



Federation of Asian
Veterinary Associations (FAVA)

FAVA Strategy to Tackle Antimicrobial Resistance (AMR) 2021-2025

**Empowering Veterinarians in Asia
Towards Fulfilling Their Roles on the
Global Action Plan on Antimicrobial
Resistance (GAP-AMR)**



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**“Empowering veterinarians in Asia towards fulfilling their
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(GAP-AMR)”**

Federation of Asian Veterinary Associations

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18 November 2021

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1. FOREWORD FROM FAVA PRESIDENT

Mitigating antimicrobial resistance (AMR) is an important undertaking to be addressed under the One Health approach, calling for all relevant disciplines and expertise to come together to jointly address this global health issue. It is an issue that transcends human health, animal health and the environment. Hence, it requires a holistic approach to overcome its challenges. On the global front, the Food and Agriculture Organization of the United Nations (FAO), World Organisation for Animal Health (WOAH), World Health Organization (WHO), and the United Nations Environment Programme (UNEP) have joined forces to tackle the problem.

In keeping a whole of society approach, the Federation of Asian Veterinary Associations (FAVA) with 24 national veterinary associations, two affiliates and one associate member, collaborated with the FAO Regional Office for Asia and Pacific (FAO RAP) and supported by the United States Agency for International Development (USAID), to work towards contributing to the global fight against AMR. With the theme “Empowering veterinarians in Asia towards fulfilling their roles on the Global Action Plan on Antimicrobial Resistance (GAP-AMR)”, one of the key outputs from this collaboration is the introduction of a FAVA Strategy to tackle AMR 2021-2025.

The FAVA Strategy to tackle AMR 2021-2025 will provide the necessary strategies, implementation plan, and monitoring and evaluation framework for the effective implementation of the stated goals. It is targeted to be used by veterinarians, veterinary associations and veterinary students, and also aims to create and foster an inspired and reinforcing environment for these veterinary stakeholders in the region. It provides the focus on how professionals can play their crucial part to help reduce the problem. The strategic objectives of the plan are aligned with the FAO Action Plan on AMR 2021-2025 with emphasis and focus on working with national veterinary associations and their members to combat AMR.

I am optimistic that with a clear plan in place, we would be able to produce improvements in reducing the threats of AMR. The continuous monitoring and evaluation of the implementation plan will provide us with valuable situational analyses which can then be used to further tweak and introduce additional measures and/or focus on measures that create the necessary impact.

The FAVA Strategy to tackle AMR 2021-2025 is a result of the valuable efforts of many members. First and foremost, FAVA would like to thank FAO-RAP for having confidence in us to undertake this collaboration, especially Dr Katinka de Balogh, Dr Kachen Wongsathapornchai and Dr Mary Joy Gordoncillo (who have diligently guided this collaboration) and not forgetting the assistance from Dr Rodolphe Mader and Dr Domingo Caro III. The FAVA Executive Board, which includes Dr Isao Kurauchi, Dr Heru Setijanto, Dr Bambang Pontjo Priosoeryanto, Dr Corazon Occidental and Dr Tin Ngwe, are also thanked for providing the direction. Special thanks to our FAO-FAVA AMR Coordinator, Dr Achariya Sailasuta, who is also the Director of the FAVA Bangkok Office for her excellent coordination and in ensuring all outputs are delivered as agreed with FAO-RAP. The FAVA Subcommittee on Pharmaceutical Stewardship is acknowledged and thanked for their inputs. Finally, I am very grateful and thank my colleagues from the drafting team made up of Dr Arifah Abdul Kadir and Dr Nur Indah Ahmad from Universiti Putra Malaysia and Dr Helen Mitin from the Department of Veterinary Services, Malaysia for working closely with me to produce this important document with a tight deadline. I also thank and appreciate the funding provided by USAID. Finally, we thank all the FAVA member associations for their undivided support, encouragement and assistance in this effort.

Dr Quaza Nizamuddin Bin Hassan Nizam
President FAVA 2020-2022

2. EXECUTIVE SUMMARY

There are still many challenges and shortcomings when implementing the National Action Plans on antimicrobial resistance (AMR) in the Asia-Oceania region. Recognizing this and foreseeing the potential contributions that veterinarians can make to move these plans forward, the Federation of Asian Veterinary Associations (FAVA) developed the FAVA Strategy to tackle AMR 2021-2025. This cohesive strategy will focus efforts on empowering veterinarians in Asia to support their respective national action plan implementation, and overall, to contribute to the One Health approach that the Global Action Plan on AMR is taking. Aligned with this overarching global plan, and the FAO Action Plan on AMR 2021-2025 which supports food and agriculture more specifically, the strategic objectives outlined in the FAVA Strategy to tackle AMR 2021-2025 consist of the following: (1) Increasing awareness and understanding of AMR and related risks among veterinarians, veterinary students, and veterinary associations; (2) contribute to regional and national efforts on surveillance and research on AMR, AMU and residues in animals; (3) advocating good practices in infection prevention and control; (4) promoting the responsible and prudent use of antimicrobials in animals (antimicrobial stewardship (AMS)); and (5) strengthening governance mechanisms and sustainability of efforts to regulate the use of antimicrobials in animals through the national veterinary associations. To monitor, evaluate, and continuously learn from its implementation, the strategy also outlines an implementation plan to enable a feedback mechanism for continued improvements over time. The FAVA Strategy to tackle AMR 2021-2025 serves as a tool to guide, encourage, and support public and private veterinarians in taking proactive roles to contribute to AMR mitigation in their countries, and in the broader region. It also outlines the planned actions by FAVA to help create a reinforcing environment for veterinary professionals and the national veterinary associations, as a collective regional contribution to the overarching Global Action Plan on AMR.

3. INTRODUCTION

In 2014, it was estimated that unless action is taken, the annual burden of human deaths from antimicrobial resistance (AMR) could reach 10 million by 2050¹. World Bank simulations for the optimistic case of low AMR impacts showed a fall of 1.1 percent in annual global gross domestic product (GDP) by 2050. The GDP shortfall would exceed USD 1 trillion annually after 2030. In the high AMR-impact scenario, there will be an annual shortfall of USD 3.4 trillion by 2030².

The Asia-Oceania region is home to two-thirds of the world's population and ten of the least developed countries. Asia is highly vulnerable to the threats of AMR because of the growing population and increasing demand for food from animal sources, which has been leading to the intensification of livestock production. This in turn has led to the increased use of antimicrobials.

