VETERINARY ANTIMICROBIAL STEWARDSHIP GUIDELINE

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DEPARTMENT OF LIVESTOCK SERVICES
MINISTRY OF FISHERIES AND LIVESTOCK

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Note to Users: If you find any errors or have suggestions for improvement, please email us at dg@dls.gov.bd

Disclaimer

The Department of Livestock Services (DLS) has developed this Veterinary Antimicrobial Stewardship (VAS) Guideline in collaboration with professionals, researchers, veterinarians, and public health experts from different disciplines to promote the prudent use of antimicrobials in Bangladesh's animal health sector. It is intended for informational guidance to relevant stakeholders and policy-support purposes only and does not supersede any existing laws, regulations, or professional standards.

PREFACE

Antimicrobial resistance (AMR) has emerged as an urgent health challenge of our time, undermining the effectiveness of therapies in both human and animal populations and threatening food safety, livelihoods, and economic development. In Bangladesh, the rapid expansion of intensive livestock, poultry, and aquaculture production—coupled with unregulated access to veterinary drugs, empirical treatment practices, and limited diagnostic capacity—has accelerated the selection and transmission of resistant pathogens across species and ecosystems. recognising this, the Department of Livestock Services (DLS) has developed this Veterinary Antimicrobial Stewardship (VAS) Guideline to safeguard the efficacy of existing antimicrobial agents and protect public and animal health.

This guideline represents a One Health–oriented, evidence-based framework for prudent antimicrobial use across the livestock value chain. It consolidates current scientific knowledge and international best practices into clear, actionable recommendations that define roles and responsibilities at every level— from national policy and regulatory bodies to veterinarians, veterinary paraprofessionals, farmers, chick and feed suppliers, pharmacists, and diagnostic laboratories. By integrating robust stewardship principles with strengthened governance, surveillance, diagnostics, biosecurity, and education, this guideline aims to reduce inappropriate antimicrobial use, slow the emergence of resistance, and promote alternative disease-prevention strategies such as vaccination and improved biosecurity.

We extend our gratitude to the expert working groups, technical partners, and field practitioners whose insights and experience have shaped this guideline. We also acknowledge the support of the Fleming Fund Country Grant Bangladesh, FAO, and WOAH, whose financial and technical contributions have been invaluable. Implementation of this guideline will require strong leadership, cross-sector collaboration, and sustained investment from both public and private sectors. It is our collective responsibility to translate these recommendations into practice—thereby preserving antimicrobial efficacy for future generations, ensuring animal health, welfare, and productivity, and safeguarding the health of all communities in Bangladesh.

EXECUTIVE SUMMARY

Antimicrobial resistance (AMR) poses a growing public health threat in Bangladesh, affecting both human and animal health, food safety, and the national economy. A significant driver of AMR is the widespread misuse and overuse of antimicrobial agents in livestock, poultry, aquaculture, and companion animals. These include practices such as unregulated over-the-counter sales, self-prescription, and reliance on non-veterinary advice—often without diagnostic guidance. Such misuse leads to the emergence of drug-resistant infections that can spread between animals and humans, threatening treatment efficacy and public health outcomes.

In response, this Veterinary Antimicrobial Stewardship (VAS) Guideline provides a comprehensive national framework to promote the prudent and responsible use of antimicrobials across the animal health sector. It aligns with Bangladesh's National Action Plan for AMR Containment and supports the One Health approach, which emphasizes the interconnectedness of human, animal, and environmental health.

The guideline defines clear roles and responsibilities for all stakeholders, including veterinarians, livestock producers, pharmacists, feed and chick dealers, pharmaceutical companies, laboratories, and government agencies. It outlines practical steps to reduce antimicrobial misuse—such as strengthening veterinary prescription systems, enforcing withdrawal periods, promoting vaccination and alternatives to antimicrobials, and improving infection prevention and farm biosecurity.

To support implementation, the guideline recommends the establishment of a resolute VAS Unit, formation of antimicrobial stewardship (AMS) teams at national and sub-national levels, establishment of surveillance systems for antimicrobial use and resistance, and sustained investment in training, public awareness, and diagnostic infrastructure. It also emphasizes the importance of regulatory enforcement, particularly by the Department of Livestock Services (DLS) and the Directorate General of Drug Administration (DGDA), to control drug quality, maintenance of withdrawal periods in livestock, and limit over-the-counter sales.

By equipping stakeholders with practical tools and policy guidance, the VAS Guideline seeks to ensure the long-term effectiveness of antimicrobial therapies, protect animal and human health, and contribute to global efforts to combat AMR. Its success will depend on strong political will, cross-sector collaboration, and sustained investment in capacity building, surveillance, and regulatory reform.

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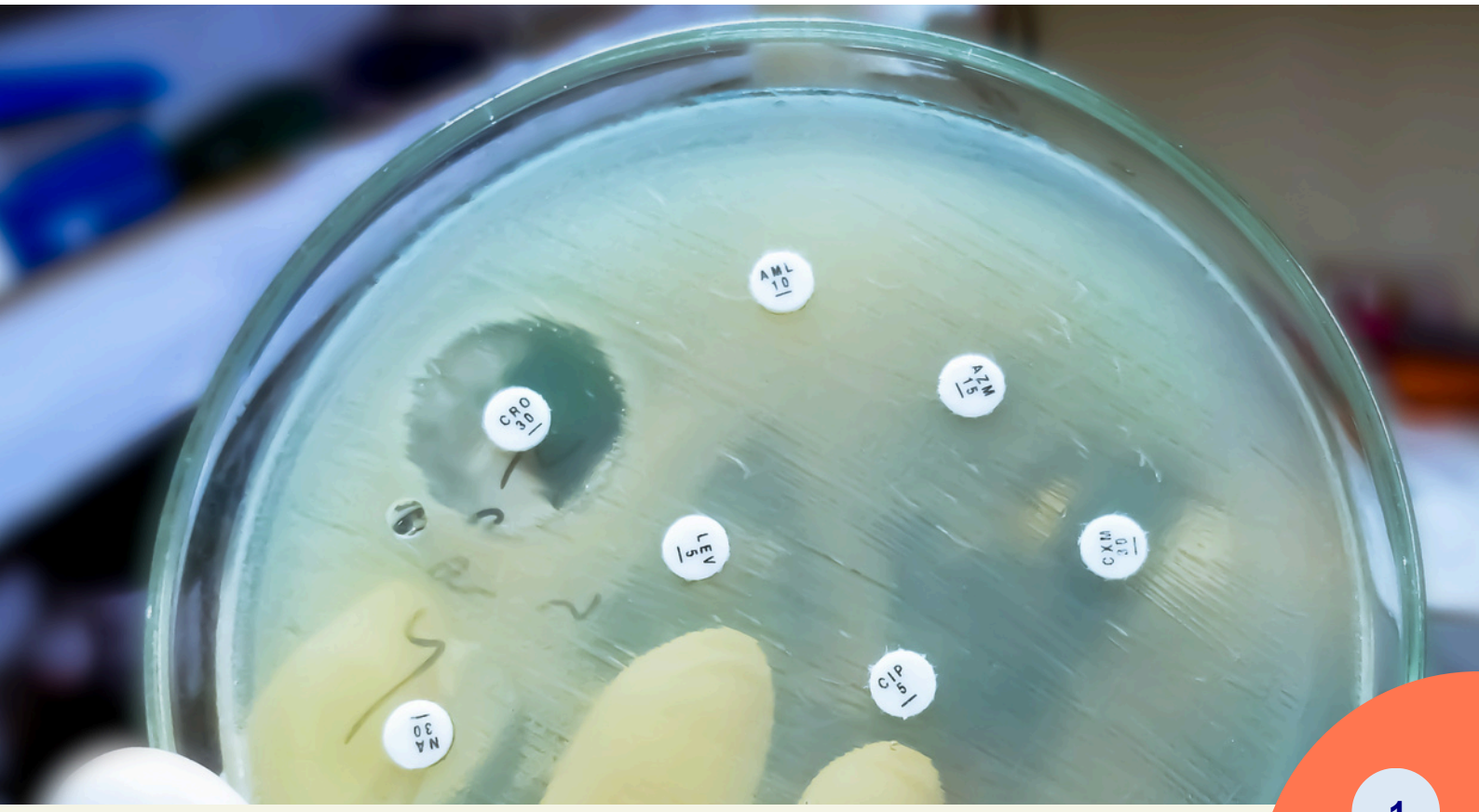
INTRODUCTION

Antimicrobial resistance (AMR) is increasingly recognised as one of the most critical public health threats in Bangladesh with profound implications for both human and animal health. The overuse and misuse of antimicrobials in the veterinary sector, including intensive livestock production, poultry farming, aquaculture, and even the management of companion animals, have significantly contributed to the emergence and spread of multidrug-resistant bacteria. Several studies have documented high levels of resistance in bacterial isolates from food-producing animals with alarming reports of resistance to several classes of commonly used antibiotics [1-5] that highlight the risks associated with zoonotic transmission and the potential for AMR pathogens to compromise food safety and public health [6-8].

In Bangladesh, the misuse of antimicrobials is compounded by unregulated over-the-counter sales, self-prescription practices, and unqualified advice by feed and chick dealers and other non-vets. Research has shown that many veterinary drugs are easily accessible without proper veterinary oversight, which leads to inappropriate dosing, suboptimal treatment durations, and ultimately, the selection of resistant bacterial populations [9-13]. Furthermore, the lack of robust diagnostic facilities, standardized treatment protocols, and an inadequate surveillance system often contributes to empirical rather than evidence-based antimicrobial use, further exacerbating the problem of AMR in the animal health sector [9].



