned a lot about the protocol guidelines for EQAs, which guarantee that quality assurance standards are followed. Finally, a thorough review of epidemic epidemiology was covered in the programme, providing insights into the trends and treatment of common health problems. My expertise and skill in the area have increased as a result of these varied training sessions, and I am now able to effectively contribute to a variety of facets of scientific research and laboratory administration Our cooperative efforts have been anchored by efficient collaboration with National Public health laboratory and other veterinary laboratories, especially in the advancement of bacterial isolation techniques. The introduction of coaching and mentoring programmes on-site has been crucial in improving the abilities and expertise of our staff.

One notable accomplishment is the creation of an Antimicrobial Resistance (AMR) database, which aids in thorough data processing and analysis. We smoothly switched to online training sessions during the first lockdown, with an emphasis on biosafety and biosecurity procedures. We have effectively put up an extensive training curriculum that addresses many important facets of how our laboratory operates. Techniques for isolating and identifying germs were covered in the training sessions, guaranteeing that our crew was knowledgeable about these core procedures. Organising a review conference with professionals from the fields of animal and human health has been a crucial step towards promoting cooperation and streamlining antimicrobial resistance (AMR) initiatives. Continuous collaboration and monitoring with the National Taskforce on AMR (NTWC) and Technical Working Group (TWG) are part of this cooperative strategy. By means of these exchanges, we hope to enhance the complementarity between the views on animal and human health, guaranteeing a complete approach to address AMR issues. Review meetings provide a forum for sharing knowledge, coordinating goals, and working together to advance antimicrobial resistance activities. They also highlight the significance of a cohesive, interdisciplinary strategy that cuts across several industries. I have been actively involved in weekly online study sessions led by Melbourne University in Australia since March 30, 2020. These sessions provide an exciting learning environment where I may interact with mentors. Notably, on October 16, 2020, I spoke at the Fleming Fund Webinar hosted by the Animal Health AMR team and gave a forward-thinking report on antimicrobial resistance (AMR). The Federal Animal Health Structure, which includes labs, is essential to ensuring the health and welfare of the livestock in Karnali Pradesh, Nepal. This organisation plays a crucial role in illness surveillance, diagnosis, and the use of preventative measures as part of the federal animal health system in Nepal. Karnali Pradesh's laboratories are set up to carry out necessary examinations and evaluations, assisting in the early identification of illnesses that might impact the state's livestock health. These facilities sustain the lives of the surrounding populations, which are mostly involved in agriculture and animal husbandry, by guaranteeing the health and production of the animals. Furthermore, the Federal Animal Health Structure in Karnali Pradesh actively supports national initiatives to improve food security, encourage sustainable farming methods, and lessen the economic effects of animal illnesses on the agricultural economy of the area.

Our projects are centred on developing expertise in sophisticated culture technologies, particularly for specialised organisms like ESBL and those of zoonotic significance. The Global Antimicrobial Resistance and Use Surveillance System's data collection is in line with this focused skill development (GLASS). In addition, regular training seminars on laboratory quality management systems demonstrate our dedication to upholding excellent laboratory standards with Sop preparation and active surveillance system in the country.

Gram's staining of isolate

H2O2 3% PREP

Having undergone extensive training in bacterial identification, isolation, and antimicrobial susceptibility testing (AST), our staff has been actively involved in capacity-building programmes. Furthermore, we have received specialised training to enable us to adopt an Active Surveillance Programme, which will improve our ability to detect and control infectious illnesses. The logistical assistance that has enabled the seamless execution of numerous activities has further contributed to the success of our projects. Furthermore, consumables for our intended monitoring programmes have been a vital source of assistance that guarantee the continuous advancement of our job. Our laboratory infrastructure has been further reinforced by the acquisition of various equipment specifically designed for Antimicrobial Resistance (AMR) laboratory testing methods. This has allowed us to undertake high-quality research and make valuable contributions to the field of AMR management. Our ongoing efforts in the field of Antimicrobial Resistance (AMR) include the development of reporting templates tailored for AMR results specifically from the National Veterinary Lab. The progress of our initiatives is regularly discussed and enhanced through teleconference meetings between Fellows and Mentors. We have also received valuable guidance to strengthen our scientific writing skills, contributing to effective communication of research findings. A forthcoming opportunity involves the supervision of Mentor visits to Beneficiary Institutes, facilitating on-site engagements for a more immersive collaboration experience. The Director of Veterinary Services (DVS) and the Ministry of Health (MoH) in Kenya worked together to create Information, Education, and Communication (IEC) materials for four different audiences: the general public, veterinary professionals, farmers, and human medical professionals. All audience groups received posters with instructional messages attached, along with two pamphlets with Frequently Asked Questions (FAQs) intended for veterinary and human medicine experts. For these five target markets, a total of seven IEC versions were made, with the material initially available solely in English. Time and money restrictions played a role in the choice to develop the materials only in English. Interestingly, in the event that the materials were translated into Kiswahili, the second official language of Kenya, the expenses and time requirements involved would double. Audience segmentation, which was informed by the various information demands of each target group, helped determine the quantity and kind of IECs. This division was made possible by a pre-test that was first carried out on posters meant for the broad audience. The work at hand is further complicated by the difficulty of insufficient country-specific information on antimicrobial resistance (AMR). Antimicrobial resistance (AMR)