The risk appears particularly high in countries where legislation, monitoring and surveillance systems for AMR and antimicrobial use (AMU), as well as infection prevention and control, are weak or inadequate (FAO, 2016).

The Quadripartite, composed of the Food and Agriculture Organization of the United Nations (FAO), United Nations Environment Programme (UNEP), World Health Organization (WHO) and World Organisation for Animal Health (WOAH, formerly OIE), aims to address AMR at the international level using a One Health approach. The Global Action Plan to combat AMR was initiated by WHO in 2015³. In line with this plan, WOAHA developed its Strategy on AMR and the Prudent Use of Antimicrobials in 2016 to support member countries to confront the global threats of AMR⁴. FAO developed the FAO Action Plan on AMR 2016-2020, which was then revised for 2021-2025⁵. These plans paved the way for the food and agriculture sector to adopt changes and take necessary steps to limit AMR.

In July 2021, WOAHA published its Fifth Annual Report on Antimicrobial Agents Intended for Use in Animals⁶. Based on antimicrobial sales data from 69 countries, the report showed a 34 percent decrease in use from 2015 to 2017. Despite limitations in the methods by which data were collected over time, which hamper proper comparisons between years, these data suggest a positive trend over time in terms of responsible use of antimicrobials in the animal health sector. Currently, the WOAHA is in the process of developing an interactive online system that will allow countries to access, review, analyse and utilise their national data while allowing the WOAHA to provide global data analyses to the public.

There has been ongoing progress but challenges remain to better understand AMU and the burden of AMR in livestock and aquaculture, which include the frequent absence of long-term funding

¹ https://amr-review.org/sites/default/files/160525_Final%20paper_with%20cover.pdf

² <https://documents1.worldbank.org/curated/en/455311493396671601/pdf/executive-summary.pdf>

³ <https://www.who.int/publications/i/item/9789241509763>

⁴ <https://www.oie.int/app/uploads/2021/03/en-oie-amrstrategy.pdf>

⁵ <https://www.fao.org/3/cb5545en/cb5545en.pdf>

⁶ <https://www.oie.int/app/uploads/2021/05/a-fifth-annual-report-amr.pdf>

commitments, difficulties in enforcing regulations and challenges for implementing monitoring systems for AMU, AMR and antimicrobial residues in most countries of the region.

Overall, there were weak areas that surfaced across National Action Plans (NAP) in South East Asia, including:

- Accountability - Many objectives were indicated but it was rare to detail implications of unmet objectives. Indicators (e.g. AMU) are required to measure whether goals set were achieved.
- Sustained engagement - Most NAPs were prepared, using a top-down approach. However, stakeholder participation with consistent community engagement is necessary for sustainable and effective policy implementation. An example from Thailand showed good participation with the government, private sector, and civil society from all 77 provinces involved in preparing the plan.
- Behavioural economics - Influencing human behaviour in antimicrobial stewardship is complex. It requires the incorporation of knowledge, attitude, practices, culture, psychology, and behavioural economics. Hence behavioural change campaigns have to be planned, implemented, evaluated and adjusted.
- Sustainability plans and transparency - Transparency and accountability of funding and resource allocation are important to monitor spending according to the defined objectives. There must be flexibility to determine incremental monitoring and evaluation targets.
- International collaboration - Nations need to collaborate to strengthen ongoing AMR work and draw lessons from country experiences. The establishment of international multi-stakeholder partnerships, working groups, and advocacy efforts are important for national and global action.
- Integration of the environmental sector - Integration of environmental issues with the rest of the plan is important. A One Health approach is an effective means of addressing AMR, but struggles of collaboration and promoting equal participation across domains, conflicts of interest of multiple collaborators, coordination, and inadequate monitoring and evaluation can deter the efficiency of such approaches.

Reports from some selected countries reveal the context and challenges faced by veterinarians on antimicrobial usage. For example, challenges faced in a country in South Asia included (i) drug legislation that did not adequately address the issue of veterinary drugs, including antimicrobials; (ii) lack of standard treatment guidelines; (iii) drugs, including antimicrobials, were easily accessible in the market without requiring a veterinary prescription; (iv) inadequate monitoring and quality assurance of marketed drugs; (v) irrational self-administration or prescription of antimicrobials with limited laboratory aid; (vi) use of antimicrobials as non-therapeutic drugs in animals; (vii) withdrawal times not given due attention; and (viii) surveillance activities on sales and use of antimicrobials in animals still being in their initial stage.

Similarly, one of the countries in South East Asia reported that there is no requirement for large companies to share information on AMR. Antimicrobial consumption data is also lacking although there is legal provision. In farm settings, the prescribing and dispensing of antimicrobials for animals are neither legally regulated nor their use legally audited. Most antimicrobials are widely available in pharmacies without a prescription.

The legal framework and provisions on AMR in a country in Central Asia was reported to face challenges with the paucity of data on AMR from both the human side as well as from the veterinary/agricultural sector. The NAP-AMR in this country that was developed in 2018 did not clearly state the involvement and responsibility of farmers and the private sector, especially the pharmaceutical companies.

Some of the issues which are highlighted and often discussed revolve around the irrational use of antimicrobials, lack of awareness of antimicrobial stewardship principles, weak infection prevention and control mechanisms in place, unregulated access to antimicrobials, self-medication/prescribing, and poor-quality counterfeit drugs in the market.

There are still many areas of concern and gaps at both the planning and implementation levels in combating AMR. Professional veterinary organisations can help complement efforts being established and implemented by intergovernmental organizations and national and local governments.

Hence FAO has collaborated with the Federation of Asian Veterinary Associations (FAVA), which is a regional organization whose membership is composed of different professional veterinary associations across Asia and Oceania, to address AMR in veterinary medicine. FAVA embarked on this journey with FAO in 2020, and in 2021, these efforts were underscored in the FAO-FAVA collaboration theme **“Empowering veterinarians in Asia towards fulfilling their roles on the Global Action Plan on AMR (GAP-AMR)”** - which included the development of the FAVA Strategy to tackle AMR 2021-2025.

4. VISION

FAVA members will strive to ensure that antimicrobials are used responsibly, prudently and appropriately across all segments of animal health care.