In the face of the escalating threat of AMR and the pervasive misuse and overuse of antimicrobials, comprehensive antimicrobial stewardship (AMS) initiatives are essential. According to the World Health Organization (WHO), AMS is “a coherent set of actions which promote using antimicrobials responsibly” by optimisomg selection, dosing, route, and duration of therapy; similarly, the World Organisation for Animal Health (WOAH) AMR working group proposed AMS as “commitment to preserving antimicrobial effectiveness by

1. Creating and sustaining conditions where antimicrobials are not needed,
2. Where use is necessary, optimising use to ensure maximum effectiveness and minimum resistance selection; within a culture of continuous improvement”.

Developing a comprehensive Veterinary Antimicrobial Stewardship (VAS) Guideline for Bangladesh is an urgent priority. It would provide evidence-based recommendations for the prudent use of antimicrobials in veterinary practice, promoting better diagnostic practices, standardized treatment protocols, and enhanced biosecurity measures to prevent disease outbreaks. By encouraging targeted antimicrobial therapy and emphasizing the role of vaccination and improved farming practices, the guideline aims to reduce unnecessary antimicrobial exposure, thereby slowing the emergence of resistance.

Moreover, the VAS guideline will serve as a crucial component of Bangladesh’s efforts to implement its National Action Plan (NAP) for containing Antimicrobial Resistance. This plan advocates a coordinated, One Health approach that integrates human, animal, and environmental health strategies to combat AMR. Peer-reviewed evidence supports that a coordinated strategy in the veterinary sector not only protects animal health but also reduces the risk of AMR transmission to humans, thereby safeguarding public health [14,15]. Additional research underscores that effective AMS can lead to improved treatment outcomes, cost savings, and a reduction in the overall burden of AMR [16,17].

This VAS guideline is designed to provide a comprehensive framework that delineates the roles and responsibilities of all stakeholders engaged in the veterinary antimicrobial continuum—from research and development through to clinical and field use. It specifies the duties of national regulatory authorities in approving and monitoring antimicrobial production quality; outlines obligations for pharmaceutical manufacturers to adhere to good manufacturing practices and to support pharmacovigilance; defines expectations for veterinarians regarding prudent prescribing, dispensing, and administration; and assigns accountability to veterinary public health bodies for surveillance, reporting of resistance patterns and farmers' or animal owners' education. This guideline is thus intended to serve as both an educational tool and a practical framework, ensuring that all stakeholders—from veterinary professionals to farmers and policymakers—are equipped to implement practices that preserve the efficacy of antimicrobials for future generations and curb the emergence of resistance.

Farmer with herd of cattle in Bangladesh countryside / Masudar Rahman, pexels

OBJECTIVES OF THE VAS GUIDELINE

1. To provide guidance for stakeholders on the prudent and responsible use of antimicrobials in animal health.
2. To improve uptake of disease prevention measures to promote animal health and reduce the need for antimicrobials
3. To improve veterinary prescription practices to ensure effective and safe antimicrobial use.
4. To enhance awareness and understanding among all veterinary and livestock-sector stakeholders on antimicrobial resistance (AMR), antimicrobial stewardship (AMS) principles, and their respective roles in promoting responsible antimicrobial use.
5. To serve as a coordination tool for the Department of Livestock Services (DLS) to align efforts among all stakeholders.

SCOPE OF THE VAS GUIDELINE

This Veterinary Antimicrobial Stewardship (VAS) Guideline shall apply to all activities involving the use, prescription, dispensing, distribution, administration, monitoring, and oversight of antimicrobials used in animals in Bangladesh. The VAS guideline covers:

1. Livestock, poultry, and companion animals.
2. Government and private veterinarians, veterinary paraprofessionals, and animal health workers.
3. Animal owners, farmers, and chick and feed producers, dealers, and retailers.
4. Manufacturers, importers, distributors, and retailers of veterinary medicinal products.
5. Diagnostic laboratories, academic and training institutions, and research organizations.
6. Regulatory, supervisory, and coordinating authorities; relevant One Health stakeholders and development partners.

DEFINITIONS

Veterinary Paraprofessionals (Paravet): A person passed a veterinary diploma course of at least 3 years from any institution recognised by the Government along with passing in the Secondary School Certificate Examination from Science Group with biology (animal health workers, veterinary field assistants, AI technicians, extension workers with animal health activities) who assist in the delivery of veterinary services under the supervision of registered veterinarians and in accordance with national laws and regulations. They may support disease prevention, vaccination, and deworming, basic animal health care, sample collection, extension, record keeping, and antimicrobial stewardship activities, but shall not independently diagnose diseases or prescribe antimicrobials.

Veterinarians/Veterinary professionals: Trained graduates and registered practitioners according to the Bangladesh Veterinary Council Act 2019.

Antimicrobials: Medicines classified as antibiotics, antivirals, antifungals, and antiparasitic used to prevent or treat infections caused by microorganisms like bacteria, viruses, fungi, and parasites.

Antimicrobial resistance: Antimicrobial resistance is a phenomenon in which microorganisms evolved to resist the effects of the antimicrobial drugs used to treat them.

Multi-drug-resistant organisms: MDR was defined as acquired non-susceptibility to at least one agent in three or more antimicrobial categories [18].

CONCEPT AND PRINCIPLES OF VAS

The veterinary antimicrobial stewardship (VAS) activities include evidence-based prescribing guided by antimicrobial susceptibility testing (AST), implementation of on-farm biosecurity and infection prevention measures, maintenance of accurate usage records (e.g., Used Daily Dose metrics), and adherence to withdrawal-period guidelines. Complementary measures involve pharmaceutical manufacturers' commitment to good manufacturing practices and transparent reporting of resistance trends, regulatory agencies' enforcement of pre- and post-market surveillance, and public-health bodies' integration of One Health data to inform education and policy. Collectively, these actions, whether direct such as targeted treatment protocols or indirect such as improving farming and biosecurity practices to reduce disease incidence are designed to conserve antimicrobial efficacy, minimize selective pressure on microbial populations, and slow the global emergence of resistance. The VAS thus comprises a coordinated, One Health-oriented framework of activities and interventions implemented by a broad spectrum of stakeholders from veterinary authority and veterinary clinicians to livestock producers and feed or chick suppliers to promote judicious use of antimicrobial agents and thereby mitigate the development and spread of AMR.

Farming with cattle in rural Bangladesh field / Masudar Rahman, pexels

7 Core Pillars of Veterinary Antimicrobial Stewardship (VAS)

1 Judicious & Targeted Antimicrobial Use

- Use of AMs only for confirmed or strongly suspected bacterial infections
- Selection of AMs based on AST; de-escalate treatment based on clinical/microbiological response
- Avoid use of AMs for viral diseases unless secondary bacterial infection is evident

2 Infection Prevention & Control (IPC)

- Prevent disease through biosecurity, vaccination, hygiene
- Improve immunity via nutrition, stress reduction, optimal stocking
- Good farming pracices

3 Promotion of Alternatives to AMs & Supportive Measures

- Use non-antibiotic alternatives to enhance immunity
- Improve gut/rumen/udder health & disease resistance
- Reduce selective pressure & ensure sustainable production

4 Regulatory & Manufacturing Controls

- Ensure Good Manufacturing Practices (GMP)
- Ensure quality, potency, purity, & traceability
- Establish pharmacovigilance system
- Adapt policies based on real-world data

5 Integration of One Health Principles

- Cross-sectoral collaboration across human, animal & environmental health
- Joint surveillance systems
- Data sharing and aligning policies across sectors
- Interventions in one domain benefit another domain

6 Education, Research, & CPD

- Training, capacity building
- Engagement in research
- Continuous education
- Staying up to date with latest science and best practices

7 Monitoring, Surveillance & Feedback

- Continuous monitoring for evaluating the effectiveness of AMS programs
- Routine surveillance helps identify AMR trends
- Routine audits & feedback mechanisms promote transparency and accountability

1. JUDICIOUS AND TARGETED USE

Veterinary antibacterials should be administered only when a bacterial infection is confirmed based on clinical evaluation and supported by diagnostic methods such as AST and molecular identification or when rapid diagnostics are unavailable but clinical signs and epidemiological data point toward a bacterial cause. Selection of antimicrobial agents should be guided by susceptibility profiles with dosing optimised according to pharmacokinetic/pharmacodynamic parameters. Timely de-escalation or discontinuation upon clinical and microbiological findings is essential to minimize unnecessary exposure and mitigate the selective pressure that contributes to AMR.

Antibacterials should only be administered if there is clear evidence of secondary bacterial complications (e.g., bacterial pneumonia superimposed on a primary viral bronchitis), supported by clinical deterioration (e.g., persistent fever, purulent nasal discharge) and diagnostic indicators (e.g., elevated procalcitonin, positive bacterial culture from tracheal swab).

Decisions regarding antimicrobial therapy should be grounded on the most current scientific evidence and clinically relevant data incorporating surveillance data, resistance patterns, and established clinical guidelines. This integrative approach ensures that therapeutic decisions are both microbiologically appropriate and aligned with principles of antimicrobial stewardship, thereby enhancing efficacy and sustainability of treatment protocols and minimising resistance development.

2. INFECTION PREVENTION AND CONTROL

A critical pillar of AMS is the initiative-taking reduction of infection incidence through scientifically validated Infection Prevention and Control (IPC) strategies. These include stringent biosecurity protocols to limit pathogen introduction and transmission into animal populations such as controlled animal movements, quarantine of new or sick animals, and vector control as well as structured vaccination programs tailored to the epidemiological profile of specific pathogens taking into account WOAH's list of priority diseases (2024 *UN Political Declaration on AMR: Key takeaways for Veterinary Services - WOAH - World Organisation for Animal Health*). Enhanced hygiene practices include regular cleaning and disinfection of housing, equipment, and water systems, further lower microbial loads in the environment. Additionally, implementation of good farming practices such as proper nutrition, stress reduction, optimal stocking density, and adequate ventilation enhances immune function and resilience to disease. By minimising the frequency and severity of infectious disease outbreaks, these interventions significantly reduce the reliance on antimicrobial therapy, thereby preserving drug efficacy, improving productivity, and safeguarding animal health and welfare.