awareness campaigns, in contrast, are not the same as health communication initiatives for diseases like polio, TB, HIV/AIDS, or malaria since the target groups for those interventions were more homogeneous, enabling a single message to be shared across national boundaries. As opposed to these illnesses, which have more consistent awareness requirements, AMR occurs in a variety of settings, such as clinical medicine, agriculture, and animal husbandry. Because AMR is multidimensional, different difficulties must be addressed in different circumstances. Thus, when taking cues from current or previous health communication strategies for diseases with less diverse audiences, antimicrobial resistance (AMR) campaigns need to be aware of the different contexts in which they are operating and adjust their messaging accordingly to effectively reach the various stakeholders involved in global human and animal healthcare. Due to the complexity of AMR, communication strategies must be flexible and nuanced, taking into account the particular difficulties presented by various practices [18].

2. MATERIALS AND METHODS

The investigation followed the guidelines for standardised procedures provided by the Clinical and Laboratory Standards Institute (CLSI) and entailed the routine conduct of bacterial isolation and identification using conventional techniques. In order to provide a controlled environment for handling biological materials, the research included starting work within a bio safety cabinet. The BD Phoenix M50 was utilised as a bacterial isolation instrument, integrating Antimicrobial Susceptibility Testing (AST) to acquire exhaustive outcomes. The study also included positive control of certain bacteria and the creation of a bio repository management system for ATCC strains. This coordinated strategy sought to improve accuracy and dependability in the study of bacteria by combining traditional and cutting-edge methods for thorough examination and making sure that bacterial strains were available and conserved for use in subsequent research projects.

Bacterial storing boxes

BD Phoenix bacteria

The lab is furnished with all the tools needed to enable a range of experiments and research activities. This comprises freezers to store samples properly and preserve them, as well as a defrost system to enable regulated thawing. A densitometer that meets or exceeds McFarland standards of 0.25, 0.5, and higher is used to quantify microbial cell density precisely. For effective and hygienic washing of lab glassware and equipment, a dishwasher is offered. Modern technology, such Vitek machines and MALDI-TOF, improves the accuracy and speed of bacterial identification and analysis. Furthermore, a variety of culture mediums are employed to establish particular environments for the investigation and cultivation of various microorganisms. All of these tools work together to provide a well-equipped lab that can support a variety of microbiological studies. The research centre places a high priority on taking

a comprehensive strategy to guarantee the effectiveness, security, and safety of its operations by implementing a number of procedures and training initiatives. Measures for bio security and bio safety are carefully put into place to protect people, the environment, and the integrity of research. The group receives training on antimicrobial resistance (AMR) in order to remain up to date on the most recent advancements and difficulties in this crucial field. Training sessions on sample collection and processing are held, with a focus on data gathering accuracy and consistency. Training in External Quality Assurances (EQAs) is given to improve the accuracy and dependability of laboratory findings and to encourage adherence to strict standards. Through specialised training that emphasises the correct handling, storage, and cataloguing of biological samples, the management of a bio repository is also covered. Putting the EQA protocol into practice guidelines guarantees ongoing progress and adherence to quality standards even more. The team's understanding of epidemic epidemiology further improves their capacity to comprehend infectious disease outbreaks and take appropriate action. All of these training programmes help to foster a culture of quality and accountability in the scientific setting.