5. MISSION

FAVA is committed to implementing programs and activities to reduce AMR in the animal sector, which are expected to positively impact humans, animals and the environment in the Asia-Oceania region

6. GOALS

FAVA Strategy to tackle AMR 2021-2025 has been formulated with three goals:

- i) Reduce the risks for the emergence and spread of AMR, while animal health, production and welfare are continuously reinforced;
- ii) Improve the practice of veterinary medicine and promote its national, regional and global relevance; and
- iii) Enhance the quality of people’s lives in the Asia-Oceania region.

These goals will be achieved through five (5) strategic objectives:

1. Increase awareness and understanding of AMR and related risks among veterinarians, veterinary students, and veterinary associations;
2. Contribute to regional and national efforts on surveillance and research on AMR, AMU and residues in animals;
3. Advocate good practices in infection prevention and control;
4. Promote the responsible and prudent use of antimicrobials (antimicrobial stewardship (AMS)); and
5. Strengthen governance mechanisms and sustainability of efforts to regulate the use of antimicrobials in animals through the national veterinary associations.

The FAVA Strategy to tackle AMR 2021-2025 targets veterinarians, national veterinary associations, and veterinary students and is aligned with the strategic objectives of FAO Action Plan on AMR 2021-2025.

7. STRATEGIC OBJECTIVES

7.1 Increasing awareness and understanding of AMR and related risks among veterinarians, veterinary students, and veterinary associations

The lack of appreciation of the relevance and implications of AMR among the public and animal health sectors especially among veterinarians and veterinary students may most likely stem from the lack of or insufficient training and exposure on the topic during pre-service and in-service years. This, in turn, may reduce compliance among veterinarians to commit to better AMU and becomes another barrier in fighting AMR. This strategic objective aims to increase awareness and enhance understanding of AMR among future and current veterinarians through the implementation of training activities tailored to the target group of interest.

7.1.1 Targeted campaigns to promote awareness and understanding of AMR risks and responses in different groups of audiences namely; veterinarians, veterinary students and veterinary associations

Lack of awareness and insufficient knowledge among veterinarians on the basic mechanisms and risk factors related to drug resistance can further exacerbate AMR in animals, which can spread to humans and the environment. Without a proper level of knowledge on the consequences of inappropriate prescribing practices and global health implications of AMR, it is difficult to initiate behaviour change among veterinarians.

7.1.2 Training and continuing professional education on antimicrobial stewardship and AMR in the veterinary & farming sector

Incorporation of AMR-related topics during formal training of veterinary students will most likely result in a better understanding and appreciation of rational use to

preserve the effectiveness of antimicrobials thereby avoiding the 'silent pandemic' of AMR from happening.

On the other hand, veterinarians working in public health and pharmaceutical sectors-across government agencies, universities and private companies should be reminded frequently of the risks of AMR and related issues as it is an important health concern with great emphasis at a global level. Another important aspect is the continuous mentoring process which needs to be in place so that experienced veterinarians can guide young veterinarians in ensuring proper diagnosis and treatment.

FAVA through its members can help to support and organise activities that would empower future and current veterinarians with knowledge of the risks and consequences of AMR and how they can help in mitigating the issue. Implementation of the activities shall attempt to include as many veterinarians as possible across government and private sectors encompassing but not limited to livestock, aquatic and companion animals.

7.1.3 Promoting investments for AMR activities such as continuous awareness campaigns, training sessions, and seminars on how to combat AMR

Continuous dissemination of messages on AMR through appropriate medium and platform that suits and complements the hectic schedule of veterinarians will help elevate interest and participation. This may also encourage them to be more aware of the current situation of AMR around the globe and support national policy and international guidelines and standards from the FAO and WOA. H.

7.2 Contribute to regional and national efforts on surveillance and research on AMR, AMU and residues in animals

Collecting and generating data of good quality from surveillance and research activities is vital to understanding the extent and association of AMU and AMR in the animal health sector. This strategic objective aims to guide FAVA members to encourage and support veterinarians to participate and apply best practices when diagnosing and prescribing antimicrobial drugs to their patients. Collaboration across different sectors and encouraging partnerships with the industry to improve the quality of data and diagnostic techniques will be beneficial to enhance AMR and AMU surveillance. In addition, to carrying out research activities on new antimicrobials and its alternatives. Outputs from activities of this objective will contribute to guiding policy makers in drafting, enhancing, and implementing policies driven by data and scientific evidence.

7.2.1 Create a reinforcing environment for routine field and laboratory diagnosis, including antimicrobial susceptibility testing (AST) of (terrestrial and aquatic) animal pathogens

Veterinarians are often presented with cases of sick animals requiring treatment, and thus often have access to samples for testing, including antimicrobial susceptibility

testing (AST). It is therefore vital to create a reinforcing environment for field and routine laboratory diagnosis and AST to support veterinarians in effectively carrying out their roles and enhance opportunities for continued improvement of capacities in animal disease diagnosis. This creates opportunities to not only contribute to the national AMR surveillance, particularly for animal pathogens but also in the development of evidence-based treatment guidelines that can help in the practice of veterinary medicine.

This can include creating systems that sustainably support veterinary field and laboratory diagnosis, including antimicrobial susceptibility testing. This can include advanced trainings, improving access to diagnostic laboratories, and introducing innovative solutions to address current gaps in the system.

7.2.2 Strengthen quality and harmonization of AMR laboratories

Efforts need to be taken to improve adherence to standard methods of AMR detection, harmonization of Antimicrobial Susceptibility Testing (examples of internationally accepted standards are from Clinical and Laboratory Standards Institute (CLSI) and European Committee on Antimicrobial Susceptibility Testing (EUCAST)) and facilities in AMR laboratories for generating high-quality data on AMR through surveillance and monitoring implemented by NAP in FAVA member countries.

The use of available international guidelines and protocols (such as relevant WOH Standards and Codex Alimentarius documents) are highly recommended for surveillance and monitoring programmes. For a more pragmatic approach, the use of the series of regional guidelines for monitoring and surveillance of antimicrobial resistance, use and residues, which are anchored on these international standards as applied in field settings, is also highly encouraged. This includes guidelines on AMR monitoring and surveillance in bacteria from healthy food animals (Guideline Vol. 1), in bacterial pathogens from diseased livestock (Guideline Vol. 2), in bacterial pathogens from diseased aquatic animals (Guideline Vol. 3), and in bacteria from the animal environment (Guideline Vol. 4). There are also existing regional guidelines for monitoring AMU at the farm level (Guideline Vol. 5) and monitoring and surveillance of antimicrobial residues (Guideline Vol. 6)⁷.