3. PROMOTION OF ALTERNATIVES AND SUPPORTIVE MEASURES

In veterinary practice, integrating scientifically validated alternatives to antimicrobials, namely probiotics, prebiotics, organic acids, and phytogenic feed additives (PFAs), can markedly reduce antimicrobial use and impede resistance development. Probiotic strains (e.g., Lactobacillus, Bifidobacterium) and prebiotic substrates (e.g., fructooligosaccharides) modulate the gut microbiota, bolster mucosal immunity, and inhibit enteric pathogens. Organic acids (such as formic, lactic, and fumaric acids) lower gastrointestinal pH, impair pathogen survival, and enhance nutrient digestibility. PFAs—botanical compounds like eugenol and carvacrol—exert inherent antimicrobial, anti-inflammatory, and antioxidant effects that further strengthen host defenses. When these strategies are combined with optimised dietary formulations, reliance on antimicrobials is reduced, selective pressure for resistant organisms is lowered, and more sustainable livestock production is achieved.

4. REGULATORY AND MANUFACTURING CONTROLS

Regulating antimicrobial production is crucial to ensure the safety and efficacy of veterinary medicines, and this is achieved through the enforcement of Good Manufacturing Practices (GMP). Key elements include raw material traceability ensuring that all ingredients meet quality standards and process validation, which confirms that manufacturing steps consistently produce products of intended quality. Batch release testing further ensures that each batch meets specifications for potency, purity, and sterility while minimising contamination risks. To ensure access to first-line antibiotics, vaccines and other essential veterinary medicines, veterinary competent authorities should work closely together with pharma industry stakeholders. This is necessary for the prevention and treatment of common infectious diseases according to their national context. For this purpose, stakeholders should follow the list of essential veterinary products developed by DGDA and DLS.

In addition to these controls, pharmacovigilance systems are essential for monitoring the safety of antimicrobials post-market. This includes tracking adverse events to detect any negative effects and monitoring AMR trends to identify emerging resistance patterns. By continuously evaluating these factors, regulatory bodies can adjust treatment guidelines, restrict the use of certain drugs, and ensure antimicrobial effectiveness is preserved while mitigating the risks of resistance.

5. INTEGRATION OF ONE HEALTH PRINCIPLES

The concept of One Health underscores the interdependent relationship between human, animal, and environmental health. In the context of VAS, this integrated approach acknowledges that AMR is a multifaceted issue that cannot be addressed in isolation within one sector but rather requires cross-sector collaboration across human health, veterinary health, and environmental disciplines.

An integrated One Health approach facilitates the collaboration of multiple sectors including veterinary, human healthcare, environmental science, agriculture, and government regulatory bodies. This collaborative effort enhances surveillance and monitoring of AMR and AMU across all sectors. For instance, joint surveillance systems can track the spread of resistant pathogens in animal populations, human populations, and the environment providing valuable data for shaping antimicrobial use policies and intervention strategies. Such coordination helps ensure that interventions in one domain (e.g., reducing antimicrobial use in animals) do not inadvertently lead to resistance in another (e.g., human health or the environment).

Additionally, integrating One Health principles promotes the alignment of veterinary practices with broader public health and environmental initiatives ensuring that stewardship efforts are part of a cohesive strategy that maximizes the overall impact on AMR. For example, reducing the environmental contamination with antimicrobial agents and resistant bacteria through improved waste management practices on farms or encouraging the reduction of antimicrobial use in agrifood systems directly benefits both animal and human health by decreasing the reservoir of resistant pathogens in the environment.

In conclusion, the One Health approach to AMS strengthens the ability to manage and combat AMR by fostering collaboration across sectors, enhancing data sharing, and aligning policies and practices across human health, animal health, and environmental management. This holistic strategy maximizes control over AMR, protecting both public health and animal welfare.

6. EDUCATION, RESEARCH, AND CONTINUOUS PROFESSIONAL DEVELOPMENT

Ongoing training, capacity-building, and engagement in research are essential for effective AMS across the animal health sector. Continuous education ensures that veterinary professionals, paraprofessionals, farmers, and other stakeholders remain informed about emerging AMR risks, innovations in diagnostic tools and evidence-based disease prevention and treatment options, and evolving stewardship practices. Incorporating research into professional development enables stakeholders to critically evaluate new scientific evidence, generate locally relevant data, conduct risk analysis, and contribute to the development of targeted, cost-effective, context-specific stewardship strategies. Active participation in research strengthens the evidence base for AMU recommendations and enhances clinical decision-making under real-world conditions. By staying up to date with the latest science and best practices and by engaging in structured research activities, veterinary practitioners can make informed, evidence-based decisions and adopt strategies that minimize resistance. This knowledge empowers farmers and veterinary paraprofessionals to apply stewardship principles, optimise antimicrobial use, and contribute to broader efforts in reducing AMR. Together, education and research contribute to improved animal health, enhanced food safety, and strengthened public health protection.

7. MONITORING, SURVEILLANCE, AND FEEDBACK

Continuous monitoring of AMR and AMU patterns is crucial for evaluating the effectiveness of AMS interventions. Regular surveillance helps identify trends in resistance and ensures that stewardship efforts are achieving their intended outcomes. Establishing routine audits and feedback mechanisms promotes transparency and accountability within the system allowing for timely adjustments to practices based on real-world data. This dynamic approach ensures that AMU remains appropriate and that resistance is controlled, contributing to the long-term success of stewardship initiatives.

ROLES AND RESPONSIBILITIES OF STAKEHOLDERS

1 Veterinarians
2 Farmers
3 Pharmaceutical Companies
4 Feed and Chick Dealers or Providers
5 Pharmacists and Pharmacy Technicians
6 Veterinary Paraprofessionals
7 Day-Old Chick Producers (Hatcheries) / Primary Breeders
8 Animal Feed Producers
9 Poultry Sellers
10 Pet Animal Owners
11 Academicians
12 Researchers
13 Veterinary Laboratories
14 Department of Livestock Services
15 Directorate General of Drug Administration
16 Bangladesh Veterinary Council
17 Development Partners
18 Professional Associations

1. VETERINARIANS

Veterinarians serve as the frontline agents in AMS framework, playing a pivotal role in ensuring the judicious and evidence-based use of antimicrobials across animal species, including wildlife. Their responsibilities extend beyond clinical treatment to encompass the implementation of preventive health measures, including biosecurity measures and vaccination programs. Additionally, veterinarians are instrumental in educating farmers and animal owners on responsible AMU, and in monitoring antimicrobial administration practices to curb the emergence and spread of AMR. Their role includes:

1. **Adherence to Standard Prescribing Guidelines**
   Adherent to the Standard Treatment Guidelines (STG)[1] published by the Department of Livestock Services when prescribing antimicrobials.

2. **Application of 4 Ds of Antimicrobial Therapy**
   Apply the "4 D's framework of optimal antimicrobial therapy": selecting the appropriate Drug, administering the correct Dose, implementing De-escalation based on pathogen identification, and ensuring the appropriate Duration of therapy.

3. **Use of Diagnostics for Targeted Therapy**
   Utilize diagnostic testing, where available, to confirm the etiological agent and guide selection of appropriate animal therapy.

4. **Avoidance of Unnecessary Antimicrobial Use**
   Refrain from initiating antimicrobial therapy in cases of uncomplicated viral infections, self-limiting bacterial infections, and non-bacterial inflammatory conditions where such therapy is clinically unwarranted.

5. **Adherence to Drug Withdrawal Periods**
   Consider the recommended drug withdrawal periods when prescribing for food-producing animals to prevent occurrence of antimicrobial residues in food.

6. **Submission of Specimens for Laboratory Testing**
   Facilitate the submission of clinical specimens from suspected AMR cases to the nearest veterinary diagnostic laboratory or the Central Veterinary Diagnostic Laboratory (CDIL) for AST.

[1] Standard Treatment Guidelines (STG) for Poultry, Bangladesh

1. VETERINARIANS (continued)

7 **Submission of Specimens for Laboratory Testing**
Facilitate the submission of clinical specimens from suspected AMR cases to the nearest veterinary diagnostic laboratory or the Central Veterinary Diagnostic Laboratory (CDIL) for AST.

8 **Use of Antimicrobial Susceptibility Testing (AST)**
Where feasible, perform antimicrobial susceptibility testing (AST) to inform the rational selection of antimicrobials based on pathogen-specific resistance profiles.

9 **Documentation and Review of Treatments**
Systematically document antimicrobial therapies and their outcomes to facilitate the assessment of treatment effectiveness and support evidence-based review and optimization of therapeutic protocols.

10 **Integration of Evidence-Based Clinical Decision Making**
Apply up-to-date pharmacological knowledge, evidence-based principles, relevant regulations and guidelines, and a contextual understanding of AMR in clinical decision-making.

11 **Reporting of Suspected AMR Cases**
Report all suspected cases of AMR to the appropriate veterinary or regulatory authorities by the veterinarians, preferably through Bangladesh Animal Health Intelligence System (BAHIS) for surveillance and action.

12 **Education of Farmers or Animal Owners on Responsible Antimicrobial Use**
Engage in farmer or animal owner education by providing accurate guidance on the responsible use of antimicrobials, relevant legal regulations, and the public and animal health risks associated with AMR. [1]

13 **Promotion of Biosecurity and Good Farming Practices**
Advocate comprehensive biosecurity measures and good farming practices on the farms to minimize pathogen exposure, protect animal health and reduce the overall infection pressure.