3. RESULT & DISCUSSION

With 19 positive cases and only 1 negative case, the examination of the chicken caecal swab sample findings shows a notable incidence of Campylobacter. This emphasises how crucial it is to have strict monitoring and control procedures in chicken farms in order to stop the pathogen's spread. The medication sensitivity pattern also clarifies important details for successful treatment plans. Remarkably, resistance to gentamicin is present in 15 instances, compared to 13 cases for ciprofloxacillin and 17 cases for tetracycline. Conversely, imipenem shows promise as a therapy alternative; 14 patients show sensitivity to it. The requirement for a customised approach to treatment is highlighted by the different drug resistance profiles. Both External Quality Assurance (EQA) and Internal Quality Assurance (IQA) demonstrate the dedication to quality assurancetests, demonstrating the lab's commitment to accuracy and dependability. By taking these precautions, you may be confident that the results are accurate and consistent, which enhances the laboratory's overall reputation in protecting public health and poultry welfare. The results of the thorough examination of forty-five water samples taken from a meat store using the advanced enrichment and plate culture method in an aerobic environment are rather informative. The discovery that 33 of the samples had microbiological contamination highlights the possible dangers related to the water quality in the butcher store setting. Two of the samples that tested positive for Pseudomonas among the bacteria that were detected indicate that specific intervention is required to reduce the risk of spoiling and associated health risks. Furthermore, the finding that five samples tested positive for Salmonella highlights serious worries about food safety and emphasises the need for strict hygiene protocols in the water sources used by the meat store. Seven Gram-positive organisms and nineteen samples that tested positive for Enterobacteriaceae highlight the complex microbial environment in the water samples, necessitating a multidimensional approach to quality assurance and sanitation. This thorough microbiological profile, made possible by the advanced culture technique, offers insightful information for putting specific corrective measures into place to maintain the highest levels of cleanliness in the butcher shop, protecting the integrity of the product and the general public's health.

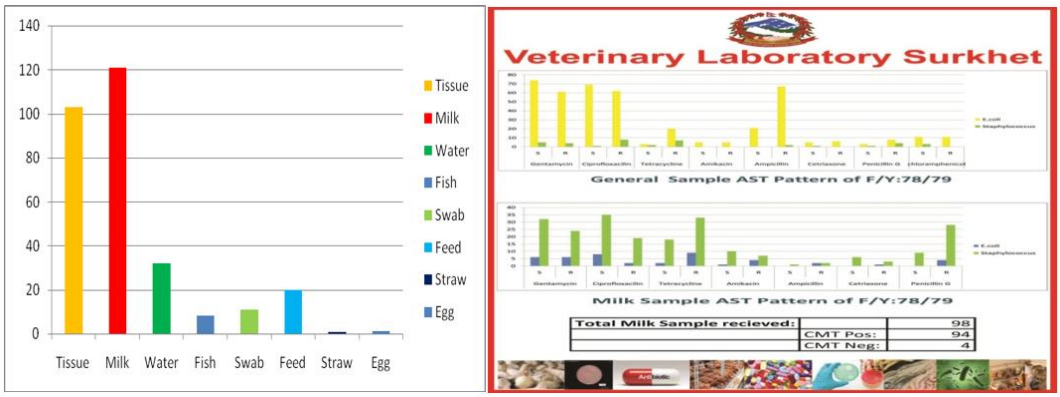
Table 01: From active surveillance program of liver sample of poultry at Surkhet

S.NO	Isolates	Local Address	NO.
1.	E.coli	Itram	7

2.	E.coli	Neware	8
3.	Klebsiella	Neware	2
4.	E.coli	Brien dranagarpalika-2	8
5.	E.coli	Brien dranagarpalika-2	7
6.	E.coli	Chinchhu -12	20
7.	E.coli	Latikoili	11
8.	E.coli	Latikoili	2
9.	E.coli	Hatia line	10
10.	Klebsiella	Hatia line	2

(Mostly sample of E.coli were positive)

Out of the 279 samples tested for visceral leishmaniasis (VL) in the fiscal year 78/79, 208 samples proved positive in total. Out of 276 milk samples, 390 showed positive findings on the California Mastitis Test (CMT), whereas 114 showed negative results. E. Coli was the most common isolate in VL patients, followed by Salmonella spp., Streptococcus, and Staphylococcus spp. Notably, 36 milk samples and 11 tissue samples had Multi-Drug Resistant (MDR) E. Coli. Based on sensitivity analysis, the laboratory isolates tested for gentamicin, amikacin, and levofloxacin showed sensitivity rates of 47%, 61%, and 52%, respectively. Staphylococcus aurous was found in 80% of the milk samples that were obtained during active monitoring of milk samples from healthy animals. There was a noticeable increase in the resistance pattern for Amoxicillin, Tetracycline, and Ciprofloxacin highlight how critical it is to keep an eye on and deal with antibiotic resistance in veterinary laboratory procedures.