7.2.3 Raise awareness on proper AMU data recording and record-keeping which can contribute to national and global efforts in AMU monitoring

Record keeping of antimicrobials sold by the pharmaceutical companies, prescribed by veterinary professionals and administered in veterinary clinics and livestock farms is a good practice. Good record-keeping and data recording systems with traceability should be practiced to detect unnecessary or inappropriate AMU. Every stakeholder

⁷ <https://www.fao.org/antimicrobial-resistance/projects/ongoing/project-3/en/>

has the responsibility to record data either manually or with a digital tool, which would be beneficial to the national regulatory authorities involved in AMU monitoring.

7.2.4 Strengthen collaborative research, development and drug discovery

Research is required to identify the best approaches and techniques to achieve the strategic objectives. At present, limited coordination of research projects has led to gaps in our understanding. Collaborative research with relevant partners, including industry partners, would further improve the understanding of resistant organisms; how resistance develops and spreads between animals and humans.

Many of the treatments are undertaken using existing knowledge and experience, and referring to literature on specific antimicrobials. Additional tools to improve the decision-making skills in using the right antimicrobials will be useful. There is a need to promote evidence-based approaches to treatments used for common animal diseases. Better decision making to select the appropriate antimicrobials will be very important and useful. It is envisaged that the feedback from veterinarians on the antimicrobials used for treating common diseases in their countries will be useful for analysis and advice.

The introduction of new antimicrobials has been slow to non-existent because pharmaceutical companies are reluctant to invest money required for the research and development needed for this purpose. This is evident, especially in companion animal medicine where the market size is small and not attractive for research on new antimicrobials.

FAVA can facilitate and encourage participation from research institutes/academic institutions, pharmaceutical and biotechnology companies and funding bodies (government/private entities) that aims to develop rapid diagnostic methods that can be applied at the farm/clinic level to help veterinarians determine suitable panel of antimicrobial drugs to be used for specific cases and on-site.

7.2.5 Use of alternatives to antimicrobials

Some examples of the alternatives to antimicrobials listed here may have the potential to decrease the need for AMU and should be considered by veterinarians in their practice:

- i. Organic acids and their salts
- ii. Phytogenic additives
- iii. Prebiotics, probiotics and direct-fed microbial
- iv. Enzymes
- v. Combinations of two or more alternative feed ingredients or combinations of a new feed supplement.

However, there should be evidence-based decisions to use these products keeping in mind the cost, availability, the desired outcome for better performance and the possible emergence of unwanted consequences.

7.3 Advocate good practices in infection prevention and control

The main objective of advocating good practices in infection and control is to reduce the need for AMU in animals, especially in the livestock and aquaculture industries. The development and implementation of good practices with prudent and responsible use of antibiotics to treat infections need to be considered in addressing AMR. The strategic plan for the herd health program and animal management should also consider the disease status including social and economic considerations in each FAVA member country. The important target areas in advocating good practices in infection prevention and control are as follow:

7.3.1 Strengthen educational herd health program and animal management program

FAVA will advocate among veterinary and animal health professionals the importance of proper herd health programs and animal/livestock management for the prevention of diseases and illnesses to reduce AMU. Proper herd health programs and good animal husbandry are important as healthy animals do not need antimicrobials. Veterinary professionals should be able to customize herd health programs including vaccination programmes, proper nutrition and animal management to suit their clients' needs and requirements.

7.3.2 Promote proper biosecurity and hygiene

Proper biosecurity measures, which include proper hygiene, sanitation program and procedure for disease prevention and control measures, should be promoted and strengthened. The provision of clean water and the use of good quality disinfectants to reduce infections in the food and agriculture sectors will result in minimizing the use of antimicrobials. The animal environment and the broader ecosystem should not be compromised and hence the need to use standards published by WOAHP and the Code of Practice to minimize and contain foodborne AMR by FAO/WHO Codex Alimentarius as references.

7.4 Promoting responsible and prudent use of veterinary antimicrobials (antimicrobial stewardship (AMS))

Antimicrobials are essential for the treatment and control of the spread of bacterial diseases, but every use increases the risk of selection for resistant bacteria. Currently, antimicrobials are used for different indications such as growth promotion, prevention, control, and treatment of bacterial diseases. FAVA supports country efforts to eliminate AMU for growth promotion and decrease AMU for disease prevention while maintaining animal health, welfare, and productivity. Countries could use additional risk management measures for highest priority critically important antimicrobials as described in the *WHO List of Critically Important Antimicrobials for Human Medicine*, or national lists, where available, including restrictions proportionate to risk and supported by scientific evidence. In addition, it is also the responsibility of the veterinarian to prescribe only after performing a disease diagnosis (which may also be done by an appropriately trained animal caretaker) to ensure that medicines are used appropriately.

7.4.1 Advocate responsible and prudent use of antimicrobials to minimize the potentially harmful effects on human health while ensuring safety and efficacy in livestock and companion animals

Responsible and prudent use of antimicrobials optimizes therapeutic effects while minimizing the risk of selection for resistant bacteria. As such, veterinarians must remain up-to-date regarding AMR patterns in their region and the principles of responsible and prudent use of antimicrobials. This can be done through both initial veterinary education and continual professional development after graduation. Veterinarians must also take steps to implement these principles in their practices. In addition, veterinarians must be prepared to educate their clients on the appropriate use of antimicrobials in animals and the risks of AMR for animals, humans, and the environment.

7.4.2 Promote appropriate antimicrobial prescribing, dispensing and administering

Only licensed veterinarians should prescribe drugs after making an accurate diagnosis (or diagnosis made by trained animal caretakers) and when it is necessary. Educating or equipping veterinarians with the skills necessary to accurately diagnose and treat illnesses in animals is of vital importance. Usually, based on clinical skills, results of necessary testing, and vast experience, veterinarians can make a good diagnosis. Ideally, samples are collected and sent to a diagnostic laboratory whenever possible for bacterial isolation and identification, and antimicrobial susceptibility testing before the start of treatment. Appropriate species-specific antimicrobial guidelines and recommendations of the country should be used.

7.4.3 Promote proper disposal of expired or unused antimicrobials in veterinary farms and clinics to minimize environmental exposure

Veterinary pharmaceutical drugs, including antimicrobials, offer many benefits in protecting the health and welfare of animals, but they can also pose risks to both environment and public health. The continuous flow of medication into the environment is a major One Health concern. For example, medication disposal protocols may include return of unused products to the pharmaceutical company with prior agreement before purchasing or registering with Biohazard Companies for regular disposal based on the accumulated amount on the farm or in the clinic. Directed efforts to raise awareness of proper disposal of animal medications among veterinarians and their clients and providing instructions on appropriate drug disposal protocols should be implemented.