[1] https://www.woah.org/en/what-we-do/global-initiatives/antimicrobial-resistance/#ui-id-4

2. FARMERS

Farmers and pet animal owners are critical stakeholders in AMS, serving as the end users responsible for the appropriate administration of antimicrobials in accordance with prescriptions of registered veterinarians. By adhering to veterinary guidance and implementing good farming practices in animal husbandry, biosecurity, and disease prevention, they play a pivotal role in minimising unnecessary antimicrobial use. This not only supports the mitigation of AMR but also enhances animal health, productivity, and welfare. Their responsibilities involve:

1. **Implementation of Good Farming and Biosecurity Practices**
   Adopt and maintain good farming practices and stringent biosecurity measures to minimize the risk of disease introduction and spread and protect animal health.

2. **Compliance with Vaccination and Deworming Protocols**
   Adhere to regular vaccination and deworming protocols as advised by a registered veterinarian.

3. **Timely Veterinary Consultation for Illness**
   Promptly seek the expertise of a registered veterinarian upon the onset of illness in animals.

4. **Rational Antimicrobial Use Under Veterinary Guidance**
   Administer antimicrobials strictly in accordance with veterinary prescriptions and instructions ensuring adherence to dosage, frequency of dosing, duration, and withdrawal periods.

5. **Avoidance of Self-Prescription of Antimicrobials**
   Refrain from self-diagnosing and self-prescribing antimicrobial agents.

6. **Avoidance of Unqualified Advice on AM use**
   Avoid relying on unqualified advice from feed and chick dealers, fellow farmers or animal owners, or pharmacists/drug sellers regarding the use of antimicrobials or drugs.

7. **Avoidance of Unwarranted Antimicrobial Stockpiling**
   Refrain from unnecessary stockpiling of antimicrobials beyond actual therapeutic requirements.

2. FARMERS (continued)

8 **Collect Antimicrobials from Reliable Sources**
Purchase prescribed antimicrobials only from reliable sources like government hospitals or clinics, and licensed pharmacy to prevent use of substandard and falsified veterinary products that could be harmful to animals and lead to AMR. Also, check product registration and manufacturing information before purchase.

9 **Safe Disposal of Unused or Expired Antimicrobials**
Ensure the proper disposal of unused or expired antimicrobials to mitigate the risk of environmental contamination.

10 **Compliance with Drug Withdrawal Periods**
Refrain from marketing or selling eggs, milk, or animal for slaughter before the completion of the prescribed drug withdrawal period to prevent violative antimicrobial residues.

11 **Implementation of Good Livestock Waste Management**
Implement effective livestock waste management in curbing the spread of AMR into the environment.

12 **Collaboration with Veterinary Professionals in Disease Management**
Cooperate with veterinarians and animal health personnel in monitoring the administration of antimicrobials and tracking the clinical progression of disease cases.

Farmers harvesting hay in rural Bangladesh / Masudar Rahman, pexels

3. PHARMACEUTICAL COMPANIES

Pharmaceutical companies represent critical stakeholders within the AMS framework, bearing a distinct responsibility to ensure the efficacy, quality, and judicious use of antimicrobial agents. Their role is pivotal in preventing the emergence and propagation of AMR through the adoption of good manufacturing practices (GMP), dissemination of transparent communication of drug information, and adherence to regulatory standards. By investing in innovation—including the development of novel therapeutics, vaccines, and alternatives to antimicrobials—and implementing stringent quality assurance protocols, these companies contribute meaningfully to national and global AMR containment efforts. Furthermore, they play an essential role in stakeholder education, particularly by raising awareness among livestock producers regarding the risks associated with inappropriate AMU and advocating for stewardship-aligned practices to reduce antimicrobial dependency. Their responsibilities involve:

1. **Regulated Manufacturing and Marketing of Antimicrobials**
   Ensure the responsible manufacture and marketing of antimicrobials ensuring alignment with national legislation and international guidelines, for example WOAH standards- see code Chp 6.8 (terrestrials animals) and VICH [1].

2. **Transparent and Accurate Antimicrobial Labeling and Information**
   Ensure transparency in the dissemination of drug information, accompanied by accurate and clear labeling regarding indications, dosing regimen, withdrawal periods, safe disposal and potential risks of resistance.

3. **Access to Quality-Assured Antimicrobials**
   Promote access to affordable, quality-assured antimicrobials refraining from the circulation of substandard or falsified veterinary products that contribute to resistance.

4. **Investment in Alternatives to Antimicrobials**
   Invest in the research and development of alternatives to antimicrobial treatments—such as vaccines, probiotics, prebiotics, postbiotics, phytobiotics, and phytogenetic feed additives (PFAs).

5. **Strengthening of Pharmacovigilance and Resistance Surveillance Systems**
   Strengthen pharmacovigilance systems and resistance monitoring infrastructure, supporting surveillance and data sharing on AMU and AMR to inform stewardship efforts.

[1] Veterinary International Conference on Harmonization): https://vichsec.org/about/what-is-vich/

3. PHARMACEUTICAL COMPANIES (continued)

6 **Promotion of Antimicrobials Aligned with AMS Principles and Ethical Code of Conduct**

1. Support the evidence-based promotion of antimicrobials in line with AMS principles and in accordance with National Action Plan on Antimicrobial Resistance.
2. Pharmaceutical manufacturers shall adopt, implement, and comply with a formal code of ethical conduct governing the manufacture, promotion, and distribution of veterinary antimicrobials.
3. Avoid aggressive marketing and sales practices that may promote overuse or misuse of antimicrobials.

7 **Capacity Building Through Targeted Stakeholder Training**

Provide targeted education and training for farmers, animal owners, veterinarians, pharmacists, drug sellers, and other stakeholders on judicious use of antimicrobials.

8 **Community Awareness and Behavior Change Initiatives**

Contribute to awareness campaigns in rural and underserved areas, among school children, livestock owners, farmers, and the general community, addressing misconceptions about antimicrobials and promoting behavior change.

9 **Oversight of Veterinarians' Compliance with Prescribing Standards**

1. Establish oversight mechanisms to monitor the compliance of company-affiliated veterinarians with the national Standard Treatment Guidelines (STG) and evidence-based prescribing practices.
2. Establish AMS teams at different tiers to monitor, guide, and coordinate the rational use of antimicrobials in the livestock sector.

10 **Collaboration for Policy Development and Regulatory Enforcement**

Collaborate with governments and regulatory bodies to strengthen policy frameworks that promote rational AMU and restrict over-the-counter sales.

3. PHARMACEUTICAL COMPANIES (continued)

11 **Environmental Stewardship in Antimicrobial Manufacturing and Disposal**

1. Promote responsible waste disposal and environmentally sound manufacturing practices to prevent antimicrobial contamination in local ecosystems.
2. Implement environmentally sound protocols for the collection and disposal of expired or unsold antimicrobials to mitigate pharmaceutical contamination and its contribution to environmental AMR reservoirs.

12 **Research Partnerships for Context-Specific AMS Solutions**

Partner with local research institutions, universities, and veterinary public health agencies, preferably through a public-private partnership, to generate context-specific data that informs AMS strategies and policies.

Dhaka, Bangladesh / estecam, Getty Images

4. FEED AND CHICK DEALERS OR PROVIDERS

Although stewardship efforts often center on veterinarians and farmers, feed and chick dealers or providers play an equally vital role in shaping AMU at the initial stages of livestock and poultry production. As key entry points into the animal health value chain, they influence disease and AMR risk, husbandry practices, and overall biosecurity. Beyond supplying quality feed and chicks, their involvement in promoting responsible AMU, educating clients, and promoting alternatives to antimicrobials is essential in reducing antimicrobial reliance and mitigating AMR. As core stakeholders in the One Health approach, their active participation is crucial to safeguarding the long-term effectiveness of antimicrobial agents. Their roles encompass:

1. **Sourcing of Quality Feed and Chicks**
   Ensure the supply of quality feed and day-old-chicks, sourced from certified hatcheries and feed mills that comply with biosecurity and hygiene standards to minimize early-life disease burden and reduce the need for prophylactic AMU.

2. **Restriction of Antimicrobial Advice**
   Refrain from advising farmers or animal producers on AMU, recognising that such guidance must be provided exclusively by licensed veterinary professionals in compliance with Bangladesh Veterinary Council Act 2019[1].

3. **Regulated Distribution of Veterinary Drugs**
   Abstain from selling or distributing veterinary medicinal products unless duly authorized through a valid drug license and supported by appropriate training in pharmaceutical stewardship, responsible handling, and regulatory compliance[2].

4. **Promotion of Preventive Health and Farm Biosecurity**
   Advocate for implementing preventive and biosecurity measures on farms—such as advising on proper farm hygiene, vaccination protocols, and disease prevention to reduce the need for AMU.

5. **Stakeholder Awareness on Antimicrobial Stewardship and Alternatives**
   Raise awareness of customers and stakeholders on the importance of responsible AMU, while actively discouraging self-medication practices and non-prescription access to veterinary drugs and encouraging the use of alternatives to antimicrobials—such as probiotics, prebiotics, and postbiotics.

[1] Bangladesh Veterinary Council Act 2019
[2] Drug and Cosmetics Act 2023

4. FEED AND CHICK DEALERS OR PROVIDERS (continued)

6 **Promote Non-Antimcirobial Growth Promoters (NAGPs)**
Collaborate with veterinarians and animal health authorities to support evidence-based practices such as promoting alternatives to antimicrobials including probiotics, prebiotics, organic acids, and other non-antimicrobial growth promoters (NAGPs) in line with AMS principles and WOAH guidance.

7 **Traceability for AMR Risk Management**
Facilitate traceability and transparency within the supply chain by maintaining proper documentation on the sourcing, formulation, and distribution of feed and chicks, enabling accountability in AMU and AMR risk management.

8 **Participation in National AMR Surveillance and Awareness Initiatives**
Participate in national AMR surveillance and awareness programs contributing to a One Health approach in the containment of AMR.