3.1 Bacteriology Specimen received in laboratory

A range of samples are sent to the lab for both active and passive monitoring. Samples of tissue, including the liver, heart, spleen, and lungs, as well as milk samples associated with mastitis, are frequently sent for culture. Furthermore, samples are often sent in for culture investigation from contaminated areas such as the skin, blood, ears, and eyes. Samples of faeces are sent in for resource purposes, namely for testing for Campylobacter. But other samples are seldom or never sent for culture, such as brain, nasal, tracheal, urine, urethral, and cervical swabs, and intestinal samples. These samples are submitted by a variety of people, the most common ones being farmers and Para-veterinarians. Although they do it less regularly, private and government veterinarians also submit samples. Reject rates are relatively low for the laboratory; on average, just one or two milk samples are rejected each month because the samples were submitted incorrectly. The aforementioned data highlights the variety of samples obtained, the frequency of specific categories, and the participants in the surveillance initiative.

3.2 Bio safety and Bio security measures in Lab

The lab is classified as a Bio safety Level 2 (BSL2) establishment, following the guidelines established by the World Health Organisation (WHO) and the Centres for Disease Control and Prevention (CDC). It has been outfitted with a Class II Type A2 Biological Safety Cabinet (BSC) from FHI 360 Nepal to guarantee a secure working environment. The laboratory exhibits efficient handling of both liquid and solid infectious waste produced on the premises, guaranteeing adherence to set norms. The lab is classified as a Biosafety Level 2 (BSL2) establishment, following the guidelines established by the World Health Organisation (WHO) and the Centres for Disease Control and Prevention (CDC). It has been outfitted with a Class II Type A2 Biological Safety Cabinet (BSC) from FHI 360 Nepal to guarantee a secure working environment. The laboratory exhibits efficient handling of both liquid and solid infectious waste produced on the premises, guaranteeing adherence to set norms.

4. CONCLUSION

Antimicrobial resistance (AMR) caused by bacteria has a concerning worldwide impact; in 2019, it was expected to be directly responsible for 1.27 million fatalities. This is a serious public health issue as the effects of AMR are getting worse. Estimates show a concerning pattern: by 2050, the number of fatalities linked to AMR is predicted to exceed 10 million annually. The lab is shown as a collaborative, lively, and well-equipped research space that actively tackles the problems caused by antibiotic resistance. The laboratory is positioned as a significant asset in the ongoing international efforts to battle infectious illnesses and protect public health because of its mix of cutting-edge technology, stringent training programmes, and a dedication to quality. The discovery of Salmonella and Pseudomonas highlights how urgently measures to reduce spoiling hazards and maintain strict food safety regulations must be taken. The necessity for a comprehensive and multifaceted approach to managing water quality is reinforced by the complex microbial environment, which includes Enterobacteriaceae and Gram-positive species. The laboratory's focus to accuracy and reliability is demonstrated by its commitment to quality assurance through both external and internal quality assurance testing. These results demonstrate the complex interplay among public health, water quality, and food production. Maintaining the integrity of food items and the health of consumers requires close observation, focused actions, and strict adherence to quality control procedures. The knowledge obtained from these studies is helpful in guiding the implementation of strategies that guarantee the highest standards of cleanliness, strengthening the laboratory's general reputation and safeguarding the public's health.

5. Future Directions

Acknowledging the existing situation, results, and selected method is essential to tackling the possibilities and difficulties related to Antimicrobial Resistance (AMR) in Karnali Province. Future research should examine sustainable solutions by embracing a thorough and integrated One Health viewpoint that takes into account the interconnection of human, animal, and environmental health. The creation of focused awareness campaigns, the use of responsible antimicrobial use practices in healthcare and agriculture, and the setup of efficient surveillance systems are important research topics. Furthermore, encouraging multidisciplinary cooperation and fortifying regulatory frameworks are crucial measures towards reducing the risks associated with AMR and seizing opportunities to enhance community health and wellbeing in Karnali Province.

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