7.4.4 Advocate the proper sales of antimicrobials to reduce inappropriate usage

Farm and pet owners are increasingly using the internet not only to access health information but also to obtain medication. Currently, the sale of antimicrobials via online stores or shopping websites without a veterinarian's prescription encourages self-medication and low quality of care. Self-administration of antimicrobials occurs in many countries and it is a problem for the veterinary profession. The use of

antimicrobials without a prescription is due to the lack of regulations restricting the sales of antimicrobials or failure to enforce the regulations. Therefore, proper regulation and enforcement of existing regulations, plus client education by veterinary practitioners may help in controlling this potentially vast source of antimicrobials. Additionally, veterinarians are strictly encouraged to purchase antimicrobials from legal sources.

7.4.5 Strengthen knowledge on responsible and prudent AMU guidelines

When selecting therapy for farm and companion animals, veterinarians need to follow treatment guidelines. The highest priority critically important antimicrobials as listed by WHO⁸ should not be used as much as possible. Veterinarians working in pharmaceutical industries should also ensure antimicrobials are used responsibly by limiting the advertising of antimicrobials, especially those critically important for public health. The pharmaceutical industries also have to make certain that there is a continuous supply of antibiotics for veterinary practices.

7.5 Strengthen governance mechanisms and sustainability of efforts to regulate the use of antimicrobials in animals through the national veterinary associations

The establishment of a governance framework/mechanism in National Action Plans (NAP) on AMR, is important. The three suggested governance framework are policy design, implementation mechanisms, and monitoring and evaluation^{9,10}.

At the policy design level, there is a need to have a strategic vision to combat AMR through situational analyses on the prevalence and incidence of AMR organisms in the country. There should be multi-sectoral and multi-disciplinary coordination and collaborations working together and cohesively. Participation from different stakeholders is important so that effective planning and implementation can be undertaken. Accountability requires a need to define clearly who is responsible for the various plans and the reporting mechanism. Transparency involves the availability of the plan, progress report, funding information, surveillance data and key issues and challenges and how all these will be addressed for scrutiny. NAPs over time will face sustainability issues. The commitment from all stakeholders to deliver is crucial. Supports from advisory groups are also necessary for sustaining the plan.

The implementation mechanism has been well described in this strategy which involve awareness and education, surveillance and research, infection prevention and control and AMS.

While the monitoring and evaluation of the NAPs by member associations can be useful to further strengthen it to tackle AMR.

⁸ <https://apps.who.int/iris/bitstream/handle/10665/312266/9789241515528-eng.pdf>

⁹ [https://doi.org/10.1016/S1473-3099\(19\)30415-3](https://doi.org/10.1016/S1473-3099(19)30415-3)

¹⁰ <https://doi.org/10.1016/j.lanwpc.2020.100084>

7.5.1 Contribute to the development of evidence-based policies, strategies and their implementation as well as in improving regulatory framework and enforcement

It is important to prepare policies so that clear directions can be set to assist in the formulation of the NAPs. Policies require inputs from various stakeholders to ensure both a top-down and bottom-up approach are incorporated. The policies must be accepted by all levels including associations.

A strong regulatory framework will have to address the various shortfalls in compliance, which the associations can suggest, and set in place the implication of not conforming to the set regulations. This will act as a deterrent for the abuse and misuse of antimicrobials.

7.5.2 Provide veterinary contributions and support to the development and implementation of the multi-sectoral and multi-disciplinary National Action Plan on AMR

It is important that veterinarians are made aware of their countries' national action plan on AMR, and have an understanding of their critical roles and responsibilities in its implementation. Coordination between sectors and across different levels of each sector using One Health is recommended. Veterinarians and veterinary associations can play a strong part in the success of the NAP-AMR, with their active involvement and representation in different working groups to enhance such coordination.

7.5.3 Monitoring and evaluation

7.5.3.1 Reporting

The publication of NAPs progress reports is necessary, as is the publication of annual surveillance reports. The collaboration among national veterinary authorities to share the information with associations is also important.

7.5.3.2 Feedback mechanisms

It will be necessary to provide feedback on the data collected and analysed by the national veterinary authorities to suggest adjustments accordingly.

7.5.3.3 Effectiveness

The associations should request an evaluation on the effectiveness of the policies and interventions introduced, which should include the cost-effectiveness of the various programs that have been instituted.

7.5.4 Promote international cooperation through leadership of FAVA

FAVA, an association made of 24 member countries in the Asia Pacific region, will be able to play a crucial role in collaboration with FAO to work with veterinarians across this region to raise veterinarians' ability to help alleviate the issues concerning AMR.

The leadership of FAVA, through their various efforts in carrying out programs and activities, can reach out to many more veterinarians who are actively involved in the different disciplines of veterinary work. Veterinarians play a crucial role in helping to address the problems associated with AMR.

8. FRAMEWORK FOR ACTION

Strategies	ACTIVITIES	ACTIONS BY				
		FAVA	National Vet Associations	Veterinarians	Additional FAVA partners	
Strategic Objective 1: Increasing awareness and understanding of AMR and its related risks among veterinarians, veterinary students and veterinary associations						
1.1 Targeted campaigns to promote awareness and understanding of AMR risks and encourage responses from different groups of audiences namely; veterinarians, veterinary students and veterinary associations	Organise educational and awareness activities on AMR targeting the current veterinary workforce across government and private sectors.		✓		Universities	
	Engage veterinary students and work closely with veterinary lecturers through student engagement activities at the local and regional level through the FAVA network.		✓			
	Competition among veterinary students can be organised to produce communication tools to disseminate the message about AMR targeted at their peers in the form of but not limited to posters, cartoons, essays, artwork and creative social media posts using various available online platforms			✓		
	Publicise the celebration of the World Antimicrobial Awareness Week at the global level annually to veterinary associations and veterinary schools/faculties. FAVA to share talks and other programmes organised by the FAO, WOAAH, WHO and UNEP to commemorate WAAW. Winners from students' competitions can be announced during WAAW to boost participation and publicity, which can then be followed by talks from experts from Quadripartite agencies on AMR.	✓	✓	✓	FAO OIE WHO	
	Share links with veterinary associations to readily available educational materials about AMR from the FAO, WHO, WOAAH and UNEP websites. At the national level, FAVA can encourage veterinary associations to spread the awareness on NAP and updated guidelines on AMR to their respective members.	✓	✓			
1.2 Trainings and professional education on antimicrobial stewardship and AMR in the veterinary & farming sector	Engage with and encourage local veterinary associations to conduct AMR training programmes as part of the Continuing Professional Development (CPD) to enhance knowledge and encourage behaviour change among veterinarians. It is suggested that the contents for the CPD activity should include topics like the implementation of National Action Plans and on legislations.		✓	✓		
	Training can also include sharing session and mentoring programmes from experienced practitioners on practical ways that can be applied by the less experienced/newer generation of veterinarians to implement good practices related to curbing AMR in their daily work activities.	✓	✓	✓		
1.3 Promoting investments for AMR activities such as continuous	Appoint veterinarians in practice who become good advocators for AMR to their peers and clients/appoint an 'ambassador' who can either be a respected or prominent veterinary figure at national level or a veterinarian recognised to have good experience and attitude towards judicious use of antimicrobials and advocate about AMR to their		✓			