9 **AMR Awareness and Education**
Feed and chick dealers and producers will join the national AMR awareness initiatives by arranging campaigns and workshops, and participate with national programs arranged by the veterinary authority through professional associations for their members and clients.

5. PHARMACISTS AND PHARMACY TECHNICIANS

Pharmacists and Pharmacy Technicians play an essential role in AMS by ensuring the responsible dispensing of veterinary antimicrobials in compliance with legal and regulatory frameworks. They are responsible for verifying prescriptions issued by licensed veterinarians, providing accurate information on dosing regimen, administration, and withdrawal periods, and advising clients on proper storage and disposal of antimicrobials. Through their expertise in pharmacology and drug safety, pharmacists contribute to minimising inappropriate AMU, thereby supporting efforts to curb the development and spread of AMR. Their contributions include:

1. **Prescription-Based Dispensing of Veterinary Antimicrobials**
   Dispense antimicrobials strictly in accordance with valid prescriptions, issued by registered veterinarians, ensuring legal and ethical compliance.

2. **Provision of Evidence-Based Guidance on Antimicrobial Use**
   Provide clear and evidence-based guidance to end users (e.g., animal owners, farmers) on the correct use, handling, storage, and disposal of antimicrobial agents.

3. **Procurement and Distribution of Quality-Assured Antimicrobials**
   Ensure the procurement and distribution of quality-assured veterinary antimicrobials, sourced from licensed manufacturers and suppliers to prevent the circulation of substandard and falsified veterinary products.

4. **Documentation and Traceability of Dispensing Activities**
   Maintain accurate records of antimicrobial dispensing activities, contributing to surveillance systems and facilitating traceability in the event of AMR investigations or regulatory audits.

5. **Enforcement of Prescription-Only Access to Antimicrobials**
   Prevent over-the-counter (OTC) sales of veterinary antimicrobials by enforcing prescription-only policies and reporting suspected misuse or over-the-counter sales violations.

6. **Compliance with Proper Storage and Handling Standards**
   Implement proper handling and storage of antimicrobials to maintain product quality and avoid the distribution of expired products.

5. PHARMACISTS AND PHARMACY TECHNICIANS (continued)

7 **Client Education on AMR Risks and Compliance**
Support awareness and education initiatives by informing clients about the risks of antimicrobial resistance and the importance of adherence to veterinary instructions.

8 **Collaboration in National AMS and One Health Frameworks**
Collaborate with veterinarians, regulatory bodies, and public health authorities to promote the rational use of antimicrobials in alignment with national AMS strategies and One Health principles.

9 **Engagement in Continuous Professional Development**
Participate in continuous professional development and training on AMR, pharmacovigilance, and advancements in antimicrobial stewardship.

A store of medicine in a Bangladesh village / Nayeem Ahmad, Getty Images

6. VETERINARY PARAPROFESSIONALS

Veterinary Paraprofessionals play a crucial role in AMS by serving as frontline implementers of animal health interventions, particularly in rural and resource-limited settings. Operating under veterinary supervision, they contribute to the judicious use of antimicrobials by promoting compliance with prescribed treatments, facilitating early disease detection, and advocating preventive measures such as vaccination and biosecurity. Their responsibilities encompass:

1. **Compliance with Veterinary Supervision and Regulatory Frameworks**
   Operate under the supervision and direction of licensed veterinarians ensuring all antimicrobial-related activities align with legal and regulatory frameworks.

2. **Contribution to AMU Documentation and AMR Surveillance**
   Assist in the monitoring and documentation of AMU and treatment outcomes contributing to local and national AMR and AMU surveillance systems.

3. **Support for Preventive Animal Health Interventions**
   Support the implementation of evidence-based animal health interventions, including vaccination, deworming, and improved husbandry practices, to reduce disease burden and limit the need for AMU.

4. **Community-Level Promotion of Responsible Antimicrobial Use**
   Promote responsible AMU at the community level by reinforcing veterinary instructions regarding dosing regimen, and withdrawal periods.

5. **Facilitation of Sample Collection and Submission**
   Supporting the collection and submission of samples for antimicrobial susceptibility testing (AST) when needed.

6. **Farmer Education on Antimicrobial Risks and Compliance**
   Educate livestock producers and animal owners on the risks associated with inappropriate AMU and the importance of adherence to veterinary prescriptions to ensure animal health and mitigate the occurrence of AMR.

6. VETERINARY PARAPROFESSIONALS (continued)

7. **Discouragement of Unsupervised Antimicrobial Use**
Discourage self-medication and over-the-counter use of antimicrobials and guide farmers toward seeking veterinary consultation for disease diagnosis and treatment decisions.

8. **Support for Early Disease Detection and Veterinary Referral**
Facilitate early disease detection and timely veterinary referral, thereby enabling targeted and judicious antimicrobial interventions.
Promotion of Farm-Level Biosecurity and Infection Control

9. **Encourage the adoption of biosecurity and infection prevention** measures to mitigate the introduction and spread of infectious diseases within and between farms.

10. **Engagement in AMR and Stewardship Training Programs**
Participate in continuing education and training programs on AMR and AMU, stewardship principles, and emerging best practices in animal health management.

11. **Safe Handling and Disposal of Veterinary Medicinal Products**
Promote proper storage and disposal of veterinary medicinal products, minimising the risk of environmental contamination and inadvertent antimicrobial exposure.

7. DAY-OLD CHICK PRODUCERS (HATCHERIES) / PRIMARY BREEDERS

The health status of parent and grandparent stock is the primary determinant of Day-Old Chick (DOC) quality and the single greatest factor influencing the need for antimicrobials in downstream production. Breeders and hatcheries hold the highest level of responsibility in the AMS chain by acting as the first and most critical control point for preventing vertically transmitted diseases. Specific roles and responsibilities are as follows:

1

Maintain Closed, High-Health Flocks

1. Implement and finance a strict biosecurity fortress around grandparents and parent stock facilities. This exceeds farm-level biosecurity and must be of the highest standard to exclude pathogens like Salmonella spp., Mycoplasma gallisepticum/synoviae, and Avian Pathogenic E. coli.
2. Source new genetic stock only from accredited, high-health-status primary breeders. Maintain a closed flock system wherever possible.

2

Implement Rigorous Health Monitoring and Surveillance

1. Conduct ongoing, systematic monitoring programs for vertically transmitted diseases as defined by national regulations and international standards.
2. Utilize a combination of serological testing, bacteriological culturing, and molecular diagnostics on breeders, hatching eggs, and meconium/chick box liners to confirm the absence of key pathogens.
3. Maintain detailed, transparent health records that are traceable to each flock and hatch.

3

Zero-Tolerance Policy for Vertically Transmitted Diseases

1. DO NOT incubate eggs or market day-old chicks (DOCs) from parent stock flocks that are known to be infected with or are shedding agents of vertically transmitted disease(s).
2. Have a clear, actionable response plan for any positive detection, which must include:
   - Immediate veterinary investigation and source tracing.
   - Cessation of egg setting from affected flocks.
   - Depopulation of affected breeder flocks if eradication is required and epidemiologically sound.
   - Transparent communication with downstream customers and relevant authorities.

7. DAY-OLD CHICK PRODUCERS (HATCHERIES) / PRIMARY BREEDERS (continued)

4 **Ethical and Economic Stewardship**

1. Recognise that selling DOCs from infected stock transfers massive biological risk, economic burden, and antimicrobial dependency to broiler or layer farmers. This is antithetical to AMS.
2. Uphold the principle that the true value of a DOC is its health status, not just its physical delivery. Investing in pristine parent stock health is the most cost-effective AMS strategy for the entire chain.

5 **Certification and Transparency**

Participate in and achieve certifications from independent health monitoring schemes.

Provide buyers with verifiable documentation of the health status of the parent stock and the specific hatchery batch of DOCs purchased.

Sonali chicken farm in Bangladesh / Arafath Raihan, Getty Images

8. ANIMAL FEED PRODUCERS

Animal feed producers are one of the key players in AMS, with direct responsibility for exclusion of antimicrobials from feed formulations. By adhering to regulatory standards, ensuring feed quality, and promoting transparency in feed composition and labeling, they help prevent the indiscriminate use of antimicrobials. Their responsibility extends to maintaining feed safety, preventing cross-contamination, and supporting the use of alternatives to antimicrobials in minimising AMR risks in animal production systems. Their roles encompass:

1. **Compliance with National and International Feed Safety Standards**
   Comply with national[1], [2] and international standards governing the manufacture, labeling, and marketing of feed free from contaminants and residues of pesticides, including those set by Codex Alimentarius and veterinary competent authorities.

2. **Prohibition of Antimicrobial Use in Feed**
   Ensure that antimicrobials are not included in feed formulations in compliance with Fish Feed and Animal Feed Act 2010[1] and Animal Feed Rules 2013 [2].

3. **Implementation of Quality Control and Quality Assurance in Feed Production**
   Implement strict quality assurance and control systems across all stages of feed production to prevent cross-contamination between poultry and cattle feed and to maintain safety and efficacy.

4. **Regulatory Labeling of Medicated (Non-antimicrobial) Feeds**
   Clearly label all medicated (non-antimicrobial) feeds indicating the active ingredients, dosage, intended species, withdrawal periods, and usage instructions in accordance with regulatory requirements.

5. **Traceability and Record-Keeping in Feed Production**
   Maintain transparent and traceable records of all substances used in feed production, including sourcing, formulation, batch distribution, and sales, to support AMR and AMU surveillance and compliance audits.

[1] Fish Feed and Animal Feed Act 2010
[2] Animal Feed Rules 2013

8. ANIMAL FEED PRODUCERS (continued)

6 **Training in Good Manufacturing Practices (GMP) and Feed Hygiene**
Train production and distribution personnel in good manufacturing practices (GMP) and feed hygiene.