Strategies	ACTIVITIES	ACTIONS BY			
		FAVA	National Vet Associations	Veterinarians	Additional FAVA partners
awareness campaigns, training sessions and seminars on how to combat AMR	peers.				
	Share communication tools and guidelines for client education about AMR available from FAO, WOA, WHO and UNEP websites with veterinarians to help them empower farmers, clients and other relevant stakeholders in relevant sectors including pharmaceutical companies about AMR and responsible AMU, good animal husbandry practices and biosecurity measures.		✓		
	Organise dialogue session among different stakeholders from the animal health sector to discuss on the current challenges faced in the livestock, aquatic and small animal/pharmaceutical sectors. This can be done through the involvement of national veterinary authority, livestock/aquatic farmer and small animal practitioners associations & pharmaceutical companies.	✓	✓		
Strategic Objective 2: Contribute to regional and national efforts on surveillance and research on AMR, AMU and residues in animals					
2.1 Create a reinforcing environment for routine field and laboratory diagnosis including antimicrobial susceptibility testing of animal pathogens	Veterinarians will be encouraged to take samples to send to laboratories for antimicrobial susceptibility testing. The results of the samples tested apart from using it to improve treatment regime, will also be shared with the national veterinary authorities for national AMR surveillance. It will also assist in the development of an evidence-based treatment guidelines		✓	✓	National veterinary authorities
	Advanced trainings on field diagnosis and laboratory diagnosis including antimicrobial sensitivity testing			✓	FAO
2.2 Strengthen quality and standardization of AMR laboratories	FAVA through national veterinary associations can promote to harmonise methods of AMR detection and facilities in AMR laboratories in collaboration with FAO and/or WOA	✓	✓		FAO
	Promote the use of international standards and guidelines and protocols for surveillance and monitoring programmes (e.g., FAO/WHO Codex Alimentarius Standards, WOA standards and guidelines, Clinical Laboratory Standards Institute for Veterinary AST)	✓	✓	✓	FAO
2.3 Raise awareness on proper AMU data recording and record-keeping which can contribute to	Veterinarians need to familiarise themselves with existing format to record and keep data on AMU use as per the national veterinary authority's requirement. If none are available then national veterinary associations can help suggest the format in consultation with FAVA.	✓	✓	✓	National veterinary authorities
	Organize continuous awareness and road shows for all the relevant stakeholders as a constant reminder on the importance of having proper antimicrobials sale and purchase record, prescription book and AMU book or digital record.		✓		

Strategies	ACTIVITIES	ACTIONS BY			
		FAVA	National Vet Associations	Veterinarians	Additional FAVA partners
national and global efforts in AMU monitoring					
2.4 Strengthen collaborative research, development and drug discovery	Foster public-private partnerships through development and promotion of a regional AMR research agenda from industry perspective.	✓	✓		FAO Industry/relevant associations
	FAVA can leverage on its broad network of veterinarians to complement regional efforts (through surveys) to identify priority bacterial pathogens in the Asia-Oceania region, and contribute towards risk-based actions to manage the identified priorities.	✓	✓	✓	FAO
	Create an economically sustainable mechanism that takes into account the needs of FAVA member countries. To promote research and development of new antimicrobials, vaccines, diagnostic reagents, etc., FAVA will play a coordinating role in establishing a system in which veterinary medical associations, the veterinary drug industry, universities, public research institutes, and national approval review bodies can collaborate and cooperate.	✓	✓		<ul style="list-style-type: none"> • Universities • Pharmaceutical companies
	Propose to establish a system for the early commercialization of effective antimicrobials, vaccines, and diagnostic reagents developed by countries involved in the "International Cooperation on Harmonization of Technical Requirements for Registration of Veterinary Medicinal Products (VICH)" to combat antimicrobial resistant bacteria	✓	✓		
	A system should be established to minimize the number of materials required for application for approval (e.g., safety studies using target animals, dose-determination studies, etc.) and to supply them quickly without incurring expenses for drugs used in humans which are widely used in clinical practice for companion animals.	✓	✓		
2.5 Use of alternatives to antimicrobials	FAVA will request to work with FAO in suggesting a guideline on the use of alternatives to antimicrobials	✓			FAO
	Organise seminar/webinar on research findings and usage of alternatives to antimicrobials.	✓	✓		
Strategic Objective 3: Advocate good practices in infection prevention and control					
3.1 Strengthen	Promote guideline for herd health program and animal management program such as	✓	✓	✓	FAO