7 **Promotion of Non-Antimicrobial Growth Promoters (NAGPs)**
Promote the use of alternatives to antimicrobials such as probiotics, prebiotics, enzymes, organic acids, and other non-antimicrobial growth promoters (NAGPs), in alignment with AMS and animal health objectives.

8 **Restriction of Indiscriminate Antimicrobial Promotion**
Refrain from engaging in promotional practices that encourage the indiscriminate use of antimicrobials through feed, particularly for growth promotion or prophylactic use without veterinary oversight.

9 **Nutritional Labeling and Expiry Disclosure on Feed Packaging**
Indicate the nutritional composition of animal feed and expiry date on packaging to provide optimal animal health benefits and reduce reliance on AMU.

10 **Safe Management of Contaminated and Expired Feed Materials**
Establish mechanisms for the proper storage, handling, and disposal of contaminated feeds and expired raw materials to minimize environmental contamination.

9. POULTRY SELLERS

Poultry sellers or retailers play a significant role in AMS by influencing downstream practices related to animal health, food safety, and AMU. As intermediaries between producers and consumers, they are responsible for ensuring that only birds sourced from farms adhering to responsible antimicrobial practices and complying with withdrawal periods are sold. Their roles include:

1. **Sourcing Poultry from Compliant and Trusted Farms**
   Source poultry is only trusted farms who follow good farming practices and responsible AMU protocols.

2. **Implementation of Biosecurity and Hygiene at Retail Outlets**
   Implement basic biosecurity and hygienic measures at retail premises to prevent disease transmission and reduce infection pressure.

3. **Compliance with Antimicrobial Withdrawal Periods Prior to Sale**
   Ensure that birds sold have not been treated with antimicrobials within the withdrawal period in compliance with veterinary guidance and food safety regulations.

4. **Maintenance of Traceability and Health Records**
   Maintain accurate records of bird sources, health status, and any antimicrobial treatments received to support traceability and regulatory oversight.

5. **Cooperation with Authorities in AMU Monitoring**
   Cooperate with veterinary and regulatory authorities in monitoring AMU.

10. PET ANIMAL OWNERS

Pet owners are vital partners in combating AMR. Responsible actions directly reduce the need for antimicrobials and prevent the spread of resistance.

1

Prioritize Prevention

1. Maintain regular vaccinations, parasite control, and veterinary check-ups.
2. Provide good nutrition, exercise, and dental care to support robust health.

2

Use Antimicrobials Responsibly

1. Never use antimicrobials without a veterinarian's prescription. Do not share or reuse old medications.
2. Follow the instructions of your veterinarian regarding the dosing regimen and always complete the full prescribed course, even if your pet seems better.
3. Dispose of unused and expired medications safely, following manufacturers instructions.

3

Practice Good Hygiene

1. Wash hands after handling sick pets, administering medication, or cleaning up waste.
2. Clean food/water bowls, bedding, and toys regularly to prevent germ spread.

11. ACADEMICIANS

Academicians play a pivotal role in shaping the future of AMS by advancing education, research, and evidence-based policy support. Through teaching, curriculum development, interdisciplinary collaboration, and scientific research, they contribute to building the technical capacity of future professionals and generating data to inform rational AMU. Their influence extends beyond the classroom, contributing to the broader adoption of AMS principles in the profession, promoting One Health approaches, and sustaining long-term efforts to mitigate AMR. Their responsibilities involve:

1. **Integration of AMS and AMR into Veterinary Curricula**
   Integrate AMS and AMR concepts into veterinary curricula following WOAH Day 1 competencies (https://www.woah.org/app/uploads/2021/03/dayone-b-ang-vc.pdf) to ensure that future professionals are well-versed in responsible AMU and the impact of AMR on both animal and human health.

2. **Implementation of AMS Practices in Teaching Hospitals**
   Promote the integration of AMS principles within university-affiliated veterinary clinics to provide students with practical training in evidence-based and responsible AMU.

3. **Advancement of Research in AMR and Stewardship Alternatives**
   1. Conduct and support research on AMR, novel antimicrobials, alternatives to antimicrobials, stewardship practices, and other alternative disease management strategies.
   2. Collaborate with national, regional, and international research institutes and networks to generate, synthesize, and disseminate evidence on AMU, AMR, and stewardship interventions.

4. **Provision of Scientific and Technical Expertise to Stakeholders**
   Provide evidence-based guidance and technical expertise to policymakers, veterinary authorities, and relevant stakeholders.

5. **Contribution to National AMS Policy and Educational Resources**
   Contribute to the development, implementation, and revision of national AMS policies, training modules, and outreach materials tailored to local contexts.

[1] Fish Feed and Animal Feed Act 2010
[2] Animal Feed Rules 2013

11. ACADEMICIANS (continued)

6 **Promotion of One Health Collaboration in AMR Mitigation**

1. Promote interdisciplinary collaboration through One Health initiatives to address AMR across human, animal, and environmental health sectors.
2. Advocate for, technical support, and participate in the establishment and strengthening of One Health institute/center/wing within academic frameworks.

7 **Support for AMS-Focused Continuous Professional Development**

Support continuous professional development (CPD) by offering AMS-related training to field veterinary practitioners and students.

8 **Dissemination of Knowledge through Workshops and Scientific Publications**

1. Organize AMR containment related workshops and seminars and publish scientific manuscripts.
2. Organize and engage in expert roundtable discussions, policy dialogues, and media communication to disseminate evidence-based information on AMS and AMR.

9 **Engagement in Public Awareness and Community Education**

Engage in public awareness and community education efforts to foster responsible AMU at all levels of the livestock sector.

12. RESEARCHERS

Researchers are at the forefront of advancing knowledge and developing innovative solutions to combat AMR. Their work is crucial in understanding the mechanisms of resistance, identifying new antimicrobial agents, and exploring alternatives to antimicrobials. Through rigorous studies and collaboration with other stakeholders, researchers contribute to evidence-based policies and strategies that support AMS efforts globally. Collaboration between AMR researchers from various sectors is crucial to generate evidence-based policies. Their contributions include:

1. **AMR Mechanism Investigation**
   Conduct research to elucidate the molecular and genetic mechanisms underlying AMR in animal pathogens and commensal bacteria.

2. **New antimicrobial agents' development**
   Investigate and develop new antimicrobial agents.

3. **Alternative therapies and Interventions**
   Investigate and develop alternatives to antimicrobials, such as vaccines, probiotics, immunomodulators, bacteriophage, and precision diagnostics to reduce reliance on antimicrobials.

4. **Surveillance System Development and Engagement**
   Contribute to and engage in the design and enhancement of national and international AMU and AMR surveillance systems, integrating laboratory data with epidemiological insights.

5. **Data Reporting**
   Report voluntarily AMR and AMU related data to the Department of Livestock Services through Bangladesh Animal Health Intelligence System (BAHIS).

6. **Risk Assessment Studies**
   Perform risk assessments to evaluate the impact of AMU in animals on public health, including transmission dynamics of resistant pathogens between animals, humans, and the environment (One Health approach).

12. RESEARCHERS (continued)

7 **Optimization of Antimicrobial Use**
Develop and validate protocols for judicious AMU based on pharmacokinetic/pharmacodynamic (PK/PD) modeling, resistance patterns, and clinical outcomes.

8 **Policy Support and Evidence Generation**
Generate robust scientific evidence to inform policymaking, clinical guidelines, and regulatory frameworks related to AMS and AMR containment.

9 **Capacity Building and Knowledge Transfer**
1. Engage in training programs, workshops, and publications of scientific manuscripts to build capacity among veterinary professionals, policymakers, and other stakeholders to inform best practices in AMR management.
2. Develop evidence-based communication and knowledge translation tools to facilitate effective dissemination and uptake of research findings by relevant stakeholders.

10 **Ethical and Responsible Research Practices**
Ensure that research involving antimicrobial agents adheres to ethical standards, regulatory guidelines, and principles of responsible data sharing and transparency.

13. VETERINARY LABORATORIES

Veterinary laboratories are central to AMS efforts by providing essential diagnostic services, conducting AMR surveillance, and supporting evidence-based decision-making. Through accurate pathogen identification and antimicrobial susceptibility testing (AST), these laboratories inform appropriate AMU, contribute to national and global AMR monitoring systems, and ensure compliance with regulatory standards. Their roles include:

1. **Surveillance and Monitoring**
   Conduct systematic surveillance of AMR patterns and trends of animal pathogens and commensal bacteria following WOAH standards to inform evidence-based treatment guidelines and policy decisions.

2. **Diagnostic Testing**
   Provide accurate and timely microbiological diagnostics, including pathogen identification and AST, to guide prudent AMU in veterinary practice.

3. **Data Management and Reporting**
   Collect, analyze, and report laboratory data on AMR trends to relevant competent authorities and stakeholders to support national and international AMR monitoring systems, specifically to the DLS through BAHIS.

4. **Quality Assurance**
   Maintain high standards of laboratory quality control and assurance to ensure the reliability and reproducibility of AMR testing results.

5. **Research and Innovation**
   1. Support research initiatives focused on AMR mechanisms, emerging resistance patterns, and the development of alternative diagnostic and therapeutic strategies.
   2. Collaborate with universities, research institutions, and other laboratories to support AMR surveillance, diagnostic services, and evidence-based antimicrobial stewardship.

13. VETERINARY LABORATORIES (continued)

6 **Capacity Building**
1. Provide training and technical support to veterinarians and laboratory personnel on best practices in sample collection, diagnostic procedures, and interpretation of AST results.
2. Arrange training for veterinary students as well.

7 **Compliance with Regulatory Frameworks**
Operate in accordance with national and international standards and regulations governing AMR surveillance and antimicrobial stewardship in veterinary settings.

Traditional farming with oxen in Bangladesh / Masudar Rahman, pexels

14. DEPARTMENT OF LIVESTOCK SERVICES

The Department of Livestock Services (DLS) holds a critical mandate in the implementation and oversight of AMS within the animal health sector. DLS is responsible for developing and enforcing regulations, policies, and guidelines governing the prudent and responsible AMU in animals; coordinating and conducting surveillance for AMU and AMR; building capacity of veterinary professionals; and promoting awareness among stakeholders. As a key authority in animal health, DLS is also tasked with ensuring alignment of national AMS efforts with international standards and fostering intersectoral collaboration under the One Health approach. Their responsibilities involve:

1. **Regulatory Oversight**
   Develop, implement, and enforce legislation and regulations governing the authorization, distribution, prescription, and use of veterinary antimicrobial agents, in alignment with national (eg. DGDA) and WOAH standards.

2. **Surveillance and Monitoring Systems**
   Design, implement and oversee integrated national AMU and AMR surveillance programs, ensuring standardized data collection, reporting, and analysis to inform risk-based regulatory interventions.

3. **Authorization and Control of Veterinary Antimicrobial Products**
   1. Conduct technical evaluations of veterinary antimicrobial products for safety, efficacy, and AMR risk, and submit recommendations to the Directorate General of Drug Administration (DGDA) for manufacturing and marketing authorization. In coordination with DGDA, oversee post-approval aspects of marketing, distribution, and labeling as they pertain to veterinary and animal health practice under the legal framework.

4. **Policy Development and Implementation**
   Develop and coordinate national policies, action plans, and guidelines to ensure prudent and responsible use of antimicrobials in the animal health sector.

14. DEPARTMENT OF LIVESTOCK SERVICES (continued)

5 **Enforcement and Compliance**
Monitor and audit veterinary antimicrobial supply chains and veterinary practices for compliance with AMS regulations applying sanctions or corrective actions where non-compliance is identified.

6 **Establishment of AMS Unit**
1. Strengthen the national animal health workforce capacity through the establishment of a dedicated 'Antimicrobial Stewardship (AMS) Unit' within the DLS, mandated to coordinate, monitor, and implement AMS-related activities, including the development and dissemination of national policies, guidelines, and operational programs.
2. Systematic Strengthening of the national veterinary services according to the WOAH PVS pathway to sustain AMR containment efforts (https://www.woah.org/en/what-we-offer/improving-veterinary-services/pvs-pathway)
3. Establish AMS teams at different service tiers to monitor, guide, and coordinate the rational use of antimicrobials in the livestock sector.

7 **Capacity Building and Training**
Facilitate continuous education and training for veterinary professionals, laboratory personnel, and stakeholders to strengthen compliance with AMS regulations and promote a culture of responsible AMU.

8 **Intersectoral Coordination (One Health Approach)**
1. Collaborate with human health, environmental, and agricultural authorities to ensure a coordinated, multisectoral response to AMR in line with the One Health approach.
2. Develop and formalise a robust coordination mechanism between DGDA and DLS to ensure aligned policies, synchronise regulatory oversight, and facilitate the continuous exchange of data on AMU, and resistance trends in animals.

14. DEPARTMENT OF LIVESTOCK SERVICES (continued)

9 **Public Awareness and Stakeholder Engagement**
Lead national awareness campaigns and engage with stakeholders across the veterinary pharmaceutical industry, academia, farming sectors, and community level to support AMS objectives.

10 **International Reporting and Cooperation**
Fulfill obligations for international reporting on AMR and AMU (e.g., to FAO-InFARM, , WHO-GLASS, & WOAH-ANIMUSE), and participate in global initiatives and knowledge exchange platforms for AMR containment.

Woman walking with cow in rural Bangladesh / Masudar Rahman, pexels

15. DIRECTORATE GENERAL OF DRUG ADMINISTRATION

The Directorate General of Drug Administration (DGDA) is responsible for ensuring the rational and regulated use of antimicrobials through the implementation of a comprehensive AMS framework. Core responsibilities include the evaluation, registration, and market authorization of antimicrobial agents, ensuring that only products meeting established standards of quality, safety, and efficacy are approved for use. The authority is tasked with enforcing regulatory controls over the manufacturing, importation, distribution, and sale of antimicrobials, including restricting over-the-counter availability, and regulating the use of Highest Priority critically important antimicrobials for human medicine in animals, and ensure the use of WOAH List of antimicrobial agents of veterinary importance (https://www.woah.org/en/document/list-of-antimicrobial-agents-of-veterinary-importance/). It also develops and disseminates evidence-based guidelines on appropriate antimicrobial prescribing and use, supports the implementation of pharmacovigilance and AMR surveillance systems, and facilitates capacity building among stakeholders. Furthermore, the DGDA plays a leading role in aligning national policies with international standards and commitments under the One Health approach, fostering cross-sectoral coordination in AMR containment efforts. Their responsibilities involve:

1

Regulatory Approval and Market Authorization

1. Evaluate, register, and authorize veterinary antimicrobial agents based on quality, safety, and efficacy criteria, integrating the technical review and recommendation from the DLS.
2. Ensure pre-market assessment includes AMR risk considerations.

2

Control of Manufacturing, Importation, and Distribution

1. License and regulate manufacturers, importers, and distributors of antimicrobials.
2. Enforce good manufacturing and distribution practices (GMP/GDP).
3. Prevent the circulation of substandard, falsified, or unauthorized antimicrobial products.

15. DIRECTORATE GENERAL OF DRUG ADMINISTRATION (continued)

3 **Prescription and Dispensing Regulations**
1.Enforce prescription-only use policies for veterinary antimicrobials by collaborating with the DLS for operational enforcement, inspection, and monitoring veterinary prescribing and dispensing practices.
2.Restrict over-the-counter (OTC) sales and unauthorized dispensing of critical antimicrobials.
3.Regulate veterinary and human antimicrobial use under separate, harmonized frameworks.

4 **Guideline Development and Implementation**
1.Develop, update, and disseminate evidence-based guidelines on the prudent use of antimicrobials in human and animal health.
2.Promote sector-specific AMS protocols in line with national and international standards.

5 **Pharmacovigilance and Post-Marketing Surveillance**
1.Establish and maintain systems for monitoring adverse drug reactions (ADRs) and antimicrobial resistance trends.
2.Collect and analyze data on AMU and AMR to inform regulatory actions.

6 **Enforcement and Compliance Monitoring**
1.Conduct inspections and compliance audits across the antimicrobial supply chain.
2.Implement sanctions for violations of antimicrobial use regulations, including illegal marketing or off-label use.

7 **Capacity Building and Stakeholder Engagement**
1.Support training and awareness programs for healthcare professionals, veterinarians, and pharmacists on antimicrobial stewardship.
2.Engage with industry, academia, and professional bodies to promote responsible AMU.

15. DIRECTORATE GENERAL OF DRUG ADMINISTRATION (continued)

8

Policy Alignment and Collaboration

1.Ensure national regulatory frameworks are aligned with global guidelines (e.g.,FAO, UNEP, WHO, WOAH).

2.Collaborate with the DLS and pharmaceutical companies to establish a systematic framework for tracking and recording national sales veterinary AMU data, thereby supporting the development of future national AMS programs, and facilitating submissions to international regulatory bodies such as WOAH.

3.Participate in cross-sectoral and international initiatives to combat AMR under the One Health approach.

Directorate General of Drug Administration in Dhaka, Bangladesh / DGDA, Facebook

16. BANGLADESH VETERINARY COUNCIL

The Bangladesh Veterinary Council (BVC), as the statutory body responsible for the registration and regulation of veterinary professionals, plays a critical role in advancing AMS within the animal health sector. Through its mandate to license veterinary practitioners, define professional standards, and oversee veterinary education and conduct, the BVC is uniquely positioned to ensure that AMS principles are integrated into all levels of veterinary practice. By promoting responsible AMU, enforcing ethical guidelines, and supporting continuing professional development, the BVC contributes significantly to national efforts in combating AMR under the One Health approach. Their major roles include:

1. **Professional Registration and Licensing**
   Ensure that only qualified and accredited veterinary graduates are registered to practice with Day 1 competencies as per WOAH guidance and Bangladesh Veterinary Council Act 2019
   Incorporate AMS competencies as part of eligibility criteria for professional licensure.

2. **Standards for Veterinary Education and Competency**
   1.Establish and enforce minimum AMS-related educational standards within veterinary curricula.
   2.Promote the inclusion of AMR, AMS, and One Health principles in undergraduate and continuing veterinary education.

3. **Code of Conduct and Professional Ethics**
   1.Develop and enforce a code of conduct that includes the ethical and responsible AMU.
   2.Mandate adherence to AMS principles as a condition of continued licensure and professional practice.

4. **Continuing Professional Development (CPD)**
   1.Require regular AMS-focused CPD programs as part of license renewal requirements.
   2.Collaborate with academic institutions and professional associations to provide AMS training and certification.

16. BANGLADESH VETERINARY COUNCIL (continued)

5 **Oversight and Accountability**
1.Monitor and evaluate veterinary practices to ensure compliance with national AMS guidelines and regulatory requirements.
2.Investigate complaints and take disciplinary action against professionals engaged in antimicrobial misuse or malpractice.

6 **Policy Support and Advisory Role**
1.Provide technical input to national AMS policy development, particularly in veterinary practice standards and regulation.
2.Serve as a liaison between veterinary professionals and regulatory authorities to ensure field-level alignment with AMS objectives.

7 **Public and Stakeholder Engagement**
1.Promote awareness among veterinary professionals and animal owners about AMR and the importance of AMS.
2.Support responsible antimicrobial use practices in clinical and field settings through outreach and advocacy.

8 **One Health Collaboration**
1.Participate in multisectoral platforms addressing AMR and AMS under the One Health framework.
2.Facilitate coordination between animal, human, and environmental health sectors for integrated AMS implementation.