Strategies	ACTIVITIES	ACTIONS BY			
		FAVA	National Vet Associations	Veterinarians	Additional FAVA partners
educational herd health program and animal management program	“Guide to Good Farming Practices for Animal Production Food Safety (2010) by WOA and FAO”.				
	Organize online workshop, webinar, road shows and conferences on herd health program and animal management that promote good practices on infection prevention and control.	✓	✓		FAO
	Publish the list of registered vaccines/antimicrobials at national veterinary association’s website for quick reference for veterinarians		✓		
3.2 Promote proper biosecurity and hygiene	Provide options for acceptable house design for the small size farmers with proper water source, irrigation system and ventilation systems by having the house design competition for small size farmers among the members’ country.	✓	✓ Standing	✓	<ul style="list-style-type: none"> • FAO • Farmers • Farmer’s association
	Promote agriculture waste management that would protect the environment and mitigate the spread of AMR in the environment including wastewater, manure and bio solids and sustainable soil and land management practices (Jose Martinez et al. 2009) and “OIE Aquatic Animal Health Code Chapter 4.7. Handling, disposal and treatment of aquatic animal waste”.	✓	✓	✓	
	Publish the list of approved sanitation agents for farm or veterinary clinics at national veterinary association’s website for quick reference for veterinarians.	✓	✓	✓	
Strategic Objective 4: Promote responsible and prudent use of veterinary antimicrobials (antimicrobial stewardship(AMS))					
4.1 Advocate responsible and prudent use of antimicrobials to minimize the potential harmful effects to human health while ensuring safety and efficacy in livestock and companion	Establish FAVA Subcommittee on antimicrobial stewardship (AMS) to enable the members to communicate and work together for the implementation of activities on the responsible and prudent use of antimicrobials at the regional level.	✓	✓	✓	FAO
	Collaborate with FAO to organize educational webinar and workshops. The expert FAO members are invited to share their experiences and deliver talk on the judicious use of antimicrobials.	✓	✓		FAO
	Promote culture and susceptibility testing prior to initiating therapy with antimicrobial drugs and de-escalation based on susceptibility results.			✓	FAO

Strategies	ACTIVITIES	ACTIONS BY			
		FAVA	National Vet Associations	Veterinarians	Additional FAVA partners
animals					
4.2 Promote appropriate antimicrobial prescribing, dispensing and administering	Senior veterinarians assist in monitoring recent graduates or new team members when prescribing, dispensing and administering antimicrobials in clinics/farms.		✓	✓	
	Advocate veterinarians on the appropriate use of antimicrobials based on treatment guideline books, educational materials and international standards through seminars, workshops and veterinary association websites.		✓	✓	
4.3 Promote proper disposal of expired or unused antimicrobials in veterinary farms and clinics to minimise environmental exposure	Promote the proper record-keeping of the unused or expired drugs. These drugs could be returned to the pharmaceutical company with prior agreement during purchasing.	✓	✓	✓	National veterinary authorities
	Utilise Biohazard Companies for regular disposal based on the accumulated amount in the farm or clinic. At the moment, some veterinarians are still not aware of the appropriate disposal of unused or expired drugs. Proper method of antimicrobial disposal would reduce the AMR risk to both environment and public health.			✓	✓
4.4 Advocate the proper sales of antimicrobials to reduce inappropriate usage	Organise awareness and road shows programme for all the relevant stakeholders (veterinarians, veterinary pharmacists, clients) on the laws and regulation of sales of drugs.		✓		National veterinary authorities
	Veterinarians are to lodge reports on the activities of irresponsible vendors dispensing antimicrobials via the internet to the regulatory authorities through the veterinary association.		✓	✓	
	Continuous Client Education programmes directed to clients and community on the practices that are considered an appropriate standard care for animals. Antimicrobials procured online may be substandard, counterfeit, adulterated and unapproved products. Antimicrobials sold without a valid prescription and proper diagnosis of a bacterial disease by a veterinarian will result in the inappropriate use of these drugs.			✓	✓
4.5 Strengthen knowledge on responsible and	Utilise seminars and webinars to disseminate information on critically-important antibiotics for human or veterinary medicine.	✓	✓		

Strategies	ACTIVITIES	ACTIONS BY			
		FAVA	National Vet Associations	Veterinarians	Additional FAVA partners
prudent AMU guidelines	Share links with FAVA member countries' veterinary association on educational materials and updated guidelines regarding prudent use of antimicrobials to influence veterinarians, farmers, clients and other relevant stakeholders.	✓	✓	✓	

Strategies	ACTIVITIES	ACTIONS BY			
		FAVA	National Vet Associations	Veterinarians	Additional FAVA partners
Strategic Objective 5: Strengthen governance mechanisms and sustainability of efforts to regulate the use of antimicrobials in animals through the national veterinary associations					
5.1 Contribute to the development of evidence-based policies, strategies and their implementation and improving regulatory framework and enforcement	FAVA will work with national veterinary associations in their respective countries to play a proactive role in the fight against AMR. The associations will need to identify key areas veterinarians from these associations can commit to helping propose in the national action plan against AMR. The guidance from other national veterinary associations and FAVA can be sought.	✓	✓	✓	FAO
	The national veterinary associations will be encouraged to identify the gaps in the current regulatory framework and undertake to suggest better regulatory framework tapping from experiences in the region and as well as from FAVA.		✓		
	Veterinarians can assist the enforcement agencies in enforcing the law and regulations governing AMR. Often some agents and middlemen sell these antimicrobials directly for use by farmers. The veterinary profession must take note of these problems and report such incidences or activities to the regulatory authorities through the association.		✓	✓	
5.2 Provide veterinary contributions and support to the development and implementation of the multi-sectoral and multi-disciplinary National Action Plan on AMR	FAVA in collaboration with FAO can support national veterinary associations on priority areas for research, capacity building as well as technical assistance on AMR	✓	✓		FAO
	FAVA through FAO can assist national veterinary associations to use the tools developed for the implementation of the National Action Plans	✓	✓		FAO

Strategies	ACTIVITIES	ACTIONS BY			
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5.3 Monitoring and evaluation	The national veterinary associations must request from the national veterinary authority to furnish reports on the progress of the national action plan and the surveillance on AMR.		✓		National veterinary authorities
	The analyses of the report and the suggestions for further improvement can be done by the national veterinary authorities with inputs from the association.		✓		National veterinary authorities
5.4 Promote international cooperation through leadership of FAVA	FAVA has established the FAVA Strategy to tackle AMR 2021-2025 which will be the document to assist member associations in various countries in proposing improved strategies to be adapted and adopted at the national level.	✓	✓		FAO
	To further strengthen the work on AMR, the AMS platform will be established, and related activities will be implemented	✓	✓		FAO
	Other areas will include utilising technical training and seminars for AMR inspection personnel from countries in the Asian region conducted by the WOAHA Collaborating Center in the field of “Diagnosis and Control of Animal Diseases and Related Veterinary Product Assessment in Asia” (Japanese National Veterinary Assay Laboratory). Training Program for Asian Veterinarians: TP-FAVII (JVMA) will be utilised to provide technical training.	✓	✓	✓	WOAH

9. MONITORING AND EVALUATION (M&E)

Monitoring and evaluation (M & E) framework will be integral to the FAVA Strategy to tackle AMR 2021-2025 and it is in the process of being developed. Once ready it will be presented to member associations and to FAO-RAP for inputs before being finalised and adopted. This will allow FAVA and FAO-RAP to track progress and performance towards achieving set goals and objectives.