17. DEVELOPMENT PARTNERS

Development partners play a crucial role in supporting national AMS efforts through the provision of technical expertise, financial resources, and strategic guidance. Their responsibilities encompass supporting capacity building, policy development, surveillance system strengthening, and promotion of research and innovation. By aligning their support with national priorities and fostering multisectoral collaboration under the One Health approach, development partners contribute to the sustainable implementation and monitoring of AMS interventions, while promoting responsible AMU across human, animal, and environmental health sectors. They play roles in:

1

Technical and Financial Support

1.Provide funding, expertise, and technical assistance to support the development, implementation, and monitoring of national AMS and AMR containment programs.

2.Facilitate access to global best practices, tools, and technologies for strengthening AMS systems.

2

Capacity Building and Knowledge Transfer

1.Support training and capacity development initiatives for healthcare professionals, veterinarians, laboratory personnel, and regulatory authorities.

2.Promote national, regional, and global collaboration for the exchange of expertise, knowledge, and experiences in AMS implementation.

3

Policy Development and Advocacy

1.Assist national governments in formulating evidence-based policies, strategies, and action plans aligned with international standards (e.g., FAO, WHO GLASS, WOAH).

2.Advocate for political commitment and multi-sectoral coordination on AMS and AMR under the One Health framework.

4

Surveillance System Strengthening

1.Support the development and enhancement of surveillance systems for AMU and AMR in human, animal, and environmental sectors according to international standards and guidance (Quadripartite guidance on One Health integrated surveillance of antimicrobial resistance and use)

2.Provide tools, protocols, and infrastructure to facilitate data collection, analysis, and reporting.

3.Share AMR, AMU data in global platforms (e.g., to FAO-InFARM, WHO-GLASS, & WOAH-ANIMUSE).

17. DEVELOPMENT PARTNERS (continued)

5 **Research and Innovation**

1.Fund and promote operational research, implementation science, and innovation in AMS, including alternative therapeutics, diagnostics, and behavior change interventions.

2.Support national research institutions in building capacity for AMR-related research and evidence generation.

6 **Monitoring, Evaluation, and Accountability**

1.Assist in the design and implementation of monitoring and evaluation (M&E) frameworks to assess progress and impact of AMS interventions.

2.Promote the use of standardized indicators and methodologies for tracking AMS outcomes across sectors.

7 **Stakeholder Coordination and Harmonization**

1.Facilitate coordination among government agencies, academia, civil society, and the private sector to ensure coherent AMS efforts.

2.Align support with national priorities and ensure harmonization with other donor programs to avoid duplication and maximize impact.

8 **Support for Community Engagement and Behavior Change**

1.Assist in the development of communication strategies and awareness campaigns to promote responsible AMU among the public, farmers, and animal owners.

2.Support behavior changes initiatives tailored to cultural, social, and economic contexts.

18. PROFESSIONAL ASSOCIATIONS

Professional associations for veterinarian's function as influential bodies in shaping the standards and practices of AMS. They serve as catalysts for education, research, and collaboration among animal healthcare professionals. They are instrumental in developing and disseminating evidence-based best practices, offering capacity-building programs, fostering continuous professional development, and promoting collaboration across the sectors. By uniting experts across diverse disciplines through organizing workshops, seminars, and conferences, these associations drive improvements in AMU and mitigating the threat of AMR. Their responsibilities encompass:

1. **Guideline Development and Standardization**
   1.Develop, update, and disseminate evidence-based clinical guidelines and protocols for antimicrobial prescribing and stewardship practices.
   2.Establish standardized metrics and quality indicators for AMU monitoring and evaluation.

2. **Education and Training**
   1.Design and implement advanced educational programs, continuing professional development modules, and certification courses focused on AMS.
   2.Facilitate training workshops and seminars to enhance the competency of veterinary professionals in the rational use of antimicrobials.

3. **Research and Innovation Support**
   1.Promote and fund research initiatives that explore innovative stewardship interventions, epidemiologic trends, and antimicrobial resistance patterns.
   2.Collaborate with academic institutions and research organizations to integrate innovative scientific findings into clinical practice.

18. PROFESSIONAL ASSOCIATIONS (continued)

6 **Interdisciplinary Collaboration and Networking**
1.Foster interdisciplinary collaboration among veterinary practitioners, microbiologists, pharmacists, epidemiologists and disease control experts, and veterinary public health officials to enhance stewardship programs.
2.Build strategic partnerships with governmental bodies, regulatory agencies, and international organizations (e.g., WOAH) and foster Public-Private-Partnership to align stewardship activities with global veterinary public health goals.

7 **Policy Advocacy and Regulatory Guidance**
Advise policymakers on regulations and funding mechanisms that support the implementation and sustainability of AMS initiatives. Advocate for policies that promote optimal antimicrobial prescribing practices and address AMR challenges at local, national, and global levels.

8 **Best Practices Dissemination**
Disseminate best practices and lessons learned through publications, conferences, and digital platforms to inform stakeholders and drive policy updates.

9 **Public Engagement and Awareness**
1.Develop and implement targeted communication strategies to educate the public on the importance of AMS and the risks associated with inappropriate AMU.
2.Engage media and community stakeholders to promote awareness campaigns that support behavioral change and community-level AMS initiatives.

REVIEW AND UPDATE MECHANISM

This guideline shall be subject to periodic review at intervals of three to five years or earlier as required. The review process shall involve relevant stakeholders including academic institutions, professional bodies, regulatory authorities, and field-level veterinary practitioners. Mechanisms shall be established to systematically collect and incorporate feedback from guideline users to ensure continued relevance, effectiveness, and compliance.

CONCLUSIONS AND STRATEGIC PRIORITIES

In conclusion, this veterinary antimicrobial stewardship (VAS) guideline offers a strategic and operationally feasible framework to strengthen the responsible use of antimicrobials within the national animal health sector. By outlining the distinct roles and responsibilities of veterinarians, livestock producers, regulatory agencies, academic and research institutions, and the pharmaceutical sector, the guideline promotes a unified and accountable approach to combating AMR. Its implementation aligns with national animal and public health priorities and reinforces the country's commitment to the One Health agenda. The guideline calls for sustained political will, investment in capacity and awareness building, and institutional coordination across all levels of government, academia, research institutes, and industry to ensure its effectiveness.

Furthermore, to effectively operationalize the VAS and combat antimicrobial resistance (AMR) within the livestock sector, the Department of Livestock Services (DLS) should take a leading role in coordinating and implementing the VAS within the national One Health framework, in alignment with the National Action Plan on AMR. The following key strategic priorities are proposed.

STRATEGIC PRIORITIES

Strategy 1: Establishing a VAS Wing for implementing AMS activities, and AMU-AMR monitoring

Creating a dedicated wing within the DLS for monitoring AMU, AMR, and implementing AMS programs will strengthen the national animal health response to limit AMR. This wing should focus on:

- Track antimicrobial prescriptions and usage patterns to detect any overuse or misuse of antimicrobials.
- Continuously collect and analyze resistance data across all levels of the veterinary sector, enabling timely interventions and updates to treatment guidelines.
- Enforce AMS guidelines through training, support, and regular evaluations, ensuring stakeholders adopt best practices in AMU.
- Formulate and update AMU and AMS related policies and guidelines.

Strategy 2: Implementing a comprehensive National Veterinary AMU Policy

A national veterinary AMU policy is essential for standardizing AMU across the country. The policy should include:

- Establish clear guidelines for the use of veterinary antimicrobials, particularly HPCIAs in animals.
- Mandate that a licensed veterinarian must prescribe all antimicrobials.
- Prohibit over-the-counter sales of antimicrobials to prevent misuse and self-medication.
- Enforce prescription-only access to veterinary antimicrobials.
- Restrict the use of antimicrobials for growth promotion in livestock, aligning with national and international standards.

STRATEGIC PRIORITIES

Strategy 3: Establishing and Strengthening Surveillance Systems for AMU and AMR in Livestock

Effective AMU and AMR surveillance is critical for understanding resistance trends and guiding policy decisions. A robust national surveillance system should be established to:

- Collect data on the quantity and type of antimicrobials used across sectors, providing insights into usage patterns.
- Analyze AMR data from animals to detect emerging threats early and develop targeted interventions.
- Use surveillance data to refine AMS guidelines and interventions, ensuring they remain effective and evidence-based.

Strategy 4: Implementing AMR Awareness and Behavior Change Programs for Relevant Stakeholders

Awareness is the foundation for tackling AMR effectively. Educating all stakeholders, including veterinarians, farmers, policymakers, and the public—is crucial. Stakeholder-specific programs should be designed, focusing on prudent use of antimicrobials and promoting the adoption of alternatives such as vaccination, improved biosecurity, and good farming practices.

Strategy 5: Strengthening Capacity

Strengthening the capacity of veterinary professionals, veterinary ara-veterinary professionals, field staff, and veterinary diagnostic laboratories through training and support on AMS principles, responsible prescribing, diagnostics, and infection prevention practices.

STRATEGIC PRIORITIES

Strategy 6: Promoting a One Health Approach for Integrated AMR Management

Adopting a One Health approach is crucial for addressing AMR comprehensively. It recognizes the interconnectedness of human, animal, and environmental health. Recommended actions include:

- Strengthen coordination and communication between human healthcare, veterinary services, and environmental agencies.
- Share AMR and AMU data across sectors to get a holistic view of resistance patterns and inform joint interventions.
- Conduct training and awareness programs for professionals across all sectors to foster a unified understanding of AMR risks and solutions.

Strategy 7: Mobilizing Resources and Fostering Partnerships

Mobilize dedicated resources through national budget allocations and build partnerships with development partners, academia, and the private sector to sustain AMS efforts.

Woman feeding cows in Gowainghat, Bangladesh / Lingkon Serao, Getty Images

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