10. REFERENCES

1. Anderson, M., Schulze, K., Cassini, A., Plachouras, D., Mossialos, E. (2019). A governance framework for development and assessment of national action plans on antimicrobial resistance. *Lancet Infect Dis*, 19: e371–84. [https://doi.org/10.1016/S1473-3099\(19\)30415-3](https://doi.org/10.1016/S1473-3099(19)30415-3)
2. Chua, A.Q., Verma, M., Hsu, L.Y., Helena Legido-Quigley, H. (2021). An analysis of national action plans on antimicrobial resistance in Southeast Asia using a governance framework approach. *The Lancet Regional Health - Western Pacific*, 7, 1-22. <https://doi.org/10.1016/j.lanwpc.2020.100084>
3. Codex Alimentarius. Code of Practice to Minimize and Contain Antimicrobial Resistance, FAO and WHO, 2015. <https://www.fao.org/fao-who-codexalimentarius/thematic-areas/antimicrobial-resistance/en/>
4. Codex Alimentarius. Principles and guidelines for the conduct of microbiological risk assessment (CAC/GL 30-1999). Adopted 1999, Amendments 2012, 2014. <https://www.fao.org/fao-who-codexalimentarius>
5. Esabelle Lo Yan Yam et al (2019). Antimicrobial Resistance in the Asia Pacific region: a meeting report. *Antimicrobial Resistance & Infection Control*, 8, 202.
6. Evaluation of FAO's role and work on AMR (2021). <http://www.fao.org/3/ne864en/ne864en.pdf.PC130/11Sup.1>
7. FAO Action Plan on Antimicrobial Resistance 2021-2025 (2021). <http://www.fao.org>
8. Food and Agriculture Organization of the United Nations Rome (2007). FAO Biosecurity Toolkit. <https://www.fao.org/3/a1140e/a1140e.pdf>.
9. FAVA Strategic Plan 2021-2025(2021). <https://www.favamember.org>
10. Guide to Good Farming Practices For Animal Production Food Safety (2010) by OIE and FAO. <https://www.fao.org/3/i0482t/i0482t00.pdf>
11. José Martinez, Patrick Dabert , Suzelle Barrington, Colin Burton. (2009). Livestock waste treatment systems for environmental quality, food safety, and sustainability. *Bioresource Technology* 100 (2009) 5527–5536. <https://doi:10.1016/j.biortech.2009.02.038>
12. Magalhães-Sant'Ana, M., More, S.J., Morton, D.B., Hanlon, A.J. (2017). Challenges facing the veterinary profession in Ireland: On-farm use of veterinary antimicrobials. *Irish Veterinary Journal*, 70 (28), 1-9. <https://doi.org/10.1186/s13620-017-0106-9>
13. Mainous III, A. G., Everett, C. J., Post, R.E., Diaz, V.A., Hueston, W.J. (2009). Availability of Antibiotics for Purchase Without a Prescription on the Internet. *Annals of Family Medicine*, 7(5), 431-434. <https://doi.org/10.1370/afm.999>
14. Mangesho, P. E., Caudell, M. A., Mwakapeje E.R., Ole-Neselle, M., Kimani, T., Dorado-García, A., Kabali, E., and Folorunso O. Fasina, F.O. (2021). Knowing Is Not Enough: A Mixed-Methods Study of Antimicrobial Resistance Knowledge, Attitudes, and Practises Among Maasai Pastoralists. *Frontiers in Veterinary Science*, 8, 152. <https://doi.org/10.3389/fvets.2021.645851>

15. National Action Plan to Tackle Antimicrobial Resistance in the Republic of Tajikistan (2018). <http://extwprlegs1.fao.org/docs/pdf/taj182164.pdf>
16. Odoi, A., Samuels, R., Carter, C. N., & Smith, J. (2021). Antibiotic prescription practices and opinions regarding antimicrobial resistance among veterinarians in Kentucky, USA. *Plos One*, 16(4), 1-18. <https://doi.org/10.1371/journal.pone.0249653>
17. OIE (World Organisation for Animal Health). <https://www.oie.int/en/what-we-do/global-initiatives/antimicrobial-resistance/#ui-id-3>
18. OIE Aquatic Animal Health Code Chapter 4.7. Handling, disposal and treatment of aquatic animal waste. https://www.oie.int/fileadmin/Home/eng/Health_standards/aahc/2010/en_chapitre_aquatic_animal_waste.htm
19. OIE Annual Report on Antimicrobial Agents Intended for Use in Animals (2021). <https://www.oie.int/app/uploads/2021/05/a-fifth-annual-report-amr.pdf>
20. Othieno, J. O., Njagi, O., & Azegele, A. (2020). Opportunities and challenges in antimicrobial resistance behavior change communication. *One Health*, 1-6. <https://doi.org/10.1016/j.onehlt.2020.100171>
21. Report on Antimicrobial Resistance (AMR). FAO Regional Conference for Asia and the Pacific Thirty-fifth Session Thimphu, Bhutan, 17-20 February 2020. <https://www.fao.org/3/nb677en/nb677en.pdf>
22. Sommanustweechai, A., Tangcharoensathien, V., Malathum, K., Sumpradit, N., Kiatying-Angsulee N., Janejai, N., S. Jaroenpoj, S. (2018). Implementing national strategies on antimicrobial resistance in Thailand: potential challenges and solutions. *Public Health* 157, 142-146. <https://doi.org/10.1016/j.puhe.2018.01.005>
23. Tisdall, D. A., Reyher, K. K., & Barrett, D. C. (2017). Achieving responsible medicines use at practice and farm level. *In Practice*, 39(3), 119-127. <https://doi.org/10.1136/inp.j658>
24. Vatovec, C., Kolodinsky, J., Callas, P., Hart, C., Gallagher, K. (2021). Pharmaceutical pollution sources and solutions: Survey of human and veterinary medication purchasing, use, and disposal. *Journal of Environmental Management*, 285, 1-8. <https://doi.org/10.1016/j.jenvman.2021.112106>
25. Windsor, P. A. (2017). How to implement farm biosecurity: the role of government and private sector – Asia – OIE Regional Commission – Windsor. <http://dx.doi.org/10.20506/TT.2761>